SPECIFICATION FOR

MAISON DE LA FRANCOPHONIE D'OTTAWA 2720 Richmond Road, Ottawa, Ontario

'ISSUED FOR TENDER'

July 2018

Prepared for:

CEPEO

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JLR No. 27672-000.1

SECTION NUMBER SECTION TITLE

FACILITY CONSTRUCTION SUBGROUP

Division 00 FRONT END DOCUMENTS

REFER TO OWNER PROVIDED FRONT END DOCUMENTS

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Division 31 EARTHWORK

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1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work Covered by the Contract Documents includes the full scope of work as prescribed in Section 00 21 13 - Instruction to Bidders, Description of Work.

1.2 CONTRACT METHOD

- .1 Construct Work under a single lump sum, Stipulated Price Contract, based on the CCDC 2-2008 document, as amended by Supplementary General Conditions contained herein.
- .2 Obtain Substantial Completion on or before time indicated on Bid Supplementary Form, Statement 'A' Duration.
- .3 Contractor Use of Premises: assume responsibility for complete use of the Construction Site.
- .4 Workplace Policies: Comply with all Workplace policies (policies are available from the Workplace) including, but not limited to the following:
- .5 Approvals and Permits:
 - .1 Refer to CCDC 2, GC 10.2.
 - .2 Work is subject to the approval, inspection, by-laws and regulations of all municipal, provincial, federal and other authorities having jurisdiction.

1.3 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's scheduled occupancy requirements based on the school year.
- .2 Coordinate Progress Schedule and coordinate with Owner Occupancy during construction.
- .3 Required stages:
 - .1 Renovation of existing three storey school building (Grant School) and elevator addition to be prioritized to allow for Owner Occupancy as indicated on Bid Supplementary Form, Statement 'A' Duration.
 - .2 Building addition to be constructed in parallel with renovation. Contractor to accommodate Partial Owner Occupancy of building and site after partial occupancy of the renovation is granted.

1.4 FEES, PERMITS AND CERTIFICATES

.1 Refer to GC 10.2, Laws, Notices, Permits and Fees.

- .2 Pay all fees and obtain all required approvals and permits unless otherwise indicated. Provide authorities with plans and information for acceptance certificates. Furnish inspection certificates as evidence that work conforms to requirements of authority having jurisdiction.
 - .1 Owner will obtain and pay for building permit.
- .3 Pay all advertisement for substantial completion.
- .4 Maintain and pay for insurance requirements.

1.5 CONTRACTOR USE OF PREMISES

- .1 Unrestricted use of site until Partial Owner Occupancy is granted.
 - .1 Limit use of premises for Work, for storage, and for access, to allow:
 - .1 Partial owner occupancy.
 - .2 Public usage.
- .2 Coordinate use of premises under direction of Consultant.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work that remain.
- .5 Repair or replace portions of existing work that have been altered during construction operations to match existing or adjoining work, as directed by Consultant.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 PARTIAL OWNER OCCUPANCY

- .1 Schedule and substantially complete designated portions of Work for Owner's occupancy prior to Substantial Performance of entire Work.
- .2 Owner will occupy area of existing three storey building as indicated in documents.
- .3 Owner will occupy designated areas for purpose of normal usage.
- .4 Execute Partial Interim Certificate of Completion for each designated portion of Work prior to Owner occupancy. Contractor shall allow:
 - .1 Access for Owner personnel.
 - .2 Use of parking facilities.
 - .3 Elevator.
 - .4 Operation of HVAC and electrical systems.

1.7 OWNER FURNISHED ITEMS

- .1 Owner Responsibilities:
 - .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.

- .2 Deliver supplier's bill of materials to Contractor.
- .3 Arrange and pay for delivery to site in accordance with Progress Schedule.
- .4 Inspect deliveries jointly with Contractor.
- .5 Submit claims for transportation damage.
- .6 Arrange for replacement of damaged, defective or missing items.
- .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

.2 Contractor Responsibilities:

- .1 Designate submittals and delivery date for each product in progress schedule.
- .2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
- .3 Receive and unload products at site.
- .4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
- .5 Handle products at site, including uncrating and storage.
- .6 Protect products from damage, and from exposure to elements.
- .7 Assemble, install, connect, adjust, and finish products.
- .8 Provide installation inspections required by public authorities.
- .9 Repair or replace items damaged by Contractor or subcontractor on site (under his control).
- .3 Schedule of Owner furnished and Owner Installed items:
 - .1 All furniture, equipment and appliances.
 - .2 Window treatment.
 - .3 Building security devices.
 - .4 Smart Boards.

1.8 SETTING OUT

- .1 Retain a Registered Ontario Land Surveyor to lay out new building and other site features as described in the documents.
- .2 Verify new layout against other site features (e.g., hydrants, manholes, roads, etc.) and advise Consultant of any potential inconsistencies.
- .3 After layout is complete and verified, notify Consultant in writing that layout has been completed in accordance with document requirements.
- .4 On completion of the building foundations, have a Legal Survey undertaken by the Ontario Land Surveyor responsible for the layout and submit a signed and sealed confirmation that the construction has been vertically and horizontally located on the site as specified by the Contract Documents.

1.9 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.

- .4 Building Permit.
- .5 Reviewed Shop Drawings.
- .6 List of Outstanding Shop Drawings.
- .7 Change Orders.
- .8 Other Modifications to Contract.
- .9 Field Test Reports.
- .10 Copy of Approved Work Schedule.
- .11 Health and Safety Plan and Other Safety Related Documents.
- .12 Record drawings.
- .13 Other documents as specified.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC):
 - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Project Supplementary Conditions.

1.2 CASH ALLOWANCES

- .1 Include in Contract Price specified cash allowances.
- .2 Cash allowances, unless otherwise specified, cover net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, and other authorized expenses incurred in performing work.
- .3 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .4 Include progress payments on accounts of work authorized under cash allowances in Consultant's monthly certificate for payment.
- .5 Prepare schedule jointly with Consultant to show when items called for under cash allowances must be authorized by Consultant for ordering purposes so that progress of Work will not be delayed.
- .6 Include in the Contract for the following allowances for Work specified:
 - .1 Electrical Service Connection:
 - .1 Allowance:\$5,000.00
 - .2 Scope of Work:
 - .1 Coordinate with Hydro Ottawa for connection.
 - .2 Coordinate with Hydro Ottawa for any metering requirements associated with the work.
 - .3 Allowance covers Hydro Ottawa fees only.
 - .2 Natural Gas Service Connection
 - .1 Allowance: \$25,000.00
 - .2 Scope of Work:
 - .1 Coordinate with Enbridge Gas for connection and equipment installation requirements for new natural gas service to facility.
 - .2 Coordinate with Enbridge Gas for any metering requirements associated with the work.
 - .3 Allowance covers Enbridge Gas fees only.
 - .3 Material Testing Services
 - .1 Allowance: \$45,000.00
 - .2 Scope of Work:
 - .1 Material testing services for soils, compaction, concrete, masonry, and asphalt pavement to be completed by Owner-appointed firm(s).
 - .2 Material testing of structural steel, metal fabrications, roofing, and window leak-testing to be undertaken by material testing firm engaged and paid for separately by the Contractor.
 - .4 Existing Elevator Steel Repairs
 - .1 Allowance: \$25,000.00

- .2 Scope of Work:
 - .1 Structural review of existing elevator construction by third party inspection agency.
 - .2 Correct plumbness if required.
 - .3 Correct bolted connections if required.
 - .4 Clean and paint structural steel and repair welds as required.
- .5 Building Signage
 - .1 Allowance: \$15,000.00
 - .2 Scope of Work:
 - .1 Design, fabrication, and installation of various building signage including, but not limited to, interior wayfinding and exterior building signage.
 - .2 Traffic signs specified on Contract drawings are excluded and are to be covered under Contract Price.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC):
 - .1 CCDC 2-2008, Stipulated Price Contract.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to CCDC 2, GC 5.2.

1.3 SCHEDULE OF PROJECTED MONTHLY PROGRESS DRAWS

.1 A minimum of ten (10) business days prior to submission of the first application for payment, provide schedule of projected monthly progress draw values, supported by evidence as Consultant may reasonably direct.

1.4 SCHEDULE OF VALUES

.1 Refer to CCDC 2, GC 5.2.

1.5 PROGRESS PAYMENT

- .1 Refer to CCDC 2, GC 5.3.
- .2 Include with each application for payment a Workers' Safety and Insurance Board clearance certificate and a statutory declaration in the form of a CCDC Document 9a, and such additional supporting documents as the Consultant may reasonably require.
- .3 Consultant will issue to Owner, no later than ten (10) business days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

- .1 Refer to CCDC 2, GC 5.4 and Section 01 77 00 Closeout Submittals.
- .2 Refer to Section 01 77 00 Closeout Procedures, Administrative Requirements.
- .3 Prepare and submit to Consultant comprehensive list of items to be completed or corrected and repair as required to conform to Contract Documents. Upon completion of the Contractor's list of deficiencies and when Work is substantially performed if permitted by lien legislation applicable to Place of Work apply for a review by Consultant to establish Substantial Performance of Work. Failure to include items on list does not alter responsibility to complete Contract.

- .4 No later than ten (10) business days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than five (5) business days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.
- .5 Consultant shall state date of Substantial Performance of Work or designated portion of Work in certificate (Form 6 Certificate of Substantial Performance from the Ontario Construction Lien Act).
 - .1 A blank copy of Form 6 Certificate of Substantial Performance from the Ontario Construction Lien Act has been included following this section for reference only.
- .6 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish reasonable date for finishing Work as permitted by lien legislation applicable to Place of Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

- .1 Refer to CCDC 2, GC 5.5.
- .2 After issuance of certificate of Substantial Performance of Work:
 - .1 Submit application for payment of holdback amount.
 - .2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.
 - .3 Include with application a Workers' Safety and Insurance Board clearance certificate.
- .3 After receipt of application for payment and sworn statement complete with Workers' Safety and Insurance Board clearance certificate. Consultant will issue to Owner, no later than ten (10) business days after receipt of an application for payment, certificate for payment of holdback amount.
- .4 Amount authorized by certificate for payment of holdback amount is due and payable the later of:
 - .1 Day following expiration of holdback period stipulated in lien legislation applicable to Place of Work, or
 - .2 Ten (10) business days following receipt of certificate for payment from the Consultant.

1.8 FINAL PAYMENT

- .1 Refer to CCDC 2, GC 5.7.
- .2 Submit application for final payment when Work is completed. Include the following documents in the submission:
 - .1 Where lien legislation is applicable to the place of Work, include in the application a declaration of last supply (Form 5 Declaration of Last Supply from the Ontario Construction Lien Act).
 - .1 A blank copy of Form 5 Declaration of Last Supply from the Ontario Construction Lien Act has been included following this section for reference only.
 - .2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.
 - .3 Include with application a Workers' Safety and Insurance Board clearance certificate.

- .3 Consultant will, no later than ten (10) business days after receipt of application for final payment, review Work to verify validity of application and give notification that application is valid or give reasons why it is not valid. Complete all outstanding Work as reasonably noted by the Consultant and upon completion notify the Consultant to review the Work following same procedures as noted above.
- .4 Should the Contractors request be found valid in accordance with Section 01 77 00 Closeout Procedures, the Consultant will issue a final certificate for payment to the Owner no later than ten (10) business days following receipt of application for final payment from the Contractor. Where lien legislation is applicable to the place of Work, the Certificate for Payment will include a Declaration of Last Supply as submitted by the Contractor.
- .5 The Owner shall, no later than ten (10) business days after the issuance of the final certificate for payment, pay the Contractor.
- .6 Following the issuance of the Consultant's final certificate for payment, the Contractor shall:
 - .1 Submit application for payment of finishing holdback amount.
 - .2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.
 - .3 Include with application a Workers' Safety and Insurance Board clearance certificate
- .7 After receipt of application for payment and sworn statement complete with Workers' Safety and Insurance Board clearance certificate, Consultant will issue to Owner, no later than ten (10) business days after receipt of an application for payment, certificate for payment of finishing holdback amount.
- .8 Amount authorized by certificate for payment for finishing holdback amount is due and payable the later of:
 - .1 Day following expiration of holdback period stipulated in lien legislation applicable to Place of Work, or
 - .2 Ten (10) business days following receipt of certificate for payment from the Consultant.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 SAMPLE CONSTRUCTION LIEN ACT FORMS

- .1 A blank copy of the following documents are included herein for reference only, in accordance with Section 01 29 00.1 Payment Procedures:
 - .1 Form 5 Declaration of Last Supply under Subsection 31 (5) OF THE ACT, Construction Lien Act R.R.O. 1990, Reg. 175, Form 5.
 - .2 Form 6 Certificate of Substantial Performance of The Contract Under Section 32 Of The Act, Construction Lien Act O.Reg. 174/11, s.3.
 - .3 Form 7 Certificate of Completion of Subcontract under Subsection 33 (1) Of The Act, Construction Lien Act O.Reg. 174/11, s.4.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

FORM 5 DECLARATION OF LAST SUPPLY UNDER SUBSECTION 31 (5) OF THE ACT

Construction Lien Act

nseri regs\grapnics\1990\173\173003au.uj	
(name of supplier)	
a supplier of services or materials to an improvement being made to:	
(address of premises)	 I
declares that:	
1. The following services or materials were supplied:	(description of services or materials)
2. These services or materials were supplied under a contract (or subcontract) w	ith(name of payer)
dated the day of, 19	
3. The last supply of services or materials made by the supplier to the improvem	ent under the contract (or subcontract), was made on
(date of last si	иррly)
4. No further services or materials will be supplied under the contract (or subcon	ntract).
Declared before me at the)
in the of)))
on the day of ,))) (supplier)
19)
A Commissioner, etc.))

R.R.O. 1990, Reg. 175, Form 5.

FORM 6 CERTIFICATE OF SUBSTANTIAL PERFORMANCE OF THE CONTRACT UNDER SECTION 32 OF THE ACT

Construction Lien Act

(County/District or Regional Municipality/City or Borough of Municipality of
Metropolitan Toronto in which premises are situate)
(street address and city, town, etc., or, if there is no street address, the location of the premises)
This is to certify that the contract for the following improvement:
(short description of the improvement)
to the above premises was substantially performed on
(date substantially performed)
Date certificate signed:
(payment certifier where there is one)
(owner and contractor, where there is no payment certifier)
Name of owner:
Address for service:
Name of contractor:
Address for service:
Name of payment certifier:
(where applicable)
Address:
(Use A or B whichever is appropriate)
A. Identification of premises for preservation of liens:
(where liens attach to premises, reference to lot and plan number or instrument registration number)
B. Office to which claim for lien must be given to preserve lien:
(where liens do not attach to premises)

O. Reg. 174/11, s. 3.

FORM 7 CERTIFICATE OF COMPLETION OF SUBCONTRACT UNDER SUBSECTION 33 (1) OF THE ACT

Construction Lien Act

This is to certify the completion of a subcontract for the supply of services or materials between		
(name of subcontractor)	•••••	
andday of, 20.		
The subcontract provided for the supply of the following services or materials		
to the following improvement:	•••••	
(short description of the improvement)		
of premises at		
(street address, or if there is none, the location of the premises)	·••••••	
Date of certification		
(payment certifier where there is one)	•••••	
(owner and contractor)		
Name of owner:		
Address for service:		
Name of contractor:		
Address for service:		
Name of payment certifier (where applicable):		
Address:	•••••	
(Use A or B whichever is appropriate)		
A. Identification of premises for preservation of liens:		
(where liens attach to premises, reference to lot and plan number or instrument registration number)	· • • •	
B. Office to which claim for lien must be given to preserve lien:		
(where liens do not attach to premises)		

1.1 SECTION INCLUDES

.1 Scheduled pre-construction, and progress meetings.

1.2 ADMINISTRATIVE

- .1 The Consultant shall schedule and administer project meetings throughout the progress of Work.
- .2 Provide physical space and make arrangements for meetings.
- .3 Preside at meetings.
- .4 The Consultant shall record the minutes.
- .5 The purpose of the meeting minutes is to document significant proceedings and decisions and identify actions by parties.
- The Consultant shall reproduce and issue a copy of minutes within five (5) business days after each meeting to the Owner, Contractor and all parties in attendance except Subcontractors for their review. Within two (2) business days of receipt of the meeting minutes, the Consultant shall be notified of any noted errors and/or omissions. Consultant will revise the meeting minutes if deemed appropriate and return the revised meeting minutes to the Owner, Contractor and all parties in attendance except Subcontractors.
- .7 The Contactor shall be responsible for distribution of meeting minutes to their Subcontractors.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRE-CONSTRUCTION MEETING

- .1 Within seven (7) days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of Owner, Consultant, and Contractor, will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Status of Building Permit.
 - .3 Contractor Use of Premises, Workplace policies and Criminal background checks in accordance with Section 01 11 00 Summary of Work.

- .4 Schedule of Work: in accordance with Section 01 32 16.07 Construction Progress Schedules -Bar (GANTT) Chart.
- .5 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 Submittal Procedures.
- .6 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 Construction Facilities.
- .7 Delivery schedule of specified equipment in accordance with Section 01 32 16.06 Construction Progress Schedules.
- .8 Site security in accordance with Section 01 56 00 Temporary Barriers and Enclosures.
- .9 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .10 Owner provided products.
- .11 Record drawings in accordance with Section 01 33 00 Submittal Procedures.
- .12 Maintenance manuals in accordance with Section 01 78 00 Closeout Submittals.
- .13 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 Closeout Submittals.
- .14 Monthly progress claims, administrative procedures, and hold backs.
- .15 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 Quality Control.
- .16 Insurances, transcript of policies.
- .17 Site concerns/inquiries to date.
- .18 List of outstanding project specific building permit conditions.
- .19 Environmental protection, measures specific to the project and Place of Work in accordance with Section 01 35 43 Environmental Procedures.
- .20 Next Meeting.
- .21 Other Business.

1.4 PROGRESS MEETINGS

- .1 During course of Work and two (2) weeks prior to project completion, schedule progress meetings biweekly.
- .2 Contractor, Consultant, and Owner are to be in attendance.
- .3 Notify parties minimum five (5) days prior to meetings.
- .4 Consultant will record minutes of meetings and circulate to attending parties and affected parties, except Subcontractors. The Contactor shall be responsible for distribution of meeting minutes to their Subcontractors.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.

- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five (5) day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately ten (10) business days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit to Consultant within five (5) business days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule complete with an electronic copy in a format acceptable to Consultant within five (5) business days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Consultant will review and return revised schedules within five (5) business days.
- .3 Revise impractical schedule and resubmit within five (5) business days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows: .
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Demolition.
 - .6 Excavation.
 - .7 Backfill.
 - .8 Building Footings.
 - .9 Slab-on-grade.
 - .10 Structural Steel.
 - .11 Masonry, Curtain wall and Roofing.
 - .12 Interior Architecture (Walls, Floors and Ceiling).
 - .13 Plumbing.
 - .14 Lighting.
 - .15 Electrical.
 - .16 Piping.
 - .17 Controls.
 - .18 Heating, Ventilating, and Air Conditioning.
 - .19 Millwork.
 - .20 Fire Systems.
 - .21 Testing and Commissioning.

- .22 Supplied Equipment Long Delivery Items.
- .23 Close-out Documentation.

1.6 PROJECT SCHEDULE REPORTING

- .1 Prior to each project meeting as per Section 01 31 19, update Project Schedule to reflect activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

2018/07/06

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Documentation required.
- .2 Shop drawings and product data
- .3 Samples
- .4 Certificates and transcripts
- .5 Building Permit

1.2 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC):
 - .1 CCDC 2-2008, Stipulated Price Contract.

1.3 ADMINISTRATIVE

- .1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in units as indicated on Contract Drawings.
- .4 Review submittals prior to submission Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .5 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work is coordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .9 Keep one (1) reviewed copy of each submission on site.

1.4 DOCUMENTATION REQUIRED

- .1 Refer to CCDC 2, GC 3.5. Construction Schedule.
- .2 Prior to construction start, submit the following:
 - .1 An executed construction contract.
 - .2 Performance Bond(s) and Labour and Material Bond(s).
 - .3 Proof of liability insurance, with provisions preventing unilateral cancellation, and with the names of the Owner(s) and Consultant(s) listed as additional insured.
 - .4 Copy of 'Notice of Project' to Ontario Ministry of Labour.
 - .5 Certificate of good standing from the Worker's Compensation Board.
 - .6 Construction schedule.
 - .7 All documentation as requested in Sections:
 - .1 02 82 00 Type 1, 2 & 3 Asbestos Operations.
 - .2 02 82 17 Type 1 & 2 Silica Operations.
 - .3 02 83 10 Type 1 Lead Operations Minimum Precautions.
 - .4 02 83 11 Type 2 Lead Operations Intermediate Precautions

1.5 SHOP DRAWINGS AND PRODUCT DATA

- .1 Refer to CCDC 2 GC 3.10.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3 Submit shop drawings as described in each specification section.
- .4 Do not proceed with any component of the Work nor provide Products without reviewed shop drawings being accepted and returned to the Contractor. Should Work commence, or Products be supplied prior to Contractor's receipt of reviewed shop drawings, the Contractor shall be liable for all corrections and costs incurred.
- .5 Submit where indicated, shop drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .7 The Consultant will review and return each shop drawing submission in accordance with the schedule agreed upon, or, in absence of such schedule, with reasonable promptness.
- .8 Adjustments made on shop drawings Consultant are not intended to change Contract Price or Contract Time. If adjustments affect value of Work or the construction schedule, state such in writing to Consultant prior to proceeding with Work.
- .9 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, Consultant in writing of revisions other than those requested.

- .10 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .11 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents. Shop drawings submitted without the Contractor's executed stamp of review, will not be considered and will be returned to the Contractor for review and re-submission.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .12 Should the Consultant deem the Contractor has not complied with the requirements of this section, the Contractor shall be held fully responsible for all delays in the Work to the same extent as if no shop drawings or details had been submitted for that section of the Work.
- .13 After Consultant's review, distribute copies.
- .14 Submit one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
- .15 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested Consultant where shop drawings will not be prepared due to standardized manufacture of product.
- Submit one (1) electronic copy of test reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within three (3) years of date of contract award for project.
- .17 Submit one (1) electronic copy of certificates for requirements requested in specification Sections and as requested by Consultant.

- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.
- .18 Submit one (1) electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Consultant.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .19 Submit one (1) electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .20 Submit one (1) electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.
- .21 Delete information not applicable to project.
- .22 Supplement standard information to provide details applicable to project.
- .23 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, one (1) electronic copy stamped by the Consultant complete with appropriate comments where applicable will be returned electronically in .PDF format and fabrication and installation of Work may proceed. If shop drawings are rejected, one (1) electronic copy stamped by the Consultant complete with appropriate comments where applicable will be returned electronically in .PDF format and resubmission procedure indicated above, shall be repeated prior to fabrication and installation of Work.

1.6 SAMPLES

- .1 Submit samples for each product together in one submission with all other required submittals for the various specification sections. Submittals for the building interior may however be submitted independently from that for the building exterior.
- .2 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .3 Deliver samples prepaid to Consultant's business address.
- .4 Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .5 Where colour, pattern or texture is criterion, submit full range of samples.
- .6 Adjustments made on samples by Consultant are not intended to change Contract Price or Contract Time. If adjustments affect value of Work or Contract Time, state such in writing to Consultant prior to proceeding with Work.
- .7 Make changes in samples which Consultant may require, consistent with Contract Documents.

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

1.7 MOCK-UPS

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

1.8 CERTIFICATES AND TRANSCRIPTS

- .1 Prior to commencing work on site, and with each application for progress payment, submit Workplace Safety Insurance Board Certificate (WSIB) of good standing.
- .2 Prior to commencing work on site submit:
 - .1 Certificate of General Liability Insurance.
 - .2 Certificate of "All Risk" Property and Boiler Insurance.

1.9 BUILDING PERMIT

- .1 Refer to GC 10.2
- .2 Unless otherwise indicated, the Owner to obtain and pay for building permit as required.
- .3 Prior to commencing work on site:
 - .1 Obtain notification from Owner that required permits had been approved and paid for, and obtain required permits from juridical authorities.
 - .2 Submit copy of building permit to Consultant.
- .4 No person shall construct or demolish a building, or any part of a building, unless a permit has been issued by the juridical authorities.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 SCOPE

.1 This section provides the structural engineering data for seismic restraint design of the Operational Functional Components for this project.

1.2 DEFINITIONS

- .1 Operational Functional Components (OFCs): are non-structural building components, including architectural finishes, building service components (mechanical, plumbing, electrical and telecommunications) and building contents.
- .2 Importance Categories for Buildings: buildings (and their respective OFCs) are defined by the National Building Code of Canada 2005.
 - .1 For seismic design, the importance categories for buildings are defined as normal, high and post disaster.
 - .2 For seismic design of OFCs, the importance categories are defined as normal, high and post-disaster with OFCs being nominally impacted after a design seismic event and repairable within two to three days and post-disaster with OFCs being fully functional after a design seismic event.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CSA S832-06 Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.
 - .2 CSA A23.3-04 Design of Concrete Structures.
 - .3 CSA A371-04 Masonry Construction for Buildings.
 - .4 CSA B44-04 Safety Code for Elevators and Escalators.
 - .5 CAN/CSA-S16-01 Limit States Design of Steel Structures.
 - .6 CSA S37-01 (R2011) Antennas, Towers and Antenna Supporting Structures.
 - .7 CSA S304.1-04 Design of Masonry Structures.
- .2 American Concrete Institute (ACI):
 - .1 ACI 355.2-04/355.2R-04 Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary.
- .3 American Society of Civil Engineers/Technical Council of Lifeline Earthquake Engineering (ASCE/TCLEE):
 - .1 Methods of Achieving Improved Seismic Performance of Communications Systems (A. Tang and A.J. Schiff, Eds.) ASCE/TCLEE Monograph No. 10, 1996.
- .4 American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.) (ASHRAE):
 - .1 A Practical Guide to Seismic Restraint, 2000.
- .5 American Society of Mechanical Engineers (ASME International):
 - .1 ASME A17.1-2007 Safety Code for Elevators and Escalators.

- .6 American Society for Testing and Materials (ASTM International):
 - .1 ASTM C635-04 Standard Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - .2 ASTM E580-02 Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint.
- .7 Ceilings and Interior Systems Construction Association (CISCA):
 - .1 Guidelines for Seismic Restraint for Direct-Hung Suspended Ceiling Assemblies, 2004.
- .8 Electrical Contractors Association of British Columbia (ECABC):
 - .1 Seismic Restraint Manual Guidelines for Electrical Systems, 1997.
- .9 Earthquake Engineering Research Institute (EERI):
 - .1 EERI 99-01 Lessons Learned Over Time, Volume 1, "Re-examining the Performance of Roll-Up Garage Doors in Fire Stations in Recent California Earthquakes."
- .10 Federal Emergency Management Agency (FEMA):
 - .1 FEMA 273-1997 (Superseded by FEMA 356) NEHRP Guideline for the Seismic Rehabilitation of Buildings.
 - .2 FEMA 356-2000 Pre-Standard and Commentary for the Seismic Rehabilitation of buildings.
- .11 Institute of Electrical and Electronics Engineers (IEEE):
 - .1 IEEE 693-1997 IEEE Recommended Practices for Seismic Design of Substations.
- .12 National Fire Protection Association (NFPA):
 - .1 NFPA 13-2002 Installation of Sprinkler Systems.
- .13 National Research Council of Canada (NRCC):
 - .1 Guidelines for Seismic Evaluation of Existing Buildings, 2005.
 - .2 National Building Code of Canada, 2005.
 - .3 National Fire Code of Canada, 2005.
 - .4 National Plumbing Code of Canada, 2005.
 - .5 User's Guide NBCC 2005, Structural Commentaries (Part 4).

1.4 QUALIFICATIONS

.1 Design and inspection of seismic restraint of OFCs to be carried out by a qualified engineer licensed in the Province of Ontario. Engineer to have a minimum of five years' experience in the design of lateral restraint for specific discipline of OFCs.

1.5 SUBMITTALS

- .1 Submit shop drawings, calculations and final certification of work in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submittals to include:
 - .1 Design calculations.
 - .2 Shop drawings for each type and device of seismic restraint.
 - .3 Layout drawings for location of devices/isolators.
 - .4 Anchor forces, anchorage/fastener details and location of anchorages to structure.

- .5 Certification of Seismic Restraint System for each OFC, confirming that installation meets Building Importance Category and performance criterion.
- .6 Certification from OFC equipment manufacturer confirming that OFC equipment is compliant with specified seismic provisions.
- .7 Maintenance data, including monitoring requirements for incorporation into maintenance manuals.

1.6 DESIGN CRITERIA

- .1 Seismic restraint design for OFC's to meet National Building Code of Canada 2005, National Fire Code 2005 and National Plumbing Code.
- .2 Building is defined with an importance factor le = 1.0. Foundation class is Fa = 0.7 for a Class "A" soil. Spectral response factor is for Kingston, Ontario with a Sa(.2) = .30 and a peak ground acceleration of 0.16.
- .3 Equivalent lateral static force acting on OFC and respective connections to be in accordance with the requirements of Clause 4.1.8.17 of the NBCC.
- .4 Where appropriate, OFCs to be provided with sufficient gap between adjacent OFC equipment and or flexible connections between system elements to ensure assumed design behaviour is achieved and OFC equipment does not collide during a seismic event.
- .5 Where identified in specific specification sections, OFC equipment or times noted as being required for immediate/continued occupancy to be seismically restrained to ensure continued operation immediately after a design seismic event. OFCs and seismic restraints to be provided with a Certification of Performance. This may include certification of equipment, attesting to a seismic resistance qualification for the equipment.
- .6 Seismic restraint attachments for mechanical and electrical equipment to meet the following as a minimum standard:
 - .1 Attachments and supports that transfer seismic forces to be constructed of materials suitable for application and to be designed and constructed in accordance with nationally recognized codes and standards (NBCC Clause 4.1.8.17).
 - .2 Attachments embedded in concrete to be suitable for cyclic and shock loads (Annex D of CSA A23.3 and ACI 355.2/355.2R).
 - .3 Rod hangers for piping, ducting and cable trays to be considered seismic supports if the length of the hanger from the supporting structure is less than or equal to 300mm. Rod hangers not to be constructed so that rod is subjected to bending moments (CAN/CSA-S16).
 - .4 Seismic supports to be constructed so that support engagement is maintained in accordance with NBCC Clause 4.1.8.17, Section 8.
 - .5 Friction clips to be used for anchorage attachment.
 - .6 Pot-installed anchors for mechanical and electrical equipment to meet ACI 355.2/355.2R and/or be approved by the International Conference of Building Officials (ICBO).
 - .7 Drilled and grouted-in-place anchors for tensile load applications to use expansive cement or expansive epoxy grout.
 - .8 Supports to be specifically evaluated if weak-axis bending of cold-formed steel is used for seismic load path.
 - .9 Components mounted on vibration isolation systems to have a minimum of four integrated or independent omni-directionally acting snubbers. Seismic force to be calculated in accordance with the NBCC or to be 2W_p minimum.

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.7 Attachment of seismic restraint anchors to be limited to main structural elements including concrete slabs, concrete beams, metal deck and main steel beams. Building columns, open web steel joists, and secondary framing for walls not to be used for securing seismic restraint anchors. Building partition walls and architectural finishes not to be used for securing seismic restraint systems and anchors. Power actuated devices not to be used for anchorages.

PART 2 - PRODUCTS

- 2.1 NOT USED
 - .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED
 - .1 Not Used.

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1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Province of Ontario:
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Updated 2005.

1.2 **ACTION AND INFORMATIONAL SUBMITTALS**

- Make submittals in accordance with Section 013300 Submittal Procedures. .1
- .2 Submit site-specific Health and Safety Plan: Within five (5) business days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work
- .3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .4 Submit copies of incident and accident reports.
- .5 Submit WHMIS MSDS - Material Safety Data Sheets
- .6 Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

1.3 **FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

Perform site specific safety hazard assessment related to project. .1

PROJECT/SITE CONDITIONS 1.5

.1 Refer to Designated Substance Survey: Pre-Renovation Designated Substance Review, Maison de la Francophonie d'Ottawa (Former Grant School, 2720 Richmond Road, Ottawa, Ontario (Project No.: 1791616, dated April 18, 2018 172 pages) is included at the end of Section 02 81 00 Designated Substance Survey

1.6 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Consultant may respond in writing, where deficiencies or concerns are noted and may request resubmission with correction of deficiencies or concerns.

1.7 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.8 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

1.9 POSTING OF DOCUMENTS

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

1.10 CORRECTION OF NON-COMPLIANCE

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

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PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

1.1 REFERENCES

.1 Definitions:

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .3 Adequate Ventilation: ventilation, including air circulation and air changes, required to cure material, dissipate humidity, and prevent accumulation of dust fumes, vapours or gases.
- .4 Construction and Demolition Waste: includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
 - .1 Includes both combustible and non-combustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, metal cans and bones.
- .5 Debris: includes both combustible and non-combustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.
- .6 Chemical Waste: includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
- .7 Environmental Pollution and Damage: the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavourably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- .8 Hazardous Materials: includes pesticides, biocides, and carcinogens, as listed by recognized authorities.
- .9 Interior Final Finishes: materials and products that will be exposed at interior, occupied spaces, including flooring, wall coverings, finish carpentry and ceilings.
- .10 Municipal Solid Waste Landfill: a permitted facility that accepts solid, nonhazardous waste such as household, commercial and industrial waste, including construction and demolition waste.
- .11 Packaged Dry Products: materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging, including carpets, resilient flooring, ceiling tiles, and insulation.
- .12 Sediment: soil and other debris that has been eroded and transported by storm or well production runoff water.
- .13 Sanitary Wastes:
 - .1 Garbage: refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
 - .2 Sewage: domestic sanitary sewage.
- .14 Wet Products: materials and products installed in wet form, including paints, sealants, adhesives and special coatings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for Consultant.
- .3 Ensure Environmental Protection Plan includes comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Ensure plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
 - .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Ensure plan includes measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
 - .9 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
 - .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
 - .13 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
 - .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
 - .15 Pesticide treatment plan to be included and updated, as required.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

1.4 SUBSTITUTIONS

.1 Notify Consultant in writing when Contractor is aware of materials, equipment, or products that meet the aesthetic and programmatic intent of Contract Documents but are more environmentally sensitive than materials, equipment, or products specified or indicated in the Contract Documents.

1.5 FIRES

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

1.6 DISPOSAL OF WASTE

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

1.7 DRAINAGE

- .1 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.8 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Consultant.

1.9 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

- .2 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .3 Collection: implement a recycling / reuse program that includes separate collection of waste materials of the following types:
 - .1 Metal:
 - .1 Ferrous
 - .2 Nonferrous
 - .2 Wood
 - .3 Debris
 - .4 Glass
 - .5 Paper:
 - .1 Bond
 - .2 Newsprint
 - .3 Newsprint
- .4 Environmental Controls: disposal operations for waste materials that are not identified to be salvaged, recycled or reused:
 - .1 Remove debris, rubbish, and other waste materials resulting from construction operations from site.
 - .2 No burning permitted.
 - .3 Transport materials with appropriate vehicles, and dispose off-site to areas that are approved for disposal by governing authorities having jurisdiction.
 - .4 Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage, and sweep, wash, or otherwise clean project site, streets, or highways.
 - .5 Comply with applicable regulations.
- .5 Air Resources: prevent creation of dust, air pollution, and odours.
 - .1 Use water sprinkling, temporary enclosures, and other appropriate methods to limit to lowest practical level dust and dirt rising and scattering in air.
 - .1 Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
 - .2 Store volatile liquids, including fuels and solvents, in closed containers.
 - .3 Properly maintain equipment to reduce gaseous pollutant emissions.
 - .4 Interior final finishes: schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
 - .5 Temporary Ventilation:
 - .1 Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
 - .2 Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources, and residues. Do not ventilate within limits of Work unless otherwise approved by Consultant.
 - .3 Preoccupancy Ventilation: after final completion and prior to initial occupancy, provide adequate ventilation for minimum five (5) days. Preoccupancy ventilation procedures:
 - .1 Use supply air fans and ducts only.
 - .2 Temporarily seal exhaust ducts.
 - .3 Temporarily disable exhaust fans.
 - .4 Provide exhaust through operable windows or temporary openings.
 - .5 Provide temporary exhaust fans as required to pull exhaust air from deep interior locations. Stair towers may be used for exhausting air from the building during the temporary ventilation.

1.10 NOTIFICATION

- .1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.
- .3 Do not take action until after receipt of written approval Consultant.
- .4 Consultant will issue stop order of work until satisfactory corrective action has been taken.
- .5 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 REFERENCES AND CODE

- .1 Perform Work in accordance with Ontario Building Code (OBC) including amendments up to tender closing date and other codes of local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Consultant.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Consultant.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Consultant.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

1.4 NATIONAL PARKS ACT

.1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.

1.2 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-2008, Stipulated Price Contract.

1.3 INSPECTION

.1 Refer to CCDC 2, GC 2.3 – Review and Inspection of the Work.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies are to be engaged by Contractor for purpose of inspecting and/or testing portions of Work.
- .2 Allocated costs: to Section 01 21 00 Allowances.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 Independent Inspection/Testing Agency to submit copies of all inspection/testing reports to Consultant.
- .6 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised Consultant at no cost to Consultant or Owner. Pay costs for retesting and re-inspection.

1.5 SUPERINTENDENT

- .1 Refer to CCDC 2, GC 3.6 Supervision.
- .2 The Superintendent shall be satisfactory to the Owner and Consultant and shall not be changed except for good reason and only then after consultation with and agreement by the Owner and Consultant.
- .3 The Superintendent shall represent the Contractor at Work site and directions given to him by the Consultant shall be held to have been given to the Contractor.
- .4 The Contractor shall remove the Superintendent of the Work if in their opinion the Superintendent is unable to carry out their proper functions and duties, due to whatever reason, to the complete satisfaction of the Consultant and the Owner.

- .5 Should the Contractor wish to replace the Superintendent, the Contractor shall submit to the Consultant, a request for the change in writing. Include in the written request the reason for the change and the experience and qualifications of the replacement superintendent.
 - The acceptance of the replacement superintendent will be at the sole discretion of Owner and Consultant and issued to the Contractor in writing. Should the replacement superintendent be deemed unacceptable to the Owner or Consultant, submit experience and qualifications of other superintendents for review and approval by the Owner and Consultant until a suitable replacement is accepted.
- The Superintendent of the work shall remain at the place of Work until all deficiencies of all trades have been rectified and the project is deemed Totally Performed by the Consultant.
- .7 The duties of the Superintendent shall include, but not be limited to the following:
 - .1 Coordination of the Work of all trades including own forces.
 - .2 Expediting labour and Products of all trades including own forces.
 - .3 Total project control and coordination.
 - .4 Project scheduling.
 - .5 Quality control and supervision as required to ensure the project is constructed in accordance with the Contract Documents.

1.6 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Cooperate to provide reasonable facilities for such access.

1.7 PROCEDURES

- .1 Notify appropriate agency and Consultant two (2) business days in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.8 REJECTED WORK

- .1 Refer to CCDC, GC 2.4.
- .2 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .3 Make good other Contractor's work damaged by such removals or replacements promptly at no cost to the Owner.
- .4 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.9 REPORTS

- .1 Submit electronic copy of inspection and test reports to the Consultant.
- .2 Provide copies to subcontractor of work being inspected or tested and/or manufacturer or fabricator of material being inspected or tested.

1.10 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Consultant and may be authorized as recoverable.

1.11 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations as directed by Consultant.
- .3 Prepare mock-ups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 If requested, Consultant may assist in preparing schedule fixing dates for preparation.
- .5 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be permitted.
- .6 Failure to prepare mock-ups to Consultant approval is not considered sufficient reason for an increase to Contract Price and no claim for increase by reason of such default will be accepted.
 - .1 Rectify, and/or remove and replace all such rejected mock-ups to Consultant approval.
- .7 Approved mock-ups may remain as part of Work subject to the approval of the Consultant.

1.12 MILL TESTS

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

1.13 EQUIPMENT AND SYSTEMS

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

1.14 TOLERANCES

- .1 Unless more stringent tolerances are required by a Section of the Specifications or a referenced standard, meet the following tolerances for installed Work:
 - .1 "plumb" shall mean plumb within 3 mm ($^{1}/_{8}$ ") in 3 m (10 ft.).
 - .2 "level" shall mean level within 3 mm ($\frac{1}{8}$ ") in 3 m (10 ft.).
 - .3 "square" shall mean not in excess of 10 seconds less or more than 90°.
 - .4 "straight" shall mean within 3 mm (1/8") in 3 m (10 ft.) under a 3 m (10 ft.) straight edge.

1.15 BUILDING COMPONENTS

- .1 Requirements specified herein apply to all elements of the building components.
- .2 Continuity of fire separations, air barriers, vapour barriers, air/vapour barriers and insulation components are critical and must be maintained at all locations. Where different systems meet, ensure proper interface and continuity between adjacent components by implementing suitable construction sequences and by using compatible materials only.
- .3 Provide control joints in interior and exterior building components of design and spacing which will permit expansion and contraction of components without causing distortion, failure of joint seals, undue stress, cracking, bowing or other defects detrimental to appearance and performance. Review design and location of control joints with Consultant prior to start of Work and follow directions given by Consultant.
- .4 Anchor exterior components to structure in manner suitable to accommodate structural deflection and creep. Design anchorage to withstand expected wind loads, positive and negative, in accordance with applicable regulations.
- .5 Ensure that air spaces within building components are fire stopped in accordance with applicable regulations.
- .6 Ensure that air spaces on the outside of vertical air barrier/vapour barriers (walls) are constructed with adequate drainage provisions to the exterior.

1.16 DRAINAGE

- .1 Lay out and construct Work to ensure that positive drainage is provided to roof drains, floor drains, site drains and catch basins, as set in their final position, preventing undrained areas and ponding.
- .2 Ensure that allowable construction tolerances and structural deflection do not cause ponding of water.
- .3 Report to Consultant in writing prior to executing Work affected, in case adequate drainage cannot be provided.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.3 DEWATERING

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

1.4 WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .3 Pay for utility charges at prevailing rates.

1.5 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Pay costs for maintaining temporary heat,
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.
- .2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .3 Provide temporary power for equipment as required.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Power supply is available and will be provided for construction use at current cost rates. Connect to existing power supply in accordance with Canadian Electrical Code and provide meters and switching.
- .6 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary phones, computer with email and high-speed internet access, computer, and equipment as necessary for own use.

1.8 FIRE PROTECTION

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

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

1.9 CONSTRUCTION AID

- .1 Provide temporary stairs, ladders and ramps required for movement and placing of materials, equipment and personnel.
- .2 Provide mechanical hoisting equipment and fully qualified operators as required during construction.
- .3 Erect required scaffolding independent of walls. Arrange to avoid interference with work of other Sections as much as possible. Design and construct scaffolding in accordance with CSA S269.2-1975.
- .4 Provide and maintain regular shoring and bracing in accordance with Construction Safety Act and other applicable regulations. Design and construct falsework in accordance with CSA S269.1-1975.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC):
 - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .3 Canadian Standards Association (CSA International):
 - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121-M1978(R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.
 - .4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.
- .4 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water:
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.4 COLD WEATHER CONDITIONS

.1 The term "cold weather periods" shall mean the periods between the 15th of September to the 31st day of May of the following year; from the date of commencement of the Work until the Work is completed.

.2 Assume full responsibility and pay all costs for snow or ice removal from the project site. Maintain site during cold weather periods including but not limited to cleaning and/or clearing any snow or ice accumulation as required to perform the Work and to provide a safe working environment around the building and project site. Dump snow at properly designated areas to the requirements of local authorities.

1.5 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs as required to perform the Work.

1.6 SITE STORAGE/LOADING

- .1 Refer to CCDC 2, GC 3.11.
- .2 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .3 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.7 CONSTRUCTION PARKING

- .1 Parking will be permitted on site at no cost, provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site and traffic areas.

1.8 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table and filing cabinets for construction documents as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 Reviewed Shop Drawings of Owner Furnished Items.
 - .6 List of Outstanding Shop Drawings.
 - .7 Site Instructions.
 - .8 Change Notices.
 - .9 Change Orders.
 - .10 Other Modifications to Contract.
 - .11 Field Test Reports.
 - .12 Copy of Most Recent and Approved Work Schedule.
 - .13 Health and Safety Plan and Other Safety Related Documents.
 - .14 'Notice of Project' from Ontario Ministry of Labour.

- .15 Building permit.
- .16 Meeting Minutes.
- .17 Other documents as specified.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.10 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 When permanent water and drain connections are completed, continue to provide temporary sanitary facilities. Permanent facilities may not be used.

1.11 CONSTRUCTION SIGNAGE

- .1 Provide and erect project sign, within [three (3)] weeks of signing Contract, in a location designated by Consultant.
- .2 Construction sign 2400 mm x 4800 mm / 8' x 16', of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter to the approval of the Consultant.
- .3 Indicate on sign, name of Owner, Consultant(s) and Contractor, of design style established by Consultant.
- .4 Erect Consultant supplied sign on wood frame in location as identified by Consultant. Maintain sign for the duration of project. Remove and return to Consultant upon completion of the Work.
- .5 No other signs or advertisements, other than warning signs, are permitted on site unless approved in writing by Consultant.
- .6 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Consultant.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International):
 - .1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

- .1 Existing temporary fencing surrounding the building is the property of Owner and to be removed and replaced within fifteen (15) business days of contract award.
- .2 Provide temporary controls in order to execute Work expeditiously.
- .3 Remove from site all such work after use.

1.3 HOARDING

- .1 Erect hoarding and solid overhead protection to the requirements of the authorities having jurisdiction around entire perimeter of construction area as required to protect public, workers, occupants, public and private property from injury or damage.
- .2 Provide and maintain required hoardings, barricades, guardrails, and lights in accordance with applicable regulations.
- .3 Erect temporary site enclosures where required using 1200 x 2400 mm/ 4' x 8' temporary steel frame panels.
- .4 Provide lockable truck entrance gates, and at least one pedestrian door, as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .5 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
- .6 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs
- .2 Provide as required by governing authorities.

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- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.6 DUST TIGHT SCREENS

- .1 Provide dust tight screen partitions or insulated partitions where required to localize dust generating activities, and for protection of workers, finished areas of Work and public.
 - .1 Erect dust tight screen partitions where required using 38 x 89 mm / 2 x 4 construction grade lumber framing at 610 mm centres and 1200 x 2400 x 13 mm / 4' x 8' x 1/2" plywood to CSA O121.
 - .2 Provide dust tight wood door frame and wood door complete with hinges, door closer, lockset and weatherstripping at all required access points.
 - .3 Provide positive dust tight seal at all:
 - .1 Plywood joints using continuous 38 mm / 1 1/2" wide foam tape.
 - .2 Access doors using weather stripping at jamb, head and sill.
 - .3 Around entire perimeter using continuous foam rods between dust tight screen partition and floor, walls, and ceilings.
 - .4 Apply plywood panels vertically flush and butt jointed.
- .2 Maintain and relocate dust tight screen protection until such work is complete.
- .3 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

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1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Be responsible for damage incurred due to lack of or improper protection.

1.12 WASTE MANAGEMENT AND DISPOSAL

Separate waste materials for reuse and recycling in accordance with Section 017421 -.1 Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 **NOT USED**

Not Used. .1

PART 3 - EXECUTION

3.1 **NOT USED**

.1 Not Used.

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.

1.2 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC):
 - .1 CCDC 2-2008. Stipulated Price Contract.
- .2 Within text of each specifications section, reference may be made to reference standards.
- .3 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.
 - .1 Cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.3 QUALITY

- .1 Refer to CCDC 2 and Section 02 42 00 Alteration Procedures.
- .2 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 **AVAILABILITY**

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- Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable .1 supply delays for items. If delays in supply of products are foreseeable, Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- Store products subject to damage from weather in weatherproof enclosures. .3
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber and other similar materials on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- Remove and replace damaged products at own expense and to satisfaction of Consultant. 8.
- Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to .9 match original. Do not paint over name plates.

1.6 **TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Owner. Unload, handle and store such products.

1.7 MANUFACTURER'S INSTRUCTIONS

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

- .2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.8 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.9 COORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Consultant if there is interference. Install as directed by Consultant.

1.11 REMEDIAL WORK

- .1 Refer to CCDC 2 and Section 01 73 00 Execution Requirements and Section 02 42 00 Alteration Procedures.
- .2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Consultant of conflicting installation. Install as directed.

1.13 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Consultant.

1.16 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

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PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-2008, Stipulated Price Contract.
- .2 Owner's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

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

1.3 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Consultant.
- .4 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

- .1 Establish two (2) permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation column locations and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Consultant.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space according to manufacturer's recommendations for safety, access and maintenance.
- .3 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Consultant.
- .2 On request of Consultant, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.9 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

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PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 013300 Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 –
 Submittal Procedures.

1.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill to complete Work.
- .2 Fit several parts together, to integrate with other Work.

- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing (as required).
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 078400 Firestopping, full thickness of the construction element.
- .13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

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1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct a meeting with Owner and Consultant to review Waste Management Plan.
- .2 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by construction.
- .3 Protect environment and prevent environmental pollution damage.

1.2 REFERENCES

.1 Definitions:

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling.
- .2 Class III: non-hazardous waste construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Inert Fill: inert waste exclusively asphalt and concrete.
- .5 Recyclable: ability of product or material to be recovered at end of its life cycle and remanufactured into new product for reuse.
- .6 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .7 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .8 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .9 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .10 Separate Condition: refers to waste sorted into individual types.
- .11 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

.2 Reference Standards:

- .1 Ontario Ministry of Environment
 - .1 Ontario 3 R's Regulations (regulation 102/94) for waste management programs applicable to construction and demolition projects greater than 2,000 m³.
- .2 Canadian Construction Association (CCA)
 - .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.4 USE OF SITE AND FACILITIES

.1 Execute Work with minimal interference and disturbance to normal use of premises.

1.5 WASTE PROCESSING SITES

.1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Owner.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, and store salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Consultant.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .9 Separate and store materials produced during dismantling of structures in designated areas.
- .10 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.

1.7 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
- .3 Remove materials on-site as Work progresses.
- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.8 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

1.9 SCHEDULING

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

1.1 SECTION INCLUDES

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

1.2 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-2008, Stipulated Price Contract.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Procedures for Acceptance of Work:
 - .1 Contractor's Inspection: Prior to making application for substantial performance of the Work
 - .1 Conduct inspection of Work, identify and submit to the Consultant in writing a comprehensive list of deficiencies and defects, and repair as required to conform to Contract Documents.
 - .2 Notify Consultant in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request in writing for Consultant to inspect Work and identify defects and deficiencies.
 - .3 Completion Tasks: submit written certificates that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
 - .4 Elevator has been tested and certified by authorities having jurisdiction and is fully operational.
 - .5 Fire alarm verification certificate issued to Consultant.
 - .6 Final Electrical Safety Authority (ESA) Inspection Certificate issued to Consultant.
 - .7 Certificates required by Utility companies: submitted.
 - .8 Operations and maintenance manuals have been submitted and approved by Consultant.
 - .9 Operation of systems: demonstrated to Owner's personnel.
 - .10 Commissioning of mechanical systems: completed in accordance with019113 General Commissioning (Cx) Requirements and except for warranty and seasonal verification activities specified within, submit electronic copies of final Commissioning Report submitted to Consultant.
 - .4 Consultants Inspection (Stage 1):
 - .1 When completion tasks are done, make application for Certificate of Substantial Performance. Refer to CCDC 2, General Conditions Article GC Part 5, and Payment. Request in writing for an inspection of Work to be performed by Owner, Consultant, and Contractor for the purpose of obtaining Substantial Performance.
 - .2 The Consultant will prepare a written list of deficiencies which will be issued to the Contractor. The Contractor shall then proceed to correct the deficiencies and complete the Work.
 - .3 Should the Work be deemed complete by the Consultant for the purpose of declaring the project Substantially Performed, the Consultant will issue a Certificate of Substantial Performance to the Contactor and Owner in accordance with the requirements of the lien statute of Place of Work. The Contractor shall then proceed to Stage 2 for Finishing Work.
 - .4 Should Work be deemed incomplete according to Owner and Consultant, complete

- outstanding items and repeat the steps noted above for additional Stage 1 inspections. Refer also to Item 1.5 Number of Inspections.
- .5 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .6 Final Payment (Stage 2):
 - .1 Upon completion of the outstanding items noted in Stage 1, request in writing for a final inspection of Finishing Work to be performed by Owner, Consultant, and Contractor for the purpose of obtaining Total Performance.
 - .2 When the Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment. Should the Work be deemed complete by the Consultant for the purpose of declaring the project Totally Performed, the Consultant will request from the Contractor complete with the required submittals as prescribed in Section 01 29 00 Payment Procedures, Final Payment.
 - 3 Refer to CCDC 2: when Work deemed incomplete by Consultant. Complete outstanding items and request re-inspection.
 - .4 Should Work be deemed incomplete according to Owner and Consultant, complete outstanding items and repeat the steps noted above for additional Stage 2 inspections. Refer also to Item 1.5 Number of Inspections.
- .7 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work and the Work being declared Totally Performed, submit application for payment of holdback amount in accordance with contractual agreement.

1.4 NUMBER OF INSPECTIONS

- .1 The Consultant and the Owner will perform final inspections as described above, under the headings of Stage 1 and Stage 2.
- .2 Should additional inspections be necessary in the opinion of the Consultant as noted in Stage 1 and / or Stage 2 inspections, such inspections will be performed by the Consultant and Owner and the Contractor shall pay all costs of time, transportation and miscellaneous expenses incurred by any and all members of the Consultant and Owner team.
- .3 The applicable Consultant rates shall be J.L. Richards & Associates Limited current per diem professional rates. The Owner shall be reimbursed at the Owner's established rates.
- .4 Owner will deduct all applicable compensation rates for Consultant and Owner for re-inspection services from the outstanding payments owning to the Contractor.

1.5 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 **NOT USED**

.1 Not Used.

PART 3 - EXECUTION

NOT USED 3.1

.1 Not Used.

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PART 1 - GENERAL

1.1 SECTION INCLUDES:

- .1 Record documents, samples, specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 As constructed documents.
- .6 Warranties and bonds.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one (1) month prior to contract completion with Owner and Consultant, in accordance with Section 01 31 19 Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Consultant to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Consultant:
 - .1 Four (4) final copies of operating and maintenance manuals.
 - .2 Four (4) copies of Commissioning Report except warranty and seasonal verification activities manuals.
- .3 Two weeks following Substantial Performance of the Work, provide to the Consultant and / or Owner as directed by Consultant:
 - .1 Spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
 - .1 Provide evidence, if requested, for type, source and quality of products supplied.
 - .2 Defective products will be rejected, regardless of previous inspections. Replace products at no cost to Owner.
 - .2 As Constructed documents.
 - .3 Maintenance materials.
 - .4 Warranties.

1.4 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8 ½ x 11 inches with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses and telephone numbers of Consultant and Contractor / Sub-Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 Quality Control.
- .6 Training: refer to Section 01 79 00 Demonstration and Training.

1.6 AS-CONSTRUCTED DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Consultant one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.

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- .4 Supplemental Instructions.
- .5 Change Orders and other modifications to Contract.
- .6 Reviewed shop drawings, product data, and samples.
- .7 Field test records.
- .8 Inspection certificates.
- .9 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Consultant.

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Prior to commencing with construction, arrange with Consultant to obtain one complete set of opaque contract drawings.
- .2 Record information on set of black line opaque drawings Consultant.
- .3 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .4 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .5 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Supplemental Instructions.
 - .6 Changes made by change orders.
 - .7 Details not on original Contract Drawings.
 - 8 References to related shop drawings and modifications.
- .6 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Supplemental Instructions.
 - .3 Changes made by Addenda and change orders or change directives.
- .7 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 FINAL SURVEY

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

1.9 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 014500 Quality Control and 019113 General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.11 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Consultant.
 - .2 Include approved listings in Maintenance Manual.
 - .3 Obtain receipt for delivered products and submit prior to final payment.

.2 Extra Stock Materials:

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to Consultant.
 - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.3 Special Tools:

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to Consultant.
 - .2 Include approved listings in Maintenance Manual.

1.12 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.

- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Consultant.

1.13 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, one (1) month before planned pre-warranty conference, to Consultant approval.
- .3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Consultant for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Consultant.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as alarm systems, lightning protection systems,.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate

items that have extended warranties and show separate warranty expiration dates.

- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Owner to proceed with action against Contractor.

1.14 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Consultant.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner will provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with individual specification sections.
 - .4 Ensure testing, adjusting, and balancing has been performed in accordance with individual specification, Section 01 91 13 General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Provide Operator Training for all systems, as specified, and as a basic minimum for the following systems:
 - .1 Heating System
 - .2 Cooling and Ventilation Systems
 - .3 Building Automation and Controls System
 - .4 Plumbing Systems, including Domestic Water, Domestic Hot Water
 - .5 Normal Power System
 - .6 Back-up Power System
 - .7 Elevator
 - .8 Lighting Controls
 - .9 Security System
 - .10 Specialized equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates for Consultant's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Owner's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
 - .1 BMM Building Management Manual.
 - .2 Cx Commissioning.
 - .3 EMCS Energy Monitoring and Control Systems.
 - .4 O&M Operation and Maintenance.
 - .5 PI Product Information.
 - .6 PV Performance Verification.
 - .7 TAB Testing, Adjusting and Balancing.

1.2 CX AGENT

- .1 Obtain and pay for Cx agent for use on the project.
- .2 Cx agent to review Cx work on behalf of Owner, with payment by Contractor.

1.3 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
 - .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.4 COMMISSIONING OVERVIEW

.1 Cx to be a line item of Contractor's cost breakdown.

- .2 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.
- .4 CX agent and Consultant will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Cx agent and Consultant.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Cx agent and Consultant, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or holdback assessments.

1.6 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Cx agent and Consultant.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Coordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Cx agent and Consultant.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Cx agent and Consultant for review and approval.
 - .10 Ensure "As-Constructed" system schematics are available.
- .4 Inform Cx agent and Consultant in writing of discrepancies and deficiencies on finished works.

1.7 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to agent and Consultant before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 Submittal Procedures.
 - .1 Submit no later than four (4) weeks after award of Contract:
 - .1 Draft Cx documentation.
 - .2 Preliminary Cx schedule.
 - .2 Request in writing to Cx agent and Consultant for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Cx agent and Consultant where not specified and obtain written approval at least 8 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Cx agent and Consultant.

1.9 COMMISSIONING DOCUMENTATION

- .1 Cx agent and Consultant to review and approve Cx documentation.
- .2 Provide completed and approved Cx documentation to Cx agent and Consultant.
- .3 Submit sample check lists and Product Information (PI) / Performance Verification (PV) forms for review and acceptance.

1.10 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 Construction Progress Schedules Bar (GANTT) Chart.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.11 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16.07 Construction Progress Schedules Bar (GANTT) Chart and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

- .4 At approximately 60% construction completion stage. Section 01 32 16.07 Construction Progress Schedules Bar (GANTT) Chart. Cx agent to call a separate Cx scope meeting with Contractor, relevant Subcontractors, Owner and Consultant to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Cx Agent, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.12 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 WITNESSING OF STARTING AND TESTING

- .1 Provide ten (10) business days' notice prior to commencement.
- .2 Cx agent and Consultant to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Consultant and Cx agent.
 - .3 Arrange for Cx agent and Consultant to witness tests.
 - .4 Obtain written approval of test results and documentation from Cx agent and Consultant before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Cx agent and Consultant.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturers' trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.

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- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.15 **PROCEDURES**

- .1 Verify that equipment and systems are complete, clean, and operating in a normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification; to include fine-tuning.
- Correct deficiencies and obtain written approval from Cx agent and Consultant after distinct phases .3 have been completed and before commencing next phase.
- Document required tests on approved PV forms. .4
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Consultant. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement the following:
 - .1 Minor equipment/systems: implement corrective measures approved by Cx agent and Consultant.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Cx agent and Consultant.
 - .3 If evaluation report concludes that major damage has occurred, Cx agent and Consultant shall reject equipment.
 - .1 Remove rejected equipment from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

START-UP DOCUMENTATION 1.16

- Assemble start-up documentation and submit to Cx agent and Consultant for approval before .1 commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports.
 - .5 Step-by-step description of complete start-up procedures, to permit Cx agent and Consultant to repeat start-up at any time.

1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Cx agent and Consultant for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.18 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved at no additional cost to Owner.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.19 START OF COMMISSIONING

- .1 Notify Cx agent and Consultant at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.20 INSTRUMENTS / EQUIPMENT

- .1 Submit to Cx agent and Consultant for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date, and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.21 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and written reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.22 WITNESSING COMMISSIONING

.1 Cx agent and Consultant to witness activities and verify results.

1.23 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Cx agent and Consultant within 5 days of test and with Cx report.

1.24 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Cx agent and Consultant in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100% of reported results.
- .2 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.
- .3 Number and location to be at discretion of Consultant.
- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .6 Perform additional commissioning until results are acceptable to Cx agent and Consultant.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Consultant for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Cx agent and Consultant's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Cx agent and Consultant deem Contractor's request for second verification was premature.

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1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 **DEFICIENCIES, FAULTS AND DEFECTS**

- Correct deficiencies found during start-up and Cx to satisfaction of Cx agent and Consultant. .1
- .2 Report problems, faults or defects affecting Cx to Cx agent and Consultant in writing. Stop Cx until problems are rectified. Proceed with written approval from CX Agent and Consultant.

COMPLETION OF COMMISSIONING 1.29

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to.
- .3 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Consultant's Certificate of Substantial Performance.
- .4 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Cx agent and Consultant.

ACTIVITIES UPON COMPLETION OF COMMISSIONING 1.30

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

TRAINING 1.31

In accordance with Section 01 79 00 – Demonstration and Training. .1

1.32 MAINTENANCE MATERIALS, SPARE PARTS AND SPECIAL TOOLS

Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in .1 contract.

1.33 **OCCUPANCY**

Cooperate fully with Cx agent and Consultant during stages of acceptance and occupancy of facility. .1

INSTALLED INSTRUMENTATION 1.34

Use instruments installed under Contract for TAB and PV if: .1

- .1 Accuracy complies with these specifications.
- .2 Calibration certificates have been deposited with Cx agent and Consultant.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/-2% of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Cx agent or Consultant will not relieve Contractor from compliance with specified start-up and testing procedures.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

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PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-demolition meeting one (1) week prior to beginning work of this Section, with Contractor's Representative and Consultant in accordance with Division 01:
 - .1 Verify project requirements.
 - .2 Verify existing site conditions adjacent to demolition work.
 - .3 Coordination with other construction sub trades.
 - .2 Ensure site supervisor and project manager attend.
 - .3 Consultant will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

.2 Scheduling:

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 In event of unforeseen delay notify Consultant in writing.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Shop Drawings:
 - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
 - .2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: Ensure Work is performed in compliance with applicable Provincial and Municipal regulations.

1.4 SITE CONDITIONS

- .1 Environmental Protection:
 - .1 Ensure Work is done in accordance with Division 01.
 - .2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .3 Fires and burning of waste or materials is not permitted on site.
 - .4 Do not bury rubbish waste materials.
 - .5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout project.

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- .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
- .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .9 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .10 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

EXISTING CONDITIONS 1.5

- .1 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify Consultant immediately. Proceed only after receipts of written instructions have been received from Consultant.
- .2 Structures to be demolished are based on their condition on date that tender is accepted.

PART 2 - PRODUCTS

2.1 **EQUIPMENT**

- .1 Equipment and Heavy Machinery:
 - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations and CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .2 Off-road vehicles to: EPA CFR 86.098-10 and EPA CFR 86.098-11.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

PART 3 - EXECUTION

3.1 **PREPARATION**

- .1 Temporary Erosion and Sedimentation Control:
 - Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to civil drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .2 Protection of In-place Conditions:
 - .1 Prevent movement, settlement or damage of adjacent structures, trees, landscaping, and properties.

- .1 Provide bracing, shoring and underpinning as required.
- .2 Repair damage caused by demolition as directed by Consultant.
- .2 Support affected structures and, if safety of structure being demolished or adjacent structures appears to be endangered, take preventative measures, stop Work and immediately notify Consultant.
- .3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

.3 Surface Preparation:

- .1 Disconnect electrical and telephone service lines entering buildings to be demolished.
 - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .2 Disconnect and cap mechanical services.
 - .1 Natural gas supply lines: remove in accordance with gas company requirements.
 - .2 Sewer and water lines: remove in accordance with authority having jurisdiction and/or as directed by Consultant.
 - .3 Other underground services: remove and dispose of as indicated or as directed by Consultant.
- .3 Do not disrupt active or energized utilities traversing premises.
- .4 Remove rodent and vermin as required by Consultant.

3.2 DEMOLITION

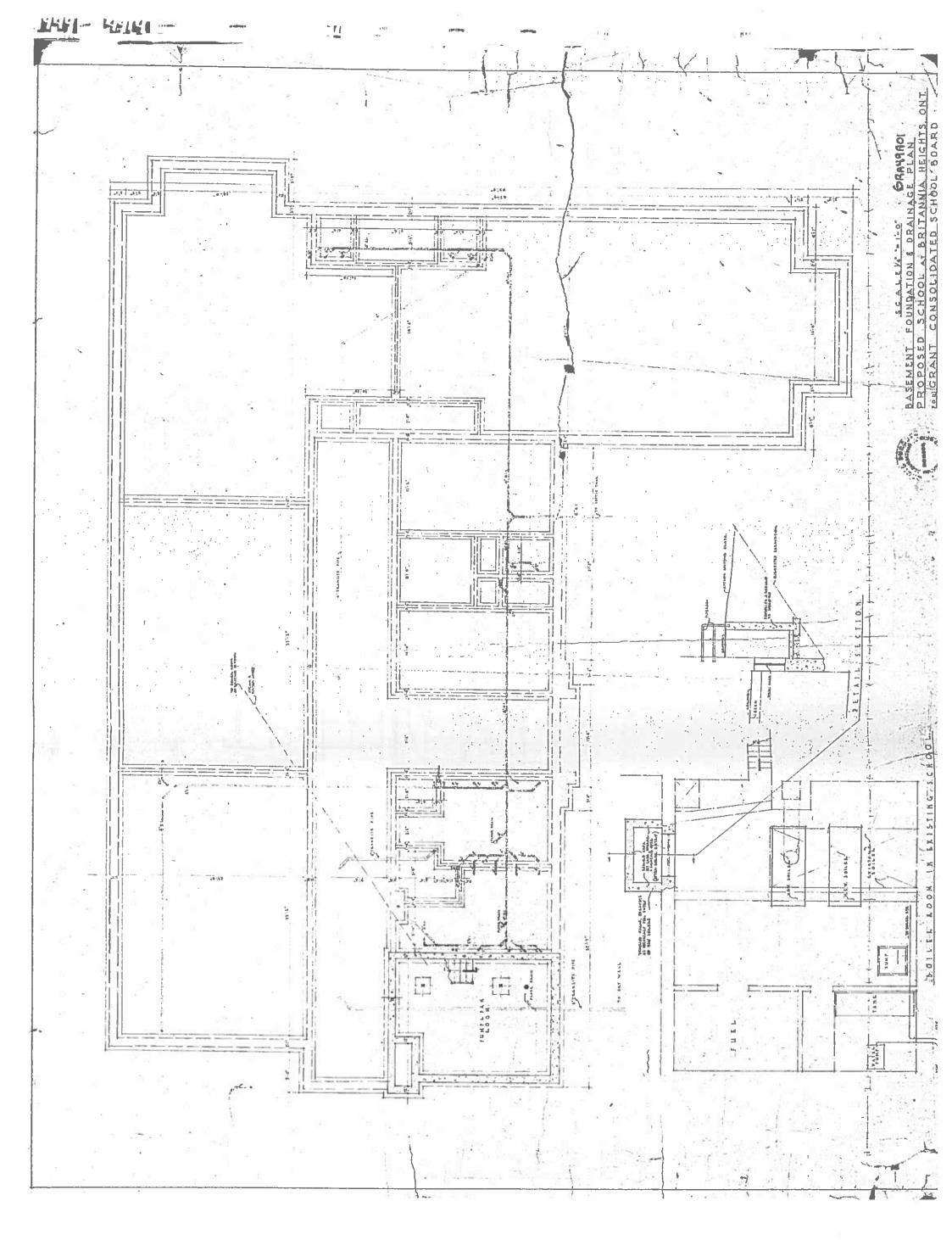
- .1 Do demolitions work in accordance with Division 01.
- .2 Blasting operations not permitted during demolition.
- .3 Perform blasting operations in accordance with CSA S350.
- .4 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
- .5 Prior to start of Work remove contaminated or hazardous materials as directed by Consultant from site and dispose of at designated disposal facilities in safe manner and in accordance with Section 02 81 01 Hazardous Materials. Refer Existing Conditions in PART 1.
- .6 Demolish structure to permit construction of addition.
- .7 Crush concrete generated due to demolition of foundations to size as directed.
 - .1 Where possible identify markets which will accept crushed material as aggregate.
 - .2 For further information regarding acceptable uses contact Provincial aggregate producers associations.
- .8 Demolish foundation walls and footings and concrete floors below or on grade within areas of new construction.
- .9 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .10 At end of each day's work, leave Work in safe and stable condition.

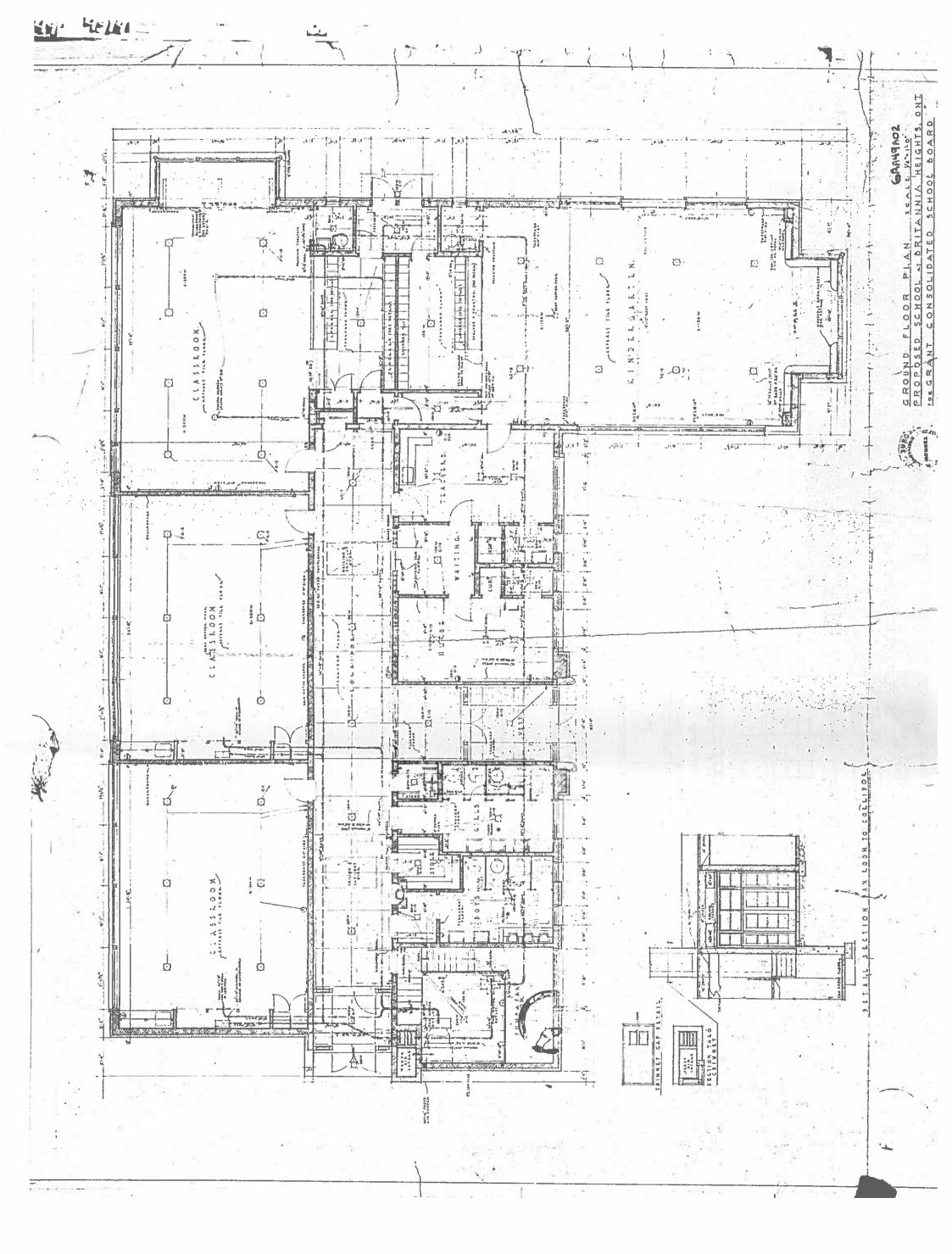
- .11 Protect interiors of parts not to be demolished from exterior elements at all times.
- .12 Demolish to minimize dusting. Keep materials wetted as directed by Consultant.
- .13 Remove structural framing.
- .14 Contain fibrous materials to minimize release of airborne fibres while being transported within facility.
- .15 Dispose of all demolition material unless otherwise indicated.
- .16 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .17 Use natural lighting to do Work where possible.
 - .1 Shut off lighting except those required for security purposes at end of each day.

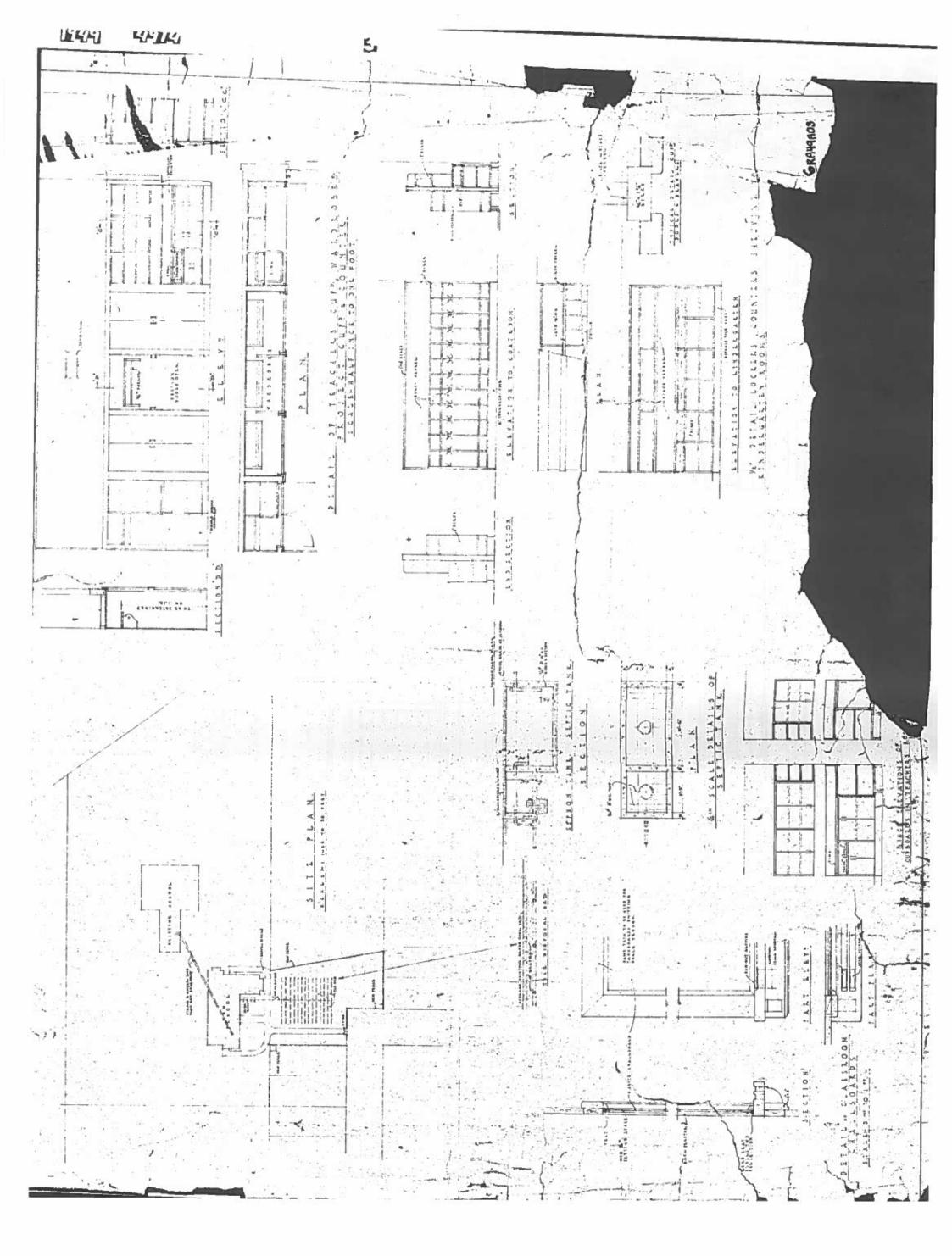
3.3 CLEANING

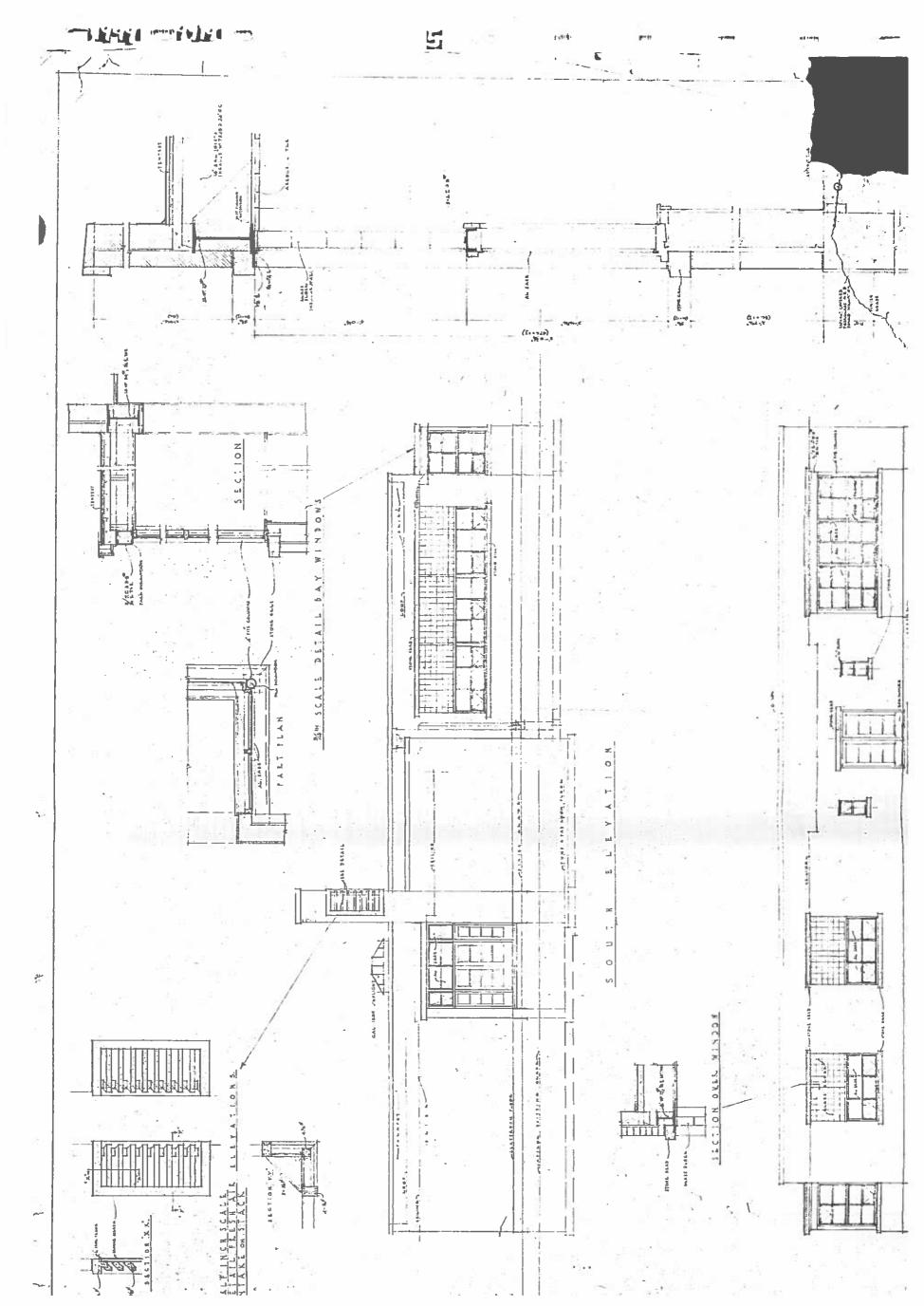
- .1 Divert excess materials from landfill to site approved by Consultant.
- .2 Designate appropriate security resources / measures to prevent vandalism, damage and theft.
- .3 Supply separate, clearly marked disposal bins for categories of waste material. Please notify Consultant prior to removal of bins from site.
- .4 Remove or relocate stockpiled material as directed by Consultant, when it interferes with operations of project construction.
- .5 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .6 Transport material designated for alternate disposal using approved haulers listed in Waste Reduction Workplan and in accordance with applicable regulations.
 - .1 Written authorization from Consultant is required to deviate from haulers listed in Waste Reduction Workplan.
- .7 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
 - .2 Written authorization from Consultant is required to deviate from disposal facilities listed in Waste Reduction Workplan.

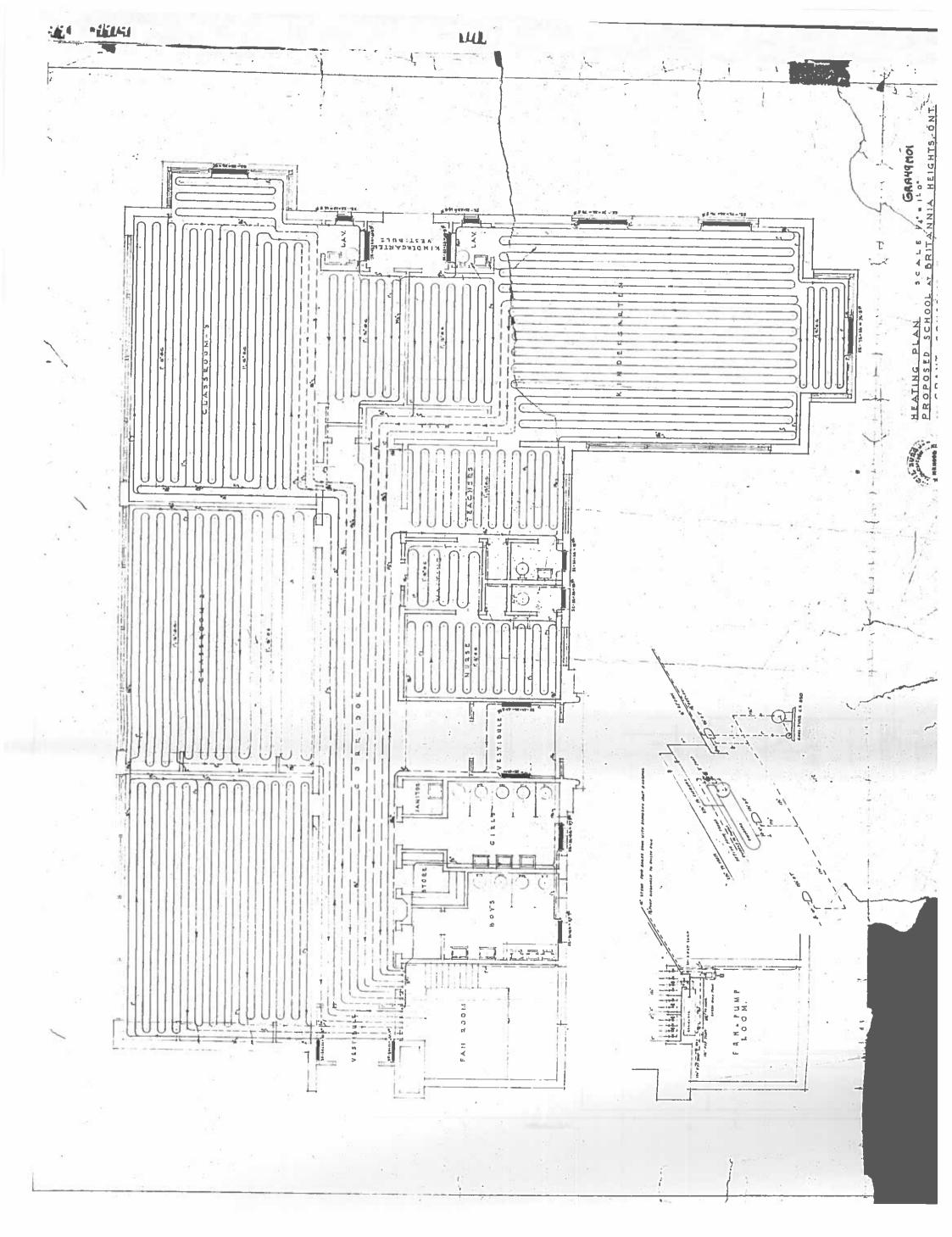
END OF SECTION













DESIGNATED SUBSTANCES SURVEY REPORT

CENTRE MULTISERVICES FRANCOPHONE DE L'OUEST D'OTTAWA 2720 RICHMOND ROAD OTTAWA, ONTARIO

EHS^P Project: 04-0144-17-004

Prepared by:

EHS Partnerships Ltd. 406 – 2 Gurdwara Road Ottawa, ON K2E 1A2

Prepared for:

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October, 2017

Prepared by:

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CONFIDENTIAL

Distribution:

1 PDF - CEPEO

1 copy - EHS Partnerships Ltd

EXECUTIVE SUMMARY

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October, 2017

EHS^P Project: 04-0144-17-004

INTRODUCTION

EHS Partnerships Ltd. (EHS^P) was retained by the Conseil des écoles publiques de l'Est de l'Ontario (CEPEO) to complete a Designated Substances Survey (DSS) at the Annex building of the Centre multiservices francophone de l'Ouest d'Ottawa located at 2720 Richmond Road in Ottawa, Ontario (Subject Building). EHS^P understands the survey was requested as a pre-demolition survey to identify representative designated substances and hazardous materials that may be present at the Subject Building. The survey will also satisfy Section 30 of the Occupational Health and Safety Act (OSHA), and Ontario Regulation 278/05 "Regulation Respecting Asbestos on Construction Projects and in Building and Repair Operations" (O. Reg. 278/05).

Nancy Lee Fortin and Megan Eagan of EHS^P conducted the site assessment on October 3, 2017.

SCOPE

The purpose of the DSS was to identify building materials that may have the potential to contain designated substances and hazardous materials at the Subject Building. The project included a review of available documentation, a site investigation, and the collection and analysis of suspect materials. Specifically, the following was conducted:

- Review of existing reports for the Subject Building;
- Detailed site investigation of the Subject Building;
- Collection and analysis of 15 samples of suspect Asbestos Containing Materials (ACM);
- Visual inspection and documentation of building materials and equipment suspected to contain lead, silica, mercury, polychlorinated biphenyls (PCBs), and ozone depleting substances (ODS);
- Visual inspection and documentation of the remaining designated substances and hazardous materials; and
- Preparation of a report outlining identified Designated Substances and Hazardous Materials, recommendations for disposal, and cost estimates for removal.

CONCLUSIONS AND RECOMMENDATIONS

Asbestos

Asbestos was identified in the following materials throughout the Subject Building:

- Parging cement on pipe fittings;
- Aircell insulation on pipe straights;
- Plaster;
- Drywall joint compound;
- Mastic associated with 1' x 1' size acoustical ceiling tiles, brown colour;
- Vinyl floor tile, 9" x 9" size, yellow colour;
- Vinyl floor tile, 9" x 9" size, black colour; and
- Sweat wrap / tar paper on pipe straights.

Aircell pipe insulation was observed to be in poor condition at the time of the assessment. Additionally, some plaster and drywall was observed to be damaged.

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All remaining materials were all observed to be in good condition at the time of the assessment.

Any disturbance of these materials is subject to Ontario Regulation 278/05 – <u>Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations.</u> Prior to the demolition of the Subject Building the following recommendations are made based on the requirements of O. Reg. 278/05:

- The owner must notify all employees and contractors involved with renovations, repairs, alterations, or demolition of the presence of all ACM, which may be disturbed or damaged. A copy of this DSS report must be made available for review by any maintenance personnel or outside contractors working in the areas where ACM may be disturbed. As a good management practice, the owner should maintain a record of this notification.
- Remove all ACM to the extent possible prior to demolition.
- All asbestos waste generated by asbestos abatement operations must be packaged, labeled and disposed of in accordance with Ontario Regulation 347/90 (as amended). Asbestos waste may be disposed of at any municipal landfill approved by the MOE to accept this type of waste pending notification to and accepted by the landfill operator.
- ACM plaster should be removed following Type 3 Operations, as outlined in O. Reg 278/05;
- ACM drywall joint compound should be removed following Type 2 or Type 3 Operations.
 - o If following Type 2 Operations, material must be removed with power tools attached to dust-collecting devices equipped with HEPA filters, or by using non-powered hand tools;
 - o If following Type 3 Operations, material may be removed using power tools.
- ACM thermal pipe insulation, including aircell and parging cement on fittings must be removed following minimum Type 2 Glovebag Operations.
- ACM vinyl floor tile, floor tile mastic, and sweat wrap/tar paper may be removed following minimum Type 1 Operations.
 - If following Type 1 Operations, the material must be kept wetted, and must be removed using non-powered hand-held tools;
 - o If following Type 2 Operations, material must be removed with power tools attached to dust-collecting devices equipped with HEPA filters, or by using non-powered hand tools;
 - o If following Type 3 Operations, material may be removed using power tools.
- Due to the proximity of the various ACMs and the anticipated demolition of the Subject Building, consideration may be made to remove all materials at once in one Type 3 Operation.

Lead

Four (4) of the paint samples collected from the Subject Building were identified to contain a lead concentration greater than 90 ppm and are therefore considered to be lead-containing. Lead is likely present in the solder of copper pipes at the Subject Building

Measures prescribed in the Ministry of Labour's Guideline titled "Lead on Construction Projects" should be followed to control the lead dust hazard during the demolition of any painted surfaces or lead-containing materials.

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Silica

Silica is presumed to present throughout the Subject Building in the following materials: poured concrete, plaster, drywall materials, brick and associated mortar, ceramic tile and associated mortar, and textured wall and ceiling finishes. Measures prescribed in the Ministry of Labour's Guideline titled <u>Silica on Construction Projects</u> should be followed during the alteration of silica-containing materials.

Mercury vapour is presumed to be present in fluorescent light tubes observed throughout the Subject Building.

Mercury

Mercury-containing fluorescent light tubes must be carefully removed and containerized for disposal in accordance with Ontario Regulation 347/09 (as amended).

Polychlorinated Biphenyls (PCBs)

While PCB-containing light ballasts were not observed, there may be some remaining ballasts in the Subject Building. All fluorescent light ballasts should be verified prior to disposal. PCBs may also be present in roofing materials and caulking observed at the Subject Building.

If potential PCB-containing materials are to be removed, they should be removed in accordance with Federal Regulation SOR/2008-273 – PCB Regulations and CCME guidelines for the management of waste containing PCBs. The roofing material and caulking should be tested for PCBs prior to removal and disposal.

Smoke Detectors

Smoke detectors with a radioactive source were not observed at the time of the assessment. No recommendations for removal and disposal are required.

Benzene and Vinyl Chloride

Excessive heat must not be used on wire coatings, plastic materials, or PVC, as heat may release benzene. If these practices cannot be avoided, then implement control measures appropriate for the control of benzene prescribed in Ontario Regulation 490/09 – <u>Designated Substances</u>. This regulation is exempt from construction projects but provides useful guidance on personal protection when a specific regulation or guideline for a specific designated substance is not available for the construction industry.

Other Designated Substances and Hazardous Materials

The following designated substances and hazardous materials were not observed at the Subject Building:

- Acrylonitrile;
- Arsenic:
- Coke oven emissions;
- Ethylene oxide;
- Isocyanates;
- Ozone Depleting Substances; and
- Urea formaldehyde foam insulation.

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Recommendations for designated substances and hazardous materials not observed during the assessment are not provided.

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1.0 INTRODUCTION

EHS Partnerships Ltd. (EHS^P) was retained by the Conseil des écoles publiques de l'Est de l'Ontario (CEPEO) to complete a Designated Substances Survey (DSS) at the Annex building of the Centre multiservices francophone de l'Ouest d'Ottawa located at 2720 Richmond Road in Ottawa, Ontario (Subject Building). EHS^P understands the survey was requested as a pre-demolition survey to identify representative designated substances and hazardous materials that may be present at the Subject Building. The survey will also satisfy Section 30 of the Occupational Health and Safety Act (OSHA), and Ontario Regulation 278/05 "Regulation Respecting Asbestos on Construction Projects and in Building and Repair Operations" (O. Reg. 278/05).

Nancy Lee Fortin and Megan Eagan of EHS^P conducted the site assessment on October 3, 2017.

2.0 SCOPE OF WORK

The purpose of the DSS was to identify building materials that may have the potential to contain designated substances and hazardous materials at the Subject Building. The project included a review of available documentation, a site investigation, and the collection and analysis of suspect materials. Specifically, the following was conducted:

- Review of existing reports for the Subject Building;
- Detailed site investigation of the Subject Building;
- Collection and analysis of 15 samples of suspect Asbestos Containing Materials (ACM);
- Visual inspection and documentation of building materials and equipment suspected to contain lead, silica, mercury, polychlorinated biphenyls (PCBs), and ozone depleting substances (ODS);
- Visual inspection and documentation of the remaining designated substances and hazardous materials; and
- Preparation of a report outlining identified Designated Substances and Hazardous Materials, recommendations for disposal, and cost estimates for removal.

2.1 Previous Reports

EHS^P referred to the following report prior to conducting the field work:

• "Centre Multiservices Francophone de l'Ouest d'Ottawa, Designated Substances Survey, 2720 Richmond Road, Ottawa, Ontario", prepared by EHS Partnerships Ltd., dated April, 2012. Project reference # 04-0068-12-001.

3.0 REGULATIONS, STANDARDS, AND GUIDELINES

A DSS is required under section 30 of the Occupational Health and Safety Act (OHSA), enforced by the Ontario Ministry of Labour prior to the undertaking of a renovation or demolition in an area that may contain dangerous or hazardous building materials.

Designated substances in Ontario are defined in accordance with OHSA as a biological, chemical, or physical agent or combination thereof as a designated substance to which the exposure of a worker is prohibited, regulated, restricted, limited or controlled. Under section 30 of OHSA – "Duty of Project Owners", owners are required to determine if designated substances are present at a project site and disclose this information to project participants. The 11 designated substances in Ontario are:

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Acrylonitrile Coke oven emissions Mercury Arsenic Ethylene oxide Silica Isocvanates

Vinyl chloride Asbestos

Lead Benzene

Designated substances that individuals are likely to be exposed to during construction projects include; asbestos, lead, mercury, and silica. The Ontario Ministry of Labour provides guidance regarding these substances during construction in the following documents:

- Ontario Regulation 490/09 (O.Reg. 490/09): Designated Substances;
- Ontario Regulation 278/05 (O.Reg. 278/05): Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations;
- Guideline Silica on Construction Projects, Ministry of Labour 2004; and,
- Guideline Lead on Construction Projects, Ministry of Labour 2004.

3.1 Asbestos

Asbestos is regulated under the Ontario Regulation 278/05 Asbestos on Construction Projects and in Buildings and Repair Operations (O.Reg. 278/05). The Regulation provides definitions, outlines assessment requirements, and procedures for the handling of asbestos-containing materials (ACM). O.Reg. 278/05 defines an ACM as a "material that contains 0.5 per cent or more asbestos by dry weight." The Regulation defines a friable material as "a material that, when dry, can be crumbled, pulverized or powdered by hand pressure." Subsection 3 (3) Table 1 of the Regulation determines the minimum required number of samples per material to be collected during an assessment. The Regulation also lists information that is required for the constructor or employer to provide to any worker involved with ACM or suspect ACM at the work site. This information includes the location of the ACM, its friability, and in the case of sprayed-on ACM the specified type of asbestos.

All ACM that may be disturbed must be removed to the extent practicable and will be subject to special handling and disposal. O. Reg. 278/05 classifies asbestos removal into either Type 1, Type 2, or Type 3 operations. Where Type 1 operations have the lowest exposure risk, and Type 3 operations have the highest potential to generate concentrations of airborne asbestos fibres.

3.2 Lead

Ontario Regulation 490/09 - Designated Substances (O. Reg. 490/09) applies to every employer and worker at a workplace where lead is present, and at which the worker is likely to be exposed to lead. In the province of Ontario, the regulations or guidelines do not provide a specific definition for a lead containing paint.

The Canadian Federal Government has been limiting the amount of lead in paint to 0.5 percent (5,000 ppm) since 1976. The Surface Coating Materials Regulation (SOR/2016-193), pursuant to the 2005 Hazardous Products Act, limits the allowed concentration of lead in a paint applied to manufactured products to 0.009 percent (90 ppm) of lead. The general industry practice is to evaluate historic paint relative to the 0.5 percent (5,000 ppm) concentration. The Guideline for Lead on Construction Projects (Ontario Ministry of Labour 2004) indicates that the disturbance of any painted surface is subject to the guideline to ensure that airborne levels of lead are maintained below 0.05 mg/m³.

ances Survey Report October, 2017 coad, Ottawa, ON EHS^P Project: 04-0144-17-004

For the purposes of this assessment, paints identified to contain concentrations of lead greater than 90 ppm are considered lead-containing and a lead based paint is identified as any paint identified to contain concentrations of lead greater than 5,000 ppm.

3.3 Silica

Exposure to airborne silica is regulated under <u>Ontario Regulation 845/90 Designated Substance – Silica.</u> Silica dust may be generated and become airborne during construction activities including blasting, grinding, crushing, and sandblasting silica-containing materials. The Ontario Ministry of Labour's guideline document <u>Silica on Construction Projects</u> outlines precautions that must be taken to prevent silica-containing particles from becoming airborne during such activities.

3.4 Polychlorinated Biphenyls (PCBs)

Canadian federal regulation SOR/2008/-273 <u>PCB Regulations</u>, and Ontario Regulations 347/90 <u>General – Waste Management</u> and 362/90 <u>Waste Management – PCB's</u>, outline the requirements for handling, storage, and removal of equipment containing PCBs.

3.5 Ozone Depleting Substances (ODS)

Ontario Regulation 189/94 <u>Refrigerants</u> describes the procedures for removal and disposal of refrigeration equipment. Such activities should only be undertaken by persons with valid ozone depleting prevention cards.

3.6 Other Designated Substances and Hazardous Materials

All remaining designated substances and hazardous materials outlined in this report are defined under the Occupational Safety and Health Act (OSHA). These include the following designated substances: acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride. The remaining hazardous materials including: mould, UFFI, and radioactive materials are also regulated under OSHA.

4.0 METHODOLOGY

4.1 Asbestos

Asbestos sampling was conducted in accordance with O. Reg. 278/05. EHS^P conducted a systematic visual inspection of structural, mechanical, and architectural elements, of the Project Area where applicable. Building materials suspected of containing asbestos were sampled, their locations documented, and classified as either friable or non-friable. EHS^P submitted the samples to EMSL Canada Incorporated (EMSL) of Ottawa, Ontario for analysis. The samples were analyzed by Polarized Light Microscopy (PLM) following US Environmental Protection Agency Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Samples were collected in accordance with subsection 3(3) Table 1 of O.Reg. 278/05. The Regulation provides the requirements for the minimum number of samples to be collected from area of homogeneous material and is summarized in Table 4.1.1 of this report.

Table 4.1.1: O. Reg. 278/05 Bulk Material Samples

Type of Material	Size of Area of Homogeneous Material	Minimum Number of Samples Collected
Surfacing material, including without limitation material that	Less than 90 m ² (<1,000 ft ²)	3
is applied to surfaces by spraying, by troweling or otherwise, such as acoustical	90 m ² or more but less than 450 m ² (1,000 - 4,900 ft ²)	5
plaster on ceilings and fireproofing materials on structural members	450 m ² or more (>4,900 ft ²)	7
Thermal insulation, except as described below	Any Size	3
Thermal insulation patch	Less than 2 m or 0.5 m ²	1
Other material	Any Size	3

4.2 Lead

EHS^P conducted a visual assessment and a lead-based paint sampling program as part of the DSS. Samples suspected of containing lead were submitted under chain of custody to EMSL of Ottawa, Ontario for lead analysis via Metals by ICP-OES.

4.3 Other Designated Substances and Hazardous Materials

All other potential designated substances and/or hazardous materials were visually identified and documented at the Subject Building as required.

5.0 SITE DESCRIPTION

The Subject Building is composed of single story residential dwelling with a finished basement and attached garage. Interior sampling was conducted throughout the Subject Building.

6.0 FINDINGS, RESULTS, AND DISCUSSION

6.1 Asbestos

As part of the October 2017 ACM survey, EHS^P collected a total of 15 bulk samples. The laboratory results are presented in Appendix A and a room-by-room asbestos inventory is provided in Appendix B. A Class A cost estimate for the removal of identified ACM is provided in Appendix C. The 2017 laboratory results are summarized in Table 6.1.1 below.

Table 6.1.1 – Summary of Analytical Results – Asbestos

Sample Number	Floor	Sample Location Material Description		Asbestos Analytical Results	Friable/ Non-Friable	
2027-BS-01a	1	Vestibule				
2027-BS-01b	1	Corridor – south	Terrazzo flooring	None detected	Not applicable	
2027-BS-01c	1	Corridor - north				
2027-BS-02a	1					
2027-BS-02b	1	Classroom 1	Carpet mastic	None detected	Not applicable	
2027-BS-02c	1					
2027-BS-03a	1	Teacher's		8% chrysotile		
2027-BS-03b	1	lounge	Vinyl floor tile – 9"x9", tan with brown streaks	a	Non-friable	
2027-BS-03c	1	Classroom 3	tui vitii bi ovii bii cuis	Stop positive		
2027-BS-04a	1	Teacher's	F1 421	0.75% chrysotile		
2027-BS-04b	1	lounge	Floor tile mastic – black/brown	64	Non-friable	
2027-BS-04c	1	Classroom 3		Stop positive		
2027-BS-05a	1					
2027-BS-05b	1	Boiler room	Flex duct fabric	None detected	Not applicable	
2027-BS-05c	1					

Notes

Table 6.1.2, below, summarizes sample results from the previous assessment, conducted in 2012.

Table 6.1.2 - Summary of Analytical Results (2012) - Asbestos

Sample Number	Floor	Sample Location	Material Description	Asbestos Analytical Results	Friable/ Non-Friable
PL-1-A	1	Classroom 4			
PL-1-B	1	Classroom 1			
PL-1-C	1	Teacher's lounge			
PL-1-D	1	Waiting room	Plaster	2% chrysotile	Non-friable
PL-1-E	1	Classroom 2			
PL-1-F	1	Classroom 3			
PL-1-G	1	Classroom 4			
VT-1-A	1	Classes om 1	Vinyl floor tile, 12"x12",	Nama dataatad	Not applicable
VT-1-B	1	Classroom 1	grey	None detected	Not applicable

⁽¹⁾ **Bold result** - indicates asbestos containing material

Floor	Sample Location	Material Description	Asbestos Analytical Results	Friable/ Non-Friable	
1	Classroom 1	Vinyl floor tile, 12"x12", grey	None detected	Not applicable	
1					
1	Classroom 1		None detected	Not applicable	
1		Winte			
1					
1	Classroom 1	Cove base mastic	None detected	Not applicable	
1					
1					
1	Classroom 1	Acoustical ceiling tile,	None detected	Not applicable	
1		1 A1, evenily spaces notes			
1		Mostic associated with			
1	Library	acoustical ceiling tiles,	2% chrysotile	Non-friable	
1		brown			
1	Classroom 1				
1	Waiting room				
1	Girls washroom	Drywall joint compound	2% chrysotile	Non-friable	
1					
1	Classroom 4				
1			None detected	Not applicable	
1	Teacher's lounge	Concrete block mortar			
1					
1					
1	Waiting room	Vinyl floor tile, 9"x9",	10%	Non-friable	
1		yenow	cm ysome		
1					
1	Waiting room	Vinyl floor tile, 9"x9",	10%	Non-friable	
1		DIACK	cm ysome		
1					
1	Boiler room	Parging cement on pipe	65%	Friable	
1		nungs	cm ysome	1111111	
1					
1	Boiler room	Aircell pipe insulation	90% chrysotile	Friable	
1			cm ysume		
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Classroom 1	Classroom 1	Classroom 1 Cove base mastic None detected	

Sample Number	Floor	Sample Location	Material Description	Asbestos Analytical Results	Friable/ Non-Friable	
TP-A	1					
TP-B	1	Boiler room	Sweat wrap/tar paper on pipe straights	5% chrysotile	Non-friable	
TP-C	1		on pipe straights			
VT-5-A	1					
VT-5-B	1	Classroom 2	Vinyl floor tile, 12"x12", blue	None detected	Not applicable	
VT-5-C	1		bluc			
CA-1-A	1					
CA-1-B	1	Roof	Caulking – black	None detected	Not applicable	
CA-1-C	1					
RC-A	1					
RC-B	1	Roof	Roofing core samples	None detected	Not applicable	
RC-C	1					
AS-A	1					
AS-B	1	Roof	Asphalt shingle	None detected	Not applicable	
AS-C	1					
CA-2-A	1					
CA-2-B	1	Exterior	Caulking – beige	None detected	Not applicable	
CA-2-C	1					
TC-A	1					
TC-B	1	Exterior windows	Troweled cementitious material	None detected	Not applicable	
TC-C	1	windows	macriai			
FP-1-A	1					
FP-1-B	1	Exterior	Foundation parging	None detected	Not applicable	
FP-1-C	1					
MR-1-A	1					
MR-1-B	1	Exterior	Brick mortar	None detected	Not applicable	
MR-1-C	1					

Notes

⁽¹⁾ **Bold result** – indicates asbestos containing material

6.1.1 Friable Asbestos Containing Materials

New friable ACM were not identified at the time of the assessment.

The following friable materials were identified during the previous assessment:

- Parging cement on pipe fittings; and
- Aircell insulation on pipe straights.

Aircell pipe straights were observed to be damaged and material exposed. This material was observed to be in poor condition.

Parging cement on pipe fittings were observed to be in good condition at the time of the assessment.

6.1.2 Non-Friable Asbestos Containing Materials

The following non-friable materials were analyzed and identified to contain asbestos:

- Vinyl floor tiles, 9"x9" size, tan colour with brown streaks; and
- Floor tile mastic, black/brown colour.

These materials were observed to be in good condition at the time of the assessment.

The following materials were identified during the previous assessment:

- Plaster;
- Drywall joint compound;
- Mastic associated with 1' x 1' size acoustical ceiling tiles, brown colour;
- Vinyl floor tile, 9" x 9" size, yellow colour;
- Vinyl floor tile, 9" x 9" size, black colour; and
- Sweat wrap / tar paper on pipe straights.

Some walls were observed to be damaged at the time of the assessment. This included some damaged plaster and drywall. All remaining materials were observed to be in good condition.

6.1.3 Materials Identified to Not Contain Asbestos

In the event the samples of a material were identified to contain asbestos it was assumed that all homogeneous-materials in the Subject Building are considered to be asbestos containing.

The following materials were analysed and identified to not contain asbestos:

- Terrazzo flooring;
- Carpet mastic;
- Flex duct fabric on boiler room equipment;
- Vinyl floor tile, 12" x 12" size, grey colour;
- Vinyl floor tile, 12" x 12" size, white colour;
- Vinyl floor tile, 12" x 12" size, blue colour;
- Cove base mastic:

- Acoustical ceiling tile, 1' x 1' size, evenly spaced holes;
- Concrete block mortar;
- Caulking black colour;
- Caulking beige colour;
- Roofing core materials;
- Asphalt roof shingles;
- Trowelled material on exterior windows;
- Foundation parging; and
- Brick mortar.

The assessment also included a visual investigation of ceiling and wall cavities, including investigation for vermiculite insulation inside concrete blocks and in attic spaces. Vermiculite was not observed within wall cavities, and attic spaces were not found at the time of the assessment.

6.2 Lead

EHS^P completed the assessment including visual inspection of potential lead based paints. Painted surfaces were observed throughout the Subject Building.

Suspect lead-containing paints were sampled during the previous assessment in 2012. The analytical results are presented in Appendix C and a summary of the lead paint results are presented below in Table 6.2.1.

Table 6.2.1 - Summary of Analytical Results (2012) - Lead Paint

Sample ID	Colour (Painted Surface)	Location	Lead Concentration (ppm)	
LBP-A	Beige Wall Paint	Room 4A	1,128 ppm	
LBP-B	White Ceiling Paint	Waiting room	1,300 ppm	
LBP-C	Grey Floor Paint	Boiler room	1,149 ppm	
LBP-D	White Wall Paint	Classroom 4	153.7 ppm	

Based on the analytical results of the samples submitted for analysis, all four (4) of the paint samples collected from within the Subject Building were identified to contain a lead concentration greater than 90 ppm and are therefore considered to be lead-containing.

Low concentrations of lead may be present on all painted surfaces, including equipment remaining in the boiler room.

It should be noted that lead is likely present in the solder of copper pipes at the Subject Building.

6.3 Silica

The following materials were observed at the Subject Building and are presumed to contain silica:

- Poured concrete;
- Plaster;

- Drywall materials;
- Brick and associated mortar; and
- Concrete block and associated mortar.

6.4 Mercury

Fluorescent light tubes were observed throughout the Subject Building. Mercury vapour is presumed to be present in approximately 90 fluorescent light tubes observed throughout the Subject Building.

Mercury may also be present in paints.

6.5 Polychlorinated Biphenyls (PCBs)

During the assessment, fluorescent lighting was observed throughout the Subject Building. Three (3) ballasts were visually examined for PCB content. Labels affixed to the ballasts were all marked as "Non PCB". While the majority of ballasts do not contain PCBs, there is a potential for some remaining PCB-containing ballasts.

PCBs may also be present in roofing materials and caulking observed throughout the Subject Building.

No other presumed PCB-containing equipment was observed in the Subject Building at the time of the assessment.

6.6 Urea-formaldehyde Foam Insulation (UFFI)

UFFI was not observed within the Subject Building at the time of the assessment.

6.7 Ozone Depleting Substances (ODS)

A visual assessment for ODS-containing equipment was performed. ODS-containing equipment was not observed within the Subject Building.

6.8 Mould

Water staining and mould growth was observed on walls and ceilings throughout the Subject Building.

6.9 Radioactive Smoke Detectors

Smoke detectors with a radioactive source were not observed tin the Subject Building.

6.10 Other Designated Substances & Hazardous Materials

A visual assessment was conducted to determine the presence of acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Small amounts of benzene and vinyl chloride may be present in plastic wire coatings and PVC piping. No other designated substances are anticipated to be present at the Subject Building.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Asbestos

Asbestos was identified in the following materials throughout the Subject Building:

- Parging cement on pipe fittings;
- Aircell insulation on pipe straights;
- Plaster;
- Drywall joint compound;
- Mastic associated with 1' x 1' size acoustical ceiling tiles, brown colour;
- Vinyl floor tile, 9" x 9" size, yellow colour;
- Vinyl floor tile, 9" x 9" size, black colour; and
- Sweat wrap / tar paper on pipe straights.

Aircell pipe insulation was observed to be in poor condition at the time of the assessment. Additionally, some plaster and drywall was observed to be damaged.

All remaining materials were all observed to be in good condition at the time of the assessment.

Any disturbance of these materials is subject to Ontario Regulation 278/05 – <u>Regulation Respecting</u> <u>Asbestos on Construction Projects and in Buildings and Repair Operations.</u> Prior to the demolition of the Subject Building the following recommendations are made based on the requirements of O. Reg. 278/05:

- The owner must notify all employees and contractors involved with renovations, repairs, alterations, or demolition of the presence of all ACM, which may be disturbed or damaged. A copy of this DSS report must be made available for review by any maintenance personnel or outside contractors working in the areas where ACM may be disturbed. As a good management practice, the owner should maintain a record of this notification.
- Remove all ACM to the extent possible prior to demolition.
- All asbestos waste generated by asbestos abatement operations must be packaged, labeled and disposed of in accordance with Ontario Regulation 347/90 (as amended). Asbestos waste may be disposed of at any municipal landfill approved by the MOE to accept this type of waste pending notification to and accepted by the landfill operator.
- ACM plaster should be removed following Type 3 Operations, as outlined in O. Reg 278/05;
- ACM drywall joint compound should be removed following Type 2 or Type 3 Operations.
 - o If following Type 2 Operations, material must be removed with power tools attached to dust-collecting devices equipped with HEPA filters, or by using non-powered hand tools;
 - o If following Type 3 Operations, material may be removed using power tools.
- ACM thermal pipe insulation, including aircell and parging cement on fittings must be removed following minimum Type 2 Glovebag Operations.
- ACM vinyl floor tile, floor tile mastic, and sweat wrap/tar paper may be removed following minimum Type 1 Operations.

- If following Type 1 Operations, the material must be kept wetted, and must be removed using non-powered hand-held tools;
- o If following Type 2 Operations, material must be removed with power tools attached to dust-collecting devices equipped with HEPA filters, or by using non-powered hand tools;
- o If following Type 3 Operations, material may be removed using power tools.
- Due to the proximity of the various ACMs and the anticipated demolition of the Subject Building, consideration may be made to remove all materials at once in one Type 3 Operation.

7.2 Lead

Four (4) of the paint samples collected from the Subject Building were identified to contain a lead concentration greater than 90 ppm and are therefore considered to be lead-containing. Lead is likely present in the solder of copper pipes at the Subject Building

Measures prescribed in the Ministry of Labour's Guideline titled "Lead on Construction Projects" should be followed to control the lead dust hazard during the demolition of any painted surfaces or lead-containing materials.

7.3 Silica

Silica is presumed to present throughout the Subject Building in the following materials: poured concrete, plaster, drywall materials, brick and associated mortar, ceramic tile and associated mortar, and textured wall and ceiling finishes. Measures prescribed in the Ministry of Labour's Guideline titled <u>Silica on Construction Projects</u> should be followed during the alteration of silica-containing materials.

7.4 Mercury

Mercury vapour is presumed to be present in fluorescent light tubes observed throughout the Subject Building.

Mercury-containing fluorescent light tubes must be carefully removed and containerized for disposal in accordance with Ontario Regulation 347/09 (as amended).

7.5 Polychlorinated Biphenyls (PCBs)

While PCB-containing light ballasts were not observed, there may be some remaining ballasts in the Subject Building. All fluorescent light ballasts should be verified prior to disposal. PCBs may also be present in roofing materials and caulking observed at the Subject Building.

If potential PCB-containing materials are to be removed, they should be removed in accordance with Federal Regulation SOR/2008-273 – PCB Regulations and CCME guidelines for the management of waste containing PCBs. The roofing material and caulking should be tested for PCBs prior to removal and disposal.

7.6 Radioactive Smoke Detectors

Smoke detectors with a radioactive source were not observed at the time of the assessment. No recommendations for removal and disposal are required.

7.7 Benzene and Vinyl Chloride

Excessive heat must not be used on wire coatings, plastic materials, or PVC, as heat may release benzene. If these practices cannot be avoided, then implement control measures appropriate for the control of benzene prescribed in Ontario Regulation 490/09 – <u>Designated Substances</u>. This regulation is exempt from construction projects but provides useful guidance on personal protection when a specific regulation or guideline for a specific designated substance is not available for the construction industry.

7.8 Other Designated Substances and Hazardous Materials

The following designated substances and hazardous materials were not observed at the Subject Building:

- Acrylonitrile;
- Arsenic;
- Coke oven emissions;
- Ethylene oxide;
- Isocyanates;
- Ozone Depleting Substances; and
- Urea formaldehyde foam insulation.

Recommendations for designated substances and hazardous materials not observed during the assessment are not provided.

Appendix A Asbestos Laboratory Report

Designated Substances Survey 2720 Richmond Road Ottawa, Ontario

EHSP Project: 04-0144-17-004



EMSL Canada Inc.

22 Antares Drive Suite 102 Ottawa, ON K2E 7Z6 Phone/Fax: 343-882-6076 / (343) 882-6077 http://www.EMSL.com / ottawalab@EMSL.com EMSL Canada Order 671702071 Customer ID: 55SEAC63

Customer PO: Project ID:

Attn: Nancy Lee Fortin

EHS Partnerships Ltd. 2 Gurdwara Road Suite 406 Nepean, ON K2E 1A2 Phone: Fax: Collected: (613) 828-8989 (613) 828-9404

Received: Analyzed: 10/ 3/2017 10/04/2017 10/05/2017

Proj: 04-0144-17-004

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 2027-BS-01A Lab Sample ID: 671702071-0001

Sample Description: VESTIBULE/TERRAZZO FLOOR

	Analyzed		Non	-Asbestos				
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment		
PLM	10/05/2017	Various	0%	100%	None Detected			
Client Sample ID:	2027-BS-01B					Lab Sample ID:	671702071-0002	

Sample Description: CORRIDOR-SOUTH/TERRAZZO FLOOR

	Analyzed		Non-	-Asbestos				
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment		
PLM	10/05/2017	Various	0%	100%	None Detected			
Client Sample ID:	2027-BS-01C					Lab Sample ID:	671702071-0003	

Sample Description: CORRIDOR-NORTH/TERRAZZO FLOOR

	Analyzed		Non	-Asbestos				
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment		
PLM	10/05/2017	Various	0%	100%	None Detected			
Client Sample ID:	2027-BS-02A					Lab Sample ID:	671702071-0004	

Sample Description: CLASSROOM 001/CARPET MASTIC

	Analyzed		Non-A	Asbestos		
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment
PLM	10/05/2017	Brown	0%	100%	None Detected	

 Client Sample ID:
 2027-BS-02B
 Lab Sample ID:
 671702071-0005

Sample Description: CLASSROOM 001/CARPET MASTIC

	Analyzed		Non	-Asbestos			
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017	Brown	0%	100%	None Detected		
Client Sample ID:	2027-BS-02C					Lab Sample ID:	671702071-0006

Sample Description: CLASSROOM 001/CARPET MASTIC

	Analyzed		Non	-Asbestos			
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017	Brown	0%	100%	None Detected		
Client Sample ID:	2027-BS-03A-Vinyl Floor Tile					Lab Sample ID:	671702071-0007

Sample Description: TEACHERS LOUNGE/VINYL TILE 9C9 TAN WITH BROWN

	Analyzed		Non-Asbestos			
TEST	Date	Color	Fibrous Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017	Brown	0% 92%	8% Chrysotile		



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EMSL Canada Order 671702071 Customer ID: 55SEAC63

Customer PO: Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

		Er	AUUUIN		illou		
Client Sample ID:	2027-BS-03A-Mastic					Lab Sample ID:	671702071-0007A
Sample Description:	TEACHERS LOUNGE/V	INYL TILE 9C9 TAN W	ITH BROWN				
	Analyzed		Non-	Asbestos			
TEST	Date	Color		Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017	Black	0%	100%	None Detected		
Client Sample ID:	2027-BS-03B					Lab Sample ID:	671702071-0008
Sample Description:	CLASSROOM 3/VINYL	TILE 9C9 TAN WITH BI	ROWN			,	
TEST	Analyzed	Color		Asbestos Non-Fibrous	Asbestos	Commont	
PLM	10/05/2017	Color	ribrous		ive Stop (Not Analyzed)	Comment	
				1 031	ive Stop (Not Analyzed)	1.1.0	074700074 0000
Client Sample ID:	2027-BS-03C					Lab Sample ID:	671702071-0009
Sample Description:	CLASSROOM 3/VINYL 1	TILE 9C9 TAN WITH BI	ROWN				
	Analyzed		Non-	Asbestos			
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017			Posit	ive Stop (Not Analyzed)		
Client Sample ID:	2027-BS-04A					Lab Sample ID:	671702071-0010
Sample Description:	TEACHERS LOUNGE/F	LOOR TILE MASTIC-B	LACK				
TEST	Analyzed	Color		Asbestos	Asbestos	Comment	
PLM	10/05/2017	Color Black	Fibrous 0%	Non-Fibrous 100%	None Detected	Comment	
		DIACK	0 70	100 /0	None Detected	1.1.01.15	074700074 0044
Client Sample ID:	2027-BS-04B					Lab Sample ID:	671702071-0011
Sample Description:	CLASSROOM 3/FLOOR	TILE MASTIC-BLACK					
	Analyzed		Non-	Asbestos			
TEST	Date	Color		Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017	Brown/Black	0%	100%	<1% Chrysotile		
400 PLM Pt Ct	10/05/2017	Brown/Black	0%	99.25%	0.75% Chrysotile		
Client Sample ID:	2027-BS-04C					Lab Sample ID:	671702071-0012
Sample Description:	CLASSROOM 3/FLOOR	TILE MASTIC-BLACK				•	
•							
	Analyzed			Asbestos			
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment	
PLM	10/05/2017			Posit	ive Stop (Not Analyzed)		
Client Sample ID:	2027-BS-05A					Lab Sample ID:	671702071-0013
Sample Description:	BOILER ROOM/FLEX D	UCT FABRIC					
TEAT	Analyzed	0.1.		Asbestos	A . I	0	
TEST	Date	Croy/Plack/Croop		Non-Fibrous	Asbestos None Detected	Comment	
PLM	10/05/2017	Gray/Black/Green	75%	25%	None Detected		
Client Sample ID:	2027-BS-05B					Lab Sample ID:	671702071-0014
Sample Description:	BOILER ROOM/FLEX D	UCT FABRIC					
	Analyzed		Non	Asbestos			

10/05/2017

Gray/Black/Green

75%

25%

None Detected

PLM



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Customer PO: Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID:	2027-BS-05C	Lab Sample ID): 671702071-0015

Sample Description: BOILER ROOM/FLEX DUCT FABRIC

	Analyzed		Non-	Asbestos		
TEST	Date	Color	Fibrous	Non-Fibrous	Asbestos	Comment
PLM	10/05/2017	Gray/Black/Green	75%	25%	None Detected	

Analyst(s):		

Simon Parent PLM (13) 400 PLM Pt Ct (1)

Reviewed and approved by:

Simon Parent, Laboratory Manager or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Ottawa, ON

Initial report from: 10/05/201711:26:54

Appendix B Room-by-Room Asbestos Inventory

Designated Substances Survey 2720 Richmond Road Ottawa, Ontario

EHSP Project: 04-0144-17-004

Address	Room	Location	Material Description	Sample	Asbestos Analytical Results	Quantity	Friable/Non-Friable	Condition
2720 Richmond	Exterior	Exterior - Roof	Asphalt shingles	AS A - C	None detected	-	-	-
2720 Richmond	Exterior	Walls	Brick mortar	MR-1 A - C	None detected	-	-	-
2720 Richmond	Exterior	Walls	Foundation parging	FP-1 A - C	None detected	-	-	-
2720 Richmond	Exterior	Walls	Caulking - beige colour	CA-2 A - C	None detected	-	-	-
2720 Richmond	Front Vestibule	Ceiling	Plaster	PL-1 A - G	2% chrysotile	63 sq. ft	Non-friable	Good
2720 Richmond	Front Vestibule	Walls	Plaster	PL-1 A - G	2% chrysotile	330 sq. ft	Non-friable	Good
2720 Richmond	Front Vestibule	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Classroom 1	Ceiling	Poured concrete	-	-	-	-	-
2720 Richmond	Classroom 1	Ceiling	Acoustical ceiling tiles, 1'x1'	CT-1 A - C	None detected	-	-	-
2720 Richmond	Classroom 1	Walls	Plaster	PL-1 A - G	2% chrysotile	1,232 sq. ft	Non-friable	Good
2720 Richmond	Classroom 1	Walls	Drywall joint compound	DC-1 A - E	2% chrysotile	30 sq. ft.	Non-friable	Good
2720 Richmond	Classroom 1	Walls	Pipe straights in bulkheads - fibreglass	-	-	-	-	-
2720 Richmond	Classroom 1	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Classroom 1	Floor	Carpet + mastic	2027-BS-02 A - C	None detected	-	-	-
2720 Richmond	Classroom 1	Floor	Vinyl floor tile, 12"x12", grey	VT-1 A - C	None detected	-	-	-
2720 Richmond	Staff + bathroom	Ceiling	Poured concrete, metal struts	-	-	-	-	-
2720 Richmond	Staff + bathroom	Ceiling	Pipe straights above ceiling - fibreglass	-	-	-	-	-
2720 Richmond	Staff + bathroom	Ceiling	Plaster	PL-1 A - G	2% chrysotile	289 sq. ft	Non-friable	Good
2720 Richmond	Staff + bathroom	Walls	Plaster	PL-1 A - G	2% chrysotile	712 sq. ft	Non-friable	Good
2720 Richmond	Staff + bathroom	Floor	Vinyl floor tile, 12"x12", grey	VT-1 A - C	None detected	-	-	-
2720 Richmond	Staff + bathroom	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Main corridor	Ceiling	Plaster	PL-1 A - G	2% chrysotile	920 sq. ft	Non-friable	Good
2720 Richmond	Main corridor	Walls	Plaster	PL-1 A - G	2% chrysotile	2,040 sq. ft	Non-friable	Fair
2720 Richmond	Main corridor	Walls	Concrete block	-	-	-	-	-
2720 Richmond	Main corridor	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Room 5A Laundry	Ceiling	Plaster	PL-1 A - G	2% chrysotile	86 sq. ft	Non-friable	Good
2720 Richmond	Room 5A Laundry	Walls	Plaster	PL-1 A - G	2% chrysotile	370 sq. ft	Non-friable	Good
2720 Richmond	Room 5A Laundry	Floor	Vinyl floor tile, 12"x12", grey	VT-1 A - C	None detected	-	-	-
2720 Richmond	Room 5A Laundry	Floor	Vinyl floor tile, 9"x9" tan	2027-BS-03 A - C	8% chrysotile	74 sq. ft	Non-friable	Good
2720 Richmond	Room 5A Laundry	Floor	Vinyl floor tile, 9"x9" black	VT-4 A - C	10% chrysotile	8 sq. ft	Non-friable	Good
2720 Richmond	Room 5A Laundry	Floor	Vinyl floor tile mastic	2027-BS-04 A - C	0.75% chrysotile	82 sq. ft	Non-friable	Good
2720 Richmond	Room 5B Support	Ceiling	Plaster	PL-1 A - G	2% chrysotile	220 sq. ft	Non-friable	Good
2720 Richmond	Room 5B Support	Walls	Plaster	PL-1 A - G	2% chrysotile	620 sq. ft	Non-friable	Good

Address	Room	Location	Material Description	Sample	Asbestos Analytical Results	Quantity	Friable/Non-Friable	Condition
2720 Richmond		Floor	Vinyl floor tile, 9"x9" tan	2027-BS-03 A - C	8% chrysotile	220 sq. ft	Non-friable	Good
2720 Richmond	Room 5B Support	Floor	Vinyl floor tile mastic	2027-BS-04 A - C	0.75% chrysotile	220 sq. ft	Non-friable	Good
2720 Richmond	Girls bathroom	Ceiling	Plaster	PL-1 A - G	2% chrysotile	220 sq. ft	Non-friable	Good
2720 Richmond	Girls bathroom	Walls	Plaster	PL-1 A - G	2% chrysotile	620 sq. ft	Non-friable	Good
2720 Richmond	Girls bathroom	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Closet next to Girls bathroom	Ceiling	Plaster	PL-1 A - G	2% chrysotile	60 sq. ft	Non-friable	Good
2720 Richmond	Closet next to Girls bathroom	Walls	Plaster	PL-1 A - G	2% chrysotile	310 sq. ft	Non-friable	Good
2720 Richmond	Closet next to Girls bathroom	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Boys bathroom	Ceiling	Plaster	PL-1 A - G	2% chrysotile	220 sq. ft	Non-friable	Good
2720 Richmond	Boys bathroom	Walls	Plaster	PL-1 A - G	2% chrysotile	620 sq. ft	Non-friable	Good
2720 Richmond	Boys bathroom	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Classroom 4 + bathroom	Ceiling	Poured concrete	-	-	-	-	-
2720 Richmond	Classroom 4 + bathroom	Ceiling	Acoustical ceiling tiles, 1'x1'	CT-1 A - C	None detected	-	-	-
2720 Richmond	Classroom 4 + bathroom	Ceiling	Plaster	PL-1 A - G	2% chrysotile	16 sq. ft	Non-friable	Good
2720 Richmond	Classroom 4 + bathroom	Walls	Plaster	PL-1 A - G	2% chrysotile	1,360 sq. ft	Non-friable	Poor
2720 Richmond	Classroom 4 + bathroom	Bulkheads	Drywall joint compound	DC-1 A - E	2% chrysotile	30 sq. ft.	Non-friable	Poor
2720 Richmond	Classroom 4 + bathroom	Bulkheads	Pipe straights - fibreglass	-	-	-	-	-
2720 Richmond	Classroom 4 + bathroom	Floor	Vinyl floor tile, 12"x12", grey	VT-1 A - C	None detected	-	-	-
2720 Richmond	Classroom 4 + bathroom	Floor	Carpet + mastic	2027-BS-02 A - C	None detected	-	-	-
2720 Richmond	Classroom 4 + bathroom	Floor	Terrazzo	2027-BS-01 A - C	None detected	-	-	-
2720 Richmond	Classroom 3	Ceiling	Poured concrete	-	-	-	-	-
2720 Richmond	Classroom 3	Ceiling	Acoustical ceiling tiles, 1'x1'	CT-1 A - C	None detected	-	-	-
2720 Richmond	Classroom 3	Bulkheads	Drywall joint compound	DC-1 A - E	2% chrysotile	10 sq. ft	Non-friable	Good
2720 Richmond	Classroom 3	Bulkheads	Pipe straights - fibreglass	-	-	-	-	-
2720 Richmond	Classroom 3	Walls	Plaster	PL-1 A - G	2% chrysotile	1,156 sq. ft	Non-friable	Good
2720 Richmond	Classroom 3	Floor	Vinyl floor tile, 12"x12", grey	VT-1 A - C	None detected	-	-	-
2720 Richmond	Classroom 2	Ceiling	Poured concrete	-	-	-	-	-
2720 Richmond	Classroom 2	Ceiling	Acoustical ceiling tiles, 1'x1'	CT-1 A - C	None detected	-	-	-
2720 Richmond	Classroom 2	Bulkheads	Drywall joint compound	DC-1 A - E	2% chrysotile	10 sq. ft	Non-friable	Good
2720 Richmond	Classroom 2	Bulkheads	Pipe straights - fibreglass	-	-	-	-	-
2720 Richmond	Classroom 2	Walls	Plaster	PL-1 A - G	2% chrysotile	1,156 sq. ft	Non-friable	Good
2720 Richmond	Classroom 2	Floor	Vinyl floor tiles, 9"x9" tan	2027-BS-03 A - C	8% chrysotile	1,040 sq. ft	Non-friable	Good
2720 Richmond	Classroom 2	Floor	Vinyl floor tile mastic	2027-BS-04 A - C	0.75% chrysotile	1,040 sq. ft	Non-friable	Good

Address	Room	Location	Material Description	Sample	Asbestos Analytical Results	Quantity	Friable/Non-Friable	Condition
2720 Richmond	Boiler Room	Ceiling	Poured concrete	-	-	-	-	-
2720 Richmond	Boiler Room	Walls	Poured concrete	-	-	-	-	1
2720 Richmond	Boiler Room	Walls	Concrete block	-	-	-	-	-
2720 Richmond	Boiler Room	General room space	Aircell thermal pipe insulation	PR-1 A - C	90% chrysotile	12 ft	Friable	Poor
2720 Richmond	Boiler Room	General room space	Parging cement on pipe fittings	PS-1 A - C	65% chrysotile	28 fittings	Friable	Good
2720 Richmond	Boiler Room	Floor	Poured concrete					

Appendix C Class A Cost Estimate

Designated Substances Survey 2720 Richmond Road Ottawa, Ontario



CLASS A - COST ESTIMATE

ASBESTOS ABATEMENT- ANNEX, CENTRE MULTISERVICES FRANCOPHONE DE L'OUEST D'OTTAWA, 2720 RICHMOND ROAD, OTTAWA, ON

Please find below the Class A cost estimate for the asbestos abatement related to the Annex Building of the Centre multiservices francophone de l'Ouest d'Ottawa, located at 2720 Richmond Road in Ottawa, ON.

Work	Cost
Type 3 - Removal and off-site disposal of asbestos-containing walls and ceiling plaster. Located in 12 areas for a total of approximately 12,620 ft ² .	\$189,300.00
Type 2 – Removal and off-site disposal of asbestos-containing drywall joint compound. Located in 4 areas for a total quantity of approximately 80 ft ² .	\$800.00
Type 1 – Removal and off-site disposal of asbestos-containing vinyl floor tile and associated mastic. Located in 3 areas for a total quantity of approximately 1,342 ft ² .	\$6,710.00
Type 2 – Glovebag removal and off-site disposal of asbestos-containing aircell pipe insulation. Total quantity of approximately 12 linear feet.	\$600.00
Type 2- Glovebag removal and off-site disposal of asbestos-containing parging cement on approximately 28 fittings.	\$1,680.00
Additional ACM identified at time of abatement contingency. (20%)	\$39,818.00
Consulting fees during asbestos abatement	\$5,800.00
Removal and off-site disposal of approximately 90 fluorescent light tubes	\$180.00
Removal and off-site disposal of potential PCB-containing lamp ballasts (9 estimated)	\$425.00
Estimated Project Total:	\$245.313.00

Estimated costs are based on the current regulatory requirements for abatement and EHSP's estimate of prices for work that could be contracted for in today's marketplace. In all cases, pricing assumes that identified hazardous building materials will be abated on a pre-demolition basis. Pricing may be affected by seasonality and industry workload. Our costs have been based on EHSP assisting in the development of the specifications and tendering of the abatement work and providing inspection and testing during the abatement process. If the work is broken into smaller phased projects or if the regulatory requirements for hazardous materials handling change, significant variances in the actual cost to the budget should be expected. No allowance for inflation has been included in the budgets. There has been no allowance for the replacement of any abated materials. All costs are exclusive of applicable taxes.

Appendix D Limitations

Designated Substances Survey 2235 Prospect Avenue Ottawa, Ontario EHS^P Project: 04-0123-17-006

LIMITATIONS

The conclusions and recommendations contained in this assessment report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted environmental assessment standards and practices applicable to these locations and are subject to the following inherent limitations:

- 1. The data and findings presented in this report are valid as of the dates of the investigations. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration at the properties, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.
- 2. The data reported and the findings, observations and conclusions expressed in this report are limited by the Scope of Work. The Scope of Work was defined by the request of the client, the time and budgetary constraints imposed by the client, and availability of access to the properties.
- 3. Because of the limitations stated above, the findings, observations and conclusions expressed by EHS^P in this report are not, and should not be, considered an opinion concerning compliance of any past or present owner or operator of the site with any federal, provincial or local laws or regulations.
- 4. No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, and conclusions, which are based solely upon site conditions in existence at the time of investigation.
- 5. EHS^P assessment reports present professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental laws, rules, regulations or policies of federal, provincial, or local governmental agencies. Any use of the assessment report constitutes acceptance of the limits of EHS^P's liability. EHS^P's liability extends only to its client and not to other parties who may obtain this assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.

Part 1 General

1.01 SUMMARY

- .1 Remove and dispose off-site all non-friable asbestos-containing tar and non-friable asbestos-containing caulking, along with any other identified non-friable asbestos-containing materials (ACMs) that require Type 1 asbestos operations as per section 1.01.2 below, from the Maison de la Francophonie d'Ottawa building located at 2720 Richmond Road, in Ottawa, Ontario (the "Site") in accordance with this specification section, as a minimum. See section 1.02 Related Sections for further information.
- .2 Comply with requirements of this section when performing the following work:
 - .1 Break, cut, grind, sand, drill, scrape, vibrate or abrade non-friable ACMs using non-powered hand-held tools, and the material is wetted to control the spread of dust or fibres.

1.02 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .3 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .4 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
- .5 Section 02 82 17.02 Type 2 Silica Operations Intermediate Precautions
- .6 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .7 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions
- .8 Section 02 86 01 Mercury Precautions

1.03 REFERENCES

- .1 Comply with Provincial and local requirements provided that, in any case of conflict among those requirements or with these Specifications, the more stringent requirements shall apply. Work shall be performed under regulations and guidelines in effect at the time work is performed. Regulations and guidelines include but are not limited to the following:
 - .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05)
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - .3 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials Information System (WHMIS) Regulation, as amended (R.R.O. 1990, Reg. 860)
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
 - .2 Ministry of the Environment and Climate Change (MOECC)
 - .1 R.R.O. 1990, Regulation 347: *General Waste Management*, as amended (R.R.O. 1990, Reg. 347)

- .2 Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended (EPA)
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, as amended (TDGA)
- .4 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .5 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.04 **DEFINITIONS**

- .1 Airless Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray without the use of compressed air. Must have appropriate capacity for the scope of work.
- .2 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .3 Approved Supervisor: a person who has charge of a workplace or authority over a worker and has received the appropriate training for that role. A supervisor is ultimately responsible to provide direction to workers on site and must follow the laws of the OHSA.
- .4 Asbestos-Containing Materials (ACMs): materials identified under Existing Conditions (Section 1.08), including fallen materials and settled dust containing 0.5% or more asbestos by dry weight.
- .5 Asbestos Waste Containers: containers for dust and waste shall be dust tight, suitable for the type of waste, impervious to asbestos, identified as asbestos waste and cleaned with a damp cloth and/or High Efficiency Particulate Air (HEPA) filtered vacuum prior to being removed from Asbestos Work Areas. Waste shall be placed inside two separate containers. Inner container: 0.15 mm (6 mil) thick sealable polyethylene waste bag. Outer container: sealable metal or fibre type where there are sharp objects included in the waste material; otherwise outer container may be a sealable metal or fibre type or a second 0.15 mm (6 mil) thick sealable polyethylene bag. Labelling requirements: Affix a pre-printed cautionary asbestos warning in both official languages that is clearly visible when ready for removal to disposal site. Asbestos Waste Containers shall be removed from Asbestos Work Areas at regular intervals.
- Asbestos Work Area: area where work takes place within banner tape or polyethylene enclosure which will, or may, disturb ACM.
- .7 Authorized Visitors: Consultant and representatives of regulatory agencies.
- .8 Banner Tape: pre-printed cautionary asbestos warning banner tape that describes the asbestos hazard.
- .9 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .10 Competent Worker: a worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations that apply to this work as outlined in References (Section 1.03).
- .11 Contractor: company or individual designated to complete the scope of work outlined in this specification.

- .12 Consultant: individual competent in the processes to be completed as part of this specification with authority to provide direction on behalf of the Owner.
- .13 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .14 HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .15 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation and movement of the equipment. Testing should be conducted using dispersed oil particulate (DOP).
- .16 HVAC System: all components of the Heating, Ventilation and Air Conditioning system.
- .17 Occupied Area: any area of the Building or work site that is outside an Asbestos Work Area(s).
- .18 Owner: Maison de la Francophonie d'Ottawa.
- .19 Polyethylene: polyethylene sheeting or rip proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation. Minimum thickness 0.15 mm (6 mil).

1.05 SUBMITTALS

- .1 Before beginning work:
 - .1 Obtain from appropriate agency and submit to Consultant, necessary permits for transportation and disposal of asbestos waste. Ensure that approved and licensed landfill operator is fully aware of hazardous nature of material(s) being landfilled and proper methods of disposal. Submit proof satisfactory to Consultant that suitable arrangements have been made to receive and properly dispose of asbestos waste.
 - .2 Submit to Consultant satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
 - .1 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment
 - .2 Inspection and maintenance of equipment
 - .3 Disinfecting of equipment
 - .4 Limitations of equipment
 - .2 Instruction and training must be provided by a competent, qualified person.
 - .3 Submit proof satisfactory to Consultant that employees have respirator fitting and testing. Workers must be fit tested with respirator that is personally issued.
 - .4 Submit proof of Contractor's Asbestos Liability Insurance.
 - .5 Submit Worker's Compensation Board status and transcription of insurance.
 - Submit proof of HEPA filter efficiency testing for all vacuums, negative air units and all other HEPA filtered equipment (e.g., grinders, sanders, cutters, etc.) prior to use in the Building. HEPA filter efficiency testing must have been completed within one month of project start and must also be completed every six (6) months for all negative air exhaust units, vacuums and all other HEPA filtered equipment (e.g., grinders, sanders, cutters etc.) in the Building. Proof of this testing must be provided to the Consultant.

- .7 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for all chemicals and/or materials to be used including, but not limited to, the following:
 - .1 Spray adhesive
 - .2 Amended water
 - .3 Slow-drying sealer
- .8 Submit a Health & Safety Plan before commencing work. Comply with all applicable health and safety regulations.

1.06 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Provincial and local requirements pertaining to asbestos provided that, in case of conflict among these requirements or with these Specifications, more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety Requirements:
 - All construction must be done in accordance with occupational health and safety requirements, the OHSA and all applicable regulations made under the OHSA.
 - .2 Health and Safety Requirements for worker and visitor protection:
 - .1 If requested by the worker, protective equipment and clothing to be worn by workers while in Asbestos Work Areas includes:
 - .1 Air purifying half-mask respirator with N100, R100 or P100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator is to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator is to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator must have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer is to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures are to be provided to, and reviewed with, each worker who is required to wear a respirator. A worker is not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
 - .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing is to be provided by the employer and worn by every worker who enters the an Asbestos Work Area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.
 - .3 Wear a CSA-approved Class C hard hat, CSA-approved safety boots and CSA-approved safety glasses at all times.

- .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Areas.
- .3 Before leaving Asbestos Work Areas, the worker shall decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, and/or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in an Asbestos Waste Container.
- .4 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Areas.
- .5 Ensure workers wash hands and face when leaving Asbestos Work Areas.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Asbestos waste generated during the project will be removed from site daily in the appropriate Asbestos Waste Containers as detailed in O. Reg. 278/05 and Reg. 347.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with the EPA, TDGA, and all regional and municipal regulations.
- .4 All asbestos waste transfer must occur by hand. It is not permitted that Asbestos Waste Containers be transferred by use of garbage chutes, mechanized belts or other means whereby the Asbestos Waste Containers may be caused to break or fail in any way during handling or transfer.
- .5 Disposal of asbestos waste generated by removal activities must comply with Provincial and municipal regulations. All asbestos waste must be disposed of in appropriate Asbestos Waste Containers.
- .6 Provide waste manifests describing and listing waste generated and disposed of. Transport containers by approved means to licensed landfill for burial.

1.08 EXISTING CONDITIONS

- .1 Information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are provided in the Designated Substances Report.
- .2 Any interested parties must satisfy themselves of quantities and locations of ACMs identified in the Designated Substances Report.
- .3 Notify Consultant of suspected ACMs discovered during work and not apparent from specifications or reports pertaining to the work. Do not disturb such materials pending written instructions from Consultant.

Part 2 Products

2.01 MATERIALS

- .1 Asbestos Waste Containers, as outlined in Definitions (Section 1.04)
- .2 Drop Sheets:
 - .1 Polyethylene: 0.15 mm thick.
 - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

- .3 Tape: fibreglass-reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .4 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of ACM.

Part 3 Execution

3.01 PROCEDURES

- .1 All work must be done in accordance with occupational health and safety requirements, the OHSA and all applicable regulations made under the OHSA.
- .2 Refer to the Designated Substances Report for a list of identified designated substances at the Building.
- .3 Before beginning work, isolate Asbestos Work Area(s) using, as a minimum, preprinted Banner Tape that is visible at access routes to Asbestos Work Area(s).
- .4 Do not begin work until Consultant has provided authorization to proceed.
- .5 At each access to Asbestos Work Areas, install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)". ATTENTION RISQUE D'EXPOSITION Á L'AMIANTE (25mm) PAS D'ENTRÉS SANS AUTORISATION (19mm) PORTER LES ÉQUIPEMENTS DE PROTECTION SPÉCIFIÉS (19mm) RESPIRER DES POUSSIÈRES D'AMIANTE PEUT REPRÉSENTER UN RISQUE Á LA SANTÉ (7mm)).
- .6 Should scaffolding be required, it must be approved by a licensed Engineer in the Province of Ontario.
- .7 Remove visible dust from all surfaces in the Asbestos Work Areas where dust is likely to be disturbed during course of work.
- .8 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
- .9 Do not use compressed air to clean or remove dust from any surface.
- .10 Wet ACMs to be removed, cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates a hazard or causes damage:
 - .1 Use Airless Sprayer to wet materials.
 - .2 When performing work, reduce dust generation to lowest levels practicable.
 - .3 Work will be subject to visual inspection and air monitoring.
 - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete segregation and clean-up of affected areas.

3.02 CLEANUP:

- .1 Frequently during work and immediately after completion of work, clean up dust and asbestos-containing waste using a HEPA vacuum or by damp mopping.
- .2 Place dust and asbestos-containing waste in Asbestos Waste Containers. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and place in Asbestos Waste Containers.

- .3 Clean exterior of each Asbestos Waste Container using damp cloths or HEPA vacuum prior to removal from Asbestos Work Areas.
- .4 Seal Asbestos Waste Containers and remove from site immediately following work. Dispose of in accordance with requirements of Provincial Authority having jurisdiction. Ensure that landfill operator is fully aware of hazardous nature of material to be disposed of and ensure that regulations and guidelines for asbestos disposal are followed.
- .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by work using a HEPA vacuum.

3.03 INSPECTION

- .1 From beginning of work until completion of final cleaning operations, the Consultant may perform daily site inspections to monitor work area and monitor contractor compliance with specifications and governing authority requirements. Deviation from these requirements that have not been approved in writing by the Consultant and/or Owner may result in work stoppage, at no cost to the Owner.
- .2 Consultant will inspect work for:
 - .1 Adherence to specific procedures and materials requirements.
 - .2 Compliance with specifications and governing authority requirements prior to contaminated work.
 - .3 Final cleanliness and completion of work. Asbestos Work Area will be considered clean when all visible dust and debris is removed and deemed acceptable to the Consultant. No distinction will be made about the content of the dust or debris.
- .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

JLR No. 27672-000.1

Part 1 General

1.01 SUMMARY

- .1 Remove and dispose off-site all friable asbestos-containing plaster materials, friable asbestos-containing pipe insulation and parging materials, friable asbestos-containing cementitious parging and friable asbestos-containing bell and spigot joint packing materials, along with any other identified asbestos-containing materials (ACMs) that require Type 2 asbestos operations as per section 1.01.2 below, from the Maison de la Francophonie d'Ottawa building located at 2720 Richmond Road, in Ottawa, Ontario (the "Site") in accordance with this specification section, as a minimum. See section 1.02 Related Sections for further information.
- .2 Comply with requirements of this section when performing the following work:
 - .1 Removing non-friable ACMs by breaking, cutting, drilling, abrading, grounding, sanding or vibrating if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.
 - .2 Removing less than one square meter (m²) friable ACMs (i.e. plaster and stipple coats) by breaking, cutting, drilling, abrading, grounding, sanding or vibrating if the work is done by means of non-powered hand-held tools and the materials.
 - .3 Removing ACM from a pipe, duct or similar structure using a glove bag.

1.02 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .3 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .4 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
- .5 Section 02 82 17.02 Type 2 Silica Operations Intermediate Precautions
- .6 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .7 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions
- .8 Section 02 86 01 Mercury Precautions

1.03 REFERENCES

.1 Comply with Provincial and local requirements, provided that in any case of conflict among those requirements or with these Specifications the more stringent requirements shall apply. Work shall be performed under regulations and guidelines in effect at the time work is performed. Regulations and guidelines include but are not limited to the following:

- .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05)
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - .3 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials Information System (WHMIS) Regulation, as amended (R.R.O. 1990, Reg. 860)
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
- .2 Ministry of the Environment and Climate Change (MOECC)
 - .1 R.R.O. 1990, Regulation 347: *General Waste Management*, as amended (R.R.O. 1990, Reg. 347)
 - .2 Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended (EPA)
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, as amended (TDGA)
- .4 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .5 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.04 **DEFINITIONS**

- .1 Airless Sprayer: spray equipment capable of producing mist or fine spray without the use of compressed air. Must have appropriate capacity for the scope of work.
- .2 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, consisting of two weighted, curtained doorways at least 2 metres apart.
- .3 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .4 Approved Supervisor: a person who has charge of a workplace or authority over a worker. This person must be approved by the Ontario Ministry of Training, Colleges and Universities as a Certified Asbestos Abatement Supervisor.
- .5 Asbestos-Containing Materials (ACMs): materials identified under Existing Conditions (Section 1.08), including fallen materials and settled dust containing 0.5% or more asbestos by dry weight.

- Asbestos Waste Containers: an impermeable container acceptable to disposal site and MOECC. New materials only. Comprised of one of the following:
 - .1 A 0.15 mm sealed polyethylene bag, inside a second 0.15 mm polyethylene bag.
 - .2 A 0.15 mm polyethylene bag, positioned inside or outside a rigid sealed container of sufficient strength to prevent perforation of the container during filling, transportation and disposal.
 - .1 Rigid sealed container: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners.
 - .2 If this is accepted by the dump operator, a written letter from the waste facility must be provided to the Consultant stating its acceptability.
 - .3 Label containers in accordance with Ontario Regulation 278/05 and Ontario Regulation 347. Label in both official languages.
 - .4 Any alternative to these methods of disposal detailed in writing to and approved by the Consultant.
- .7 Asbestos Work Area: area where work takes place within banner tape or polyethylene enclosure which will, or may, disturb ACM.
- .8 Authorized Visitors: Consultants and representatives of regulatory agencies.
- .9 Banner Tape: pre-printed cautionary asbestos warning banner tape that delineates the asbestos work area.
- .10 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .11 Competent Worker: a worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations that apply to this work as outlined in References (Section 1.03). This person must be approved by the Ontario Ministry of Training, Colleges and Universities as a Certified Asbestos Abatement Worker.
- .12 Contractor: company or individual designated to complete the scope of work outlined in this specification.
- .13 Consultant: individual competent in the processes to be completed as part of this specification with authority to provide direction on behalf of the Owner.
- .14 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .15 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible, double-pull, double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
 - .5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

- .16 HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .17 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation and movement of the equipment. Testing should be conducted using dispersed oil particulate (DOP).
- .18 HVAC system: all components of the Heating, Ventilation and Air Conditioning system.
- .19 Negative Pressure: system that extracts air directly from work area, filters such extracted air through (HEPA) filtering system, and discharges this air directly outside work area to exterior of Building. This system should be placed through HEPA filter efficiency testing prior to installation or movement of the equipment to other work areas.
- .20 Occupied Area: any area of Building or work site that is outside Asbestos Work Area.
- .21 Owner: Maison de la Francophonie d'Ottawa.
- .22 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation. Minimum thickness 0.15 mm (6 mil).
- .23 Weighted, Curtained Doorways: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, constructed as follows:
 - .1 Place two overlapping sheets of FR polyethylene over existing or temporarily framed doorway. Secure each along top of doorway. Secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
 - .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.

1.05 SUBMITTALS

- .1 Before beginning work:
 - Obtain from appropriate agency and submit to Consultant, necessary permits for transportation and disposal of asbestos waste. Ensure that approved and licensed landfill operator is fully aware of hazardous nature of material(s) being landfilled, and proper methods of disposal. Submit proof satisfactory to Consultant that suitable arrangements have been made to receive and properly dispose of asbestos waste.
 - .2 Submit to Consultant satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
 - .1 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment
 - .2 Inspection and maintenance of equipment
 - .3 Disinfecting of equipment
 - .4 Limitations of equipment

- .2 Instruction and training must be provided by a competent, qualified person.
- .3 Submit proof satisfactory to Consultant that employees have respirator fitting and testing. Workers must be fit-tested with respirator that is personally issued.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit Worker's Compensation Board status and transcription of insurance.
- Submit proof of HEPA filter efficiency testing for all vacuums, negative air units and all other HEPA filtered equipment (e.g., grinders, sanders, cutters, etc.) prior to use in the Building. HEPA filter efficiency testing must be completed immediately prior to all vacuums, negative air units and all other HEPA filtered equipment (e.g., grinders, sanders, cutters, etc.) arriving in the Building and every six (6) months following that date for the duration of the project. Proof of this testing must be provided to the Consultant.
- .7 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for all chemicals and/or materials to be used including, but not limited to, the following:
 - .1 Spray Adhesive;
 - .2 Amended Water; and,
 - .3 Slow-drying Sealer.
- .8 Submit a Health & Safety Plan before commencing work. Comply with all applicable health and safety regulations.
- .9 Submit layout of proposed enclosures and decontamination facilities to Consultant.
- .10 Submit Provincial and local requirements for Notice of Project Form, when required based on abatement method.

1.06 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Provincial and local requirements pertaining to asbestos, provided that, in case of conflict among those requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety Requirements for worker and visitor protection:
 - .1 All construction must be done in accordance occupational health and safety requirements, the OHSA and all applicable regulations made under the OHSA.
 - .2 Health and Safety Requirements for worker and visitor protection:
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
 - .1 At a minimum, a half-face air-purifying respirator equipped with P100 particulate filter cartridges, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to authority having jurisdiction.

- .1 Workers must have respirators fit-tested qualitatively or quantitatively prior to use. Instruction must be provided on the use, care and maintenance of respirator being used.
- .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full-body covering including head covering with snug-fitting cuffs at wrists, ankles, and neck.
- .3 Separate disposable covers shall be used to cover footwear.
- .4 Wear a CSA-approved Class C hard hat, CSA-approved safety boots and CSA-approved safety glasses at all times.

.2 Visitor Protection:

- .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
- .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
- .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.
- .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
- .3 Health and Safety Requirements for worker or visitor entering the Asbestos Work Area:
 - .1 Wear respirator, with new filters or reusable filters that have been deemed as satisfactory, and protective clothing before entering Asbestos Work Area.
 - .2 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .4 Health and Safety Requirements for worker or visitor exiting the Asbestos Work Area:
 - .1 Decontaminate protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing protective clothing. Place disposable protective clothing in Asbestos Waste Containers for disposal as asbestos waste. Be sure not to affect the seal between the face and the respirator during decontamination. Still wearing the respirator, exit Asbestos Work Area. Using soap and water wash hands and face at wash facilities provided by the employer. Clean outside of respirator with soap and water and be sure to cover respirator filters to avoid damage to HEPA filters from water. Upon completion of asbestos abatement, dispose of footwear or footwear covers as asbestos waste or clean footwear thoroughly inside and out using a HEPA filtered vacuum, soap and water before removing from Asbestos Work Area.

1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Asbestos waste generated during the project will be removed daily from site in the appropriate Asbestos Waste Container as detailed in Ontario Regulation 278/05 and Ontario Regulation 347.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with the EPA, TDGA, and all regional and municipal regulations.
- .4 All asbestos waste transfer must occur by hand. It is not permitted that Asbestos Waste Containers be transferred by use of garbage chutes, mechanized belts or other means whereby the Asbestos Waste Containers may be caused to break or fail in any way during handling or transfer.
- .5 Disposal of asbestos waste generated by removal activities must comply with Provincial and municipal regulations. All asbestos waste must be disposed of in appropriate Asbestos Waste Containers.
- .6 Provide waste manifests describing and listing waste generated and disposed of. Transport containers by approved means to licensed landfill for burial.

1.08 EXISTING CONDITIONS

- .1 Information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are provided in the Designated Substances Report.
- .2 Any interested parties must satisfy themselves of approximate quantities and locations of ACMs identified in the Designated Substances Report.
- .3 Notify Consultant of suspected ACMs discovered during work and not apparent from specifications or reports pertaining to the work. Do not disturb such material pending written instructions from Consultant.

Part 2 Products

2.01 MATERIALS

- .1 Asbestos Waste Containers, as outlined in Definitions (Section 1.04).
- .2 Glove Bag, as outlined in Definitions (Section 1.04):
- .3 FR polyethylene: minimum 0.25 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- .4 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .5 Slow-drying Sealer: non-staining, clear, water-dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
 - .1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.
- .6 Spray Adhesive: quick-drying aerosol contact cement used to bond FR polyethylene sheeting during enclosure construction.
 - .1 Spray adhesive must be free of methylene chloride.

- .7 Tape: fibre-reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .8 Wetting Agent: a non-ionic surfactant added to reduce water tension to allow thorough wetting of fibres.

Part 3 Execution

3.01 PREPARATION

- .1 All work must be done in accordance with occupational health and safety requirements, the OHSA and all applicable regulations made under the OHSA.
- .2 Refer to the Designated Substances Report for a list of identified designated substances at the Building.
- .3 Do not begin Asbestos Abatement work until:
 - .1 Arrangements have been made for disposal of waste.
 - .2 For wet removal techniques, arrangements have been made for containing, filtering, and disposing of waste water.
 - .3 Work areas and decontamination enclosures and parts of Building required to remain in use are effectively segregated.
 - .4 Tools, equipment, and materials waste containers are on hand.
 - .5 Arrangements have been made for Building security.
 - .6 Warning signs are displayed where access to contaminated areas is possible.
 - .7 Notifications have been completed and other preparatory steps have been taken.
 - .8 Consultant has given authorization to proceed.
- .4 Should scaffolding be required, it must be approved by a licensed Engineer in the Province of Ontario.
- .5 Asbestos Work Areas:
 - .1 Surround the Asbestos Work Area(s) with banner tape ensuring that all access points have restricted access.
 - .2 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other Building areas during work phase.
 - .3 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that generate dust, such as dry sweeping, or vacuuming using non-HEPA vacuum equipment.
 - At each access to Asbestos Work Area(s) install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm). ATTENTION RISQUE D'EXPOSITION Á L'AMIANTE (25mm) PAS D'ENTRÉS SANS AUTORISATION (19mm) PORTER LES ÉQUIPEMENTS DE PROTECTION SPÉCIFIÉS (19mm) RESPIRER DES POUSSIÈRES D'AMIANTE PEUT REPRÉSENTER UN RISQUE Á LA SANTÉ (7mm)".

- .5 The spread of dust from the Asbestos Work Areas shall be prevented by:
 - .1 Sealing off openings such as corridors, doorways, windows, elevator shafts, pipe penetrations, stairwells, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with duct tape.
 - .2 Using upper seals to prevent dust, fibres and any debris from contaminating wall cavities or other spaces that are not accessible for cleaning.
 - .3 Removing any ceiling mounted objects such as suspended ceiling tile grid system and ceiling or wall fixtures that may interfere with asbestos removal, as directed by Consultant.
 - .4 Covering porous surfaces not being removed including all fire alarm systems, sensors and/or devices, flooring and pipe insulation with polyethylene sheeting sealed with duct tape and spray adhesive. Cover floors, where required, so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting, when possible.
 - .5 Entire enclosure in each individual Asbestos Work Area, including upper seals, are to be constructed in such a fashion that they remain intact for the duration of asbestos abatement activities in the Asbestos Work Area, or until directed by the Consultant following the receipt of acceptable asbestos inspection and air monitoring reports.
 - .6 Build airlocks at entrances to and exits from Asbestos Work Areas so that Asbestos Work Areas are always closed off by one Weighted, Curtained Doorway when workers enter or exit.
- .6 Pipe Insulation Removal Using Glove Bag:
 - .1 A glove bag shall not to be used to remove insulation from a pipe, duct or similar structure if:
 - .1 It may not be possible to maintain a proper seal for any reason including, without limitation:
 - .1 The condition of the insulation.
 - .2 The temperature of the pipe, duct or similar structure.
 - .3 The bag could become damaged for any reason including, including, without limitation:
 - .1 The type of jacketing.
 - .2 The temperature of the pipe, duct or similar structure.
 - .2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestoscontaining contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.

- .3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.
- .4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.
- .5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.
- .6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.
- .7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.
- .8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.
- .7 Application of water required for wetting ACMs, requires the shut off electrical power, 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools or provide 110 volt safety lighting if power is provided from a ground fault panel, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment. Contractor is responsible for providing qualified personnel to connect all utilities including the water and hydro.
- .8 Maintain emergency and fire exits from Asbestos Work Area(s), or establish alternative exits satisfactory to authority having jurisdiction.
- .9 After preparation of Asbestos Work Area and installation of decontamination systems, remove asbestos-containing materials. Spray debris in immediate Asbestos Work Area with amended water through use of low pressure spraying device to reduce dust as work progresses.
- .10 Maintenance of Asbestos Work Area(s):
 - .1 The Asbestos Work Area shall be inspected by a competent worker for defects in the enclosure, barriers and wash facility:
 - .1 At the beginning of each shift;
 - .2 At the end of a shift if there is no shift that begins immediately after the first-named shift; and,
 - .3 At least once each day on days when there are no shifts.
 - .2 Defects observed during an inspection shall be repaired immediately and no other work shall be carried out in the work area until the repair.
 - .3 Maintain Asbestos Work Areas in tidy condition.

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.4 Use smoke methods to test effectiveness of barriers when directed by Consultant.

3.02 SUPERVISION

- .1 Minimum of one Approved Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of ACM.

3.03 ASBESTOS REMOVAL

- .1 Before removing asbestos:
 - .1 Prepare Asbestos Work Area in accordance with section 3.01.
 - .2 Spray ACM with water containing specified wetting agent, using Airless Sprayer capable of providing "mist" application to prevent release of fibres. Saturate ACM sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .2 Remove saturated ACM in small sections. Do not allow saturated asbestos to dry out. As it is being removed, pack ACM in Asbestos Waste Containers.
- .3 Seal Asbestos Waste Containers. Clean outside of Asbestos Waste Containers with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the Asbestos Work Area.
- .4 Remove Asbestos Waste Containers from the Asbestos Work Area frequently and at regular intervals.
- .5 After completion of removal work, wire brush and wet-wipe or wet-sponge all surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .6 Asbestos Work Area will be considered clean when all visible dust and debris is removed from the substrate to which it was adhered and any other dust / debris in the Asbestos Work Area is removed and the entire Asbestos Work Area is deemed acceptable to the Consultant. No distinction will be made about the content of the dust or debris.
- .7 After wire brushing and wet-wiping or wet-sponging to remove visible asbestos, wet clean entire Asbestos Work Area and equipment used in removal process.
- .8 After acceptance of visual inspection by Consultant apply continuous coat of slow-drying sealer to all surfaces of Asbestos Work Area.

3.04 FINAL CLEANUP

- .1 Following cleaning specified in 3.03 above, and when air sampling shows that airborne fibre levels do not exceed 0.01 fibres/cubic centimeter (f/cc) using forced air clearance methods inside the enclosure(s) and Phase Contrast Microscopy (PCM) analysis as determined by NIOSH Method 7400, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of Asbestos Work Area. Vacuum visible asbestos-containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in Asbestos Waste Containers.
- .4 Include in clean-up sealed Asbestos Waste Containers and equipment used in work and remove from Asbestos Work Areas, at appropriate time in cleaning sequence.
- .5 Conduct final inspection to ensure that no dust or debris remains on surfaces as result of dismantling operations. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible.
- As work progresses, and to prevent exceeding available storage capacity on site, remove Asbestos Waste Containers and dispose of at authorized disposal area in accordance with requirements of disposal authority.

3.05 INSPECTION

- .1 Prior to the beginning of the removal, Consultant will perform a pre-contamination inspection on the Asbestos Work Area. The pre-contamination inspection will be completed to ensure the integrity of the containment, that all required paper work including submittals have been reviewed or are on site and all equipment required to complete the measures and procedures that apply to Type 2 asbestos operations are present.
- .2 From beginning of work until completion of final cleaning operations, Consultant to perform daily site inspections to monitor Asbestos Work Area and monitor contractor compliance with specifications and governing authority requirements. Deviations from these requirements that have not been approved in writing by the Consultant and/or Owner may result in work stoppage, at no cost to the Owner.
- .3 Following completion of the work the Consultant must be contacted to complete a final visual inspection. This inspection must be organised by the contractor with a minimum of twenty-four (24) hours' notice. Asbestos Work Area will be considered clean when all visible dust and debris is removed from the substrate to which it was adhered and deemed acceptable to the Consultant. No distinction will be made about the content of the dust or debris. This inspection is to take place in a dry environment.
- .4 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .5 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Consultant may order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.06 AIR MONITORING

- .1 From beginning of work until completion of cleaning operations and reinstatement activities, Consultant may take air samples on daily basis outside of Asbestos Work Area(s).
 - .1 All air monitoring to be conducted in accordance with O. Reg. 278/05 and following NIOSH Method 7400.
 - .2 If air monitoring shows that areas outside Asbestos Work Area(s) are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to Asbestos Work Area(s), as directed by the Consultant, at no cost to the Owner.

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- .3 Stop work when PCM measurements outside of the Asbestos Work Area exceed 0.05 f/cc and correct procedures, at no cost to the owner.
- .2 Consultant to take air samples inside the work area as required to establish the type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
 - .1 If fibre levels are above protection factor of respirators in use, stop abatement, apply means of dust suppression, and use higher respiratory protection factor in respiratory protection for persons inside enclosure.
- .3 If enclosures were used for asbestos abatement, final air monitoring to be conducted as follows: after Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate settling period has passed, Consultant may perform air monitoring within Asbestos Work Area using forced air clearance methods, if required. Enclosure to remain in place until completion of final clearance air sampling:
 - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc for all samples taken as analyzed by PCM techniques.
 - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean Asbestos Work Area and apply another acceptable coat of lock-down agent to surfaces at no cost to the Owner.
 - .3 Repeat re-cleaning as necessary until fibre levels are less than 0.01 f/cc. Additional testing may be subject to Transmission Electron Microscopy analysis following the NIOSH Method 7402.
 - .4 The number of air samples taken shall be in accordance with O. Reg. 278/05, paragraph 4, sub-section 18(6).

END OF SECTION

Part 1 General

1.01 SUMMARY

- .1 Remove and dispose off-site all friable asbestos-containing plaster materials, friable asbestos-containing pipe insulation and parging materials, friable asbestos-containing cementitious parging and friable asbestos-containing bell and spigot joint packing materials, along with any other identified asbestos-containing materials (ACMs) that require Type 3 asbestos operations as per section 1.01.2 below, from the Maison de la Francophonie d'Ottawa building located at 2720 Richmond Road, in Ottawa, Ontario (the "Site") in accordance with this specification section, as a minimum. See section 1.02 Related Sections for further information.
- .2 Comply with requirements of this section when performing the following work:
 - .1 The removal or disturbance of more than one square metre (m²) of friable ACM during the repair, alteration, or demolition of all or part of a building or equipment.
 - .2 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable ACM, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.

1.02 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .1 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .2 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .3 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
- .4 Section 02 82 17.02 Type 2 Silica Operations Intermediate Precautions
- .5 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .6 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions
- .7 Section 02 86 01 Mercury Precautions

1.03 REFERENCES

- .1 Comply with Provincial and local requirements, provided that in any case of conflict among those requirements or with these Specifications the more stringent requirements shall apply. Work shall be performed under regulations and guidelines in effect at the time work is performed. Regulations and guidelines include but are not limited to the following:
 - .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05).
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)

- .3 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
- .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials Information System (WHMIS) Regulation, as amended (R.R.O. 1990, Reg. 860)
- .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
- .2 Ministry of the Environment and Climate Change (MOECC)
 - .1 R.R.O. 1990, Regulation 347: *General Waste Management*, as amended (R.R.O. 1990, Reg. 347)
 - .2 Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended (EPA)
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, as amended (TDGA).
- .4 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December 2017)
- .5 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.04 **DEFINITIONS**

- .1 Airless Sprayer: spray equipment capable of producing mist or fine spray without the use of compressed air. Must have appropriate capacity for the scope of work.
- .2 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, consisting of two Weighted, Curtained Doorways at least 2 meters apart.
- .3 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .4 Approved Supervisor: a person who has charge of a workplace or authority over a worker. A supervisor is ultimately responsible to provide direction to workers on site and must follow the laws of the OSHA. This person must be approved by the Ontario Ministry of Training, Colleges and Universities as a Certified Asbestos Abatement Supervisor.
- .5 Asbestos-Containing Materials (ACMs): materials identified under Existing Conditions (Section 1.08), including fallen materials and settled dust containing 0.5% or more asbestos by dry weight.
- Asbestos Waste Containers: an impermeable container acceptable to disposal site and MOECC. New materials only. Comprised of one of the following:
 - .1 A 0.15 mm sealed polyethylene bag, inside a second 0.15 mm polyethylene bag.

- .2 A 0.15 mm polyethylene bag, positioned inside or outside a rigid sealed container of sufficient strength to prevent perforation of the container during filling, transportation and disposal.
 - .1 Rigid sealed container: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners.
 - .2 If this is accepted by the approved and licensed landfill operator, a written letter from the waste facility must be provided to the Consultant stating its acceptability.
- .3 Label containers in accordance with Ontario Regulation 278/05 and Ontario Regulation 347. Label in both official languages.
- .4 Any alternative to these methods of disposal detailed in writing to and approved by the Consultant.
- Asbestos Work Area: area where actual removal of ACMs takes place within banner tape or FR polyethylene enclosure which will, or may, disturb ACMs.
- .8 Authorized Visitors: Consultants and representatives of regulatory agencies.
- .9 Banner Tape: pre-printed cautionary asbestos warning banner tape that delineates the asbestos work area.
- .10 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .11 Competent Worker: a worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations that apply to this work as outlined References (Section 1.03). This person must be approved by the Ontario Ministry of Training, Colleges and Universities as a Certified Asbestos Abatement Worker.
- .12 Contractor: company or individual designated to complete the scope of work outlined in this specification.
- .13 Consultant: individual competent in the processes to be completed as part of this specification with authority to provide direction on behalf of the Owner.
- .14 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .15 FR polyethylene: fire retardant polyethylene minimum 0.25 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .17 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation and movement of the equipment. Testing should be conducted using dispersed oil particulate (DOP).
- .18 HVAC system: all components of the Heating, Ventilation and Air Conditioning system.

- .19 Negative Pressure: system that extracts air directly from work area, filters such extracted air through HEPA filtering system, and discharges this air directly outside work area to exterior of Building. This system should be placed through HEPA filter efficiency testing prior to installation or movement of the equipment between floors.
 - .1 System to maintain minimum pressure differential of 0.02 inches of water relative to adjacent areas outside of work areas.
- .20 Occupied Area: any area of Building or work site that is outside Asbestos Work Area(s).
- .21 Owner: Maison de la Francophonie d'Ottawa.
- .22 Polyethylene Sheeting Sealed with Tape: Polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area. Minimum thickness 0.15 mm (6 mil).
- .23 Weighted, Curtained Doorways: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, constructed as follows:
 - .1 Place two overlapping sheets of FR polyethylene over existing or temporarily framed doorway. Secure each along top of doorway. Secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
 - .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.

1.05 SUBMITTALS

- .1 Before beginning work:
 - .1 Obtain from appropriate agency and submit to Consultant, necessary permits for transportation and disposal of asbestos waste. Ensure that approved and licensed landfill operator is fully aware of hazardous nature of material(s) being landfilled, and proper methods of disposal. Submit proof satisfactory to Consultant that suitable arrangements have been made to receive and properly dispose of asbestos waste.
 - .2 Submit proof satisfactory to Consultant that every worker has had instruction and training on hazards of asbestos exposure, in personal hygiene and work practices, in use, cleaning, and disposal of respirators and protective clothing, in use of showers, entry and exit from work areas, and aspects of work procedures and protective measures. Ensure asbestos workers and asbestos supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by the Ministry of Training, Colleges and Universities. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.
 - .1 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment
 - .2 Inspection and maintenance of equipment

- .3 Disinfecting of equipment
- .4 Limitations of equipment
- .2 Instruction and training must be provided by a competent, qualified person.
- .3 Every worker involved in a maximum precaution (Type 3) asbestos abatement operation must complete an Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities.
- .4 Every supervisor of a worker involved in a maximum precaution (Type 3) asbestos abatement operation must complete an Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities.
- .3 Submit proof satisfactory to Consultant that employees have respirator fitting and testing. Workers must be fit-tested with respirator that is personally issued.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit Worker's Compensation Board status and transcription of insurance.
- Submit proof of HEPA filter efficiency testing for all vacuums, negative air units and all other HEPA filtered equipment prior to use in the Building. HEPA filter efficiency testing must be completed immediately prior to all vacuums, negative air units and other HEPA filtered equipment arriving in the Building and every six (6) months following that date for the duration of the project. Proof of this testing must be provided to the Consultant.
- .7 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for all chemicals and/or materials to be used including, but not limited to, following:
 - .1 Spray Adhesive;
 - .2 Amended Water; and,
 - .3 Slow-drying Sealer.
- .8 Submit a Health & Safety Plan before commencing work. Comply with all applicable health and safety regulations.
- .9 Submit Provincial requirements for Notice of Project Form.

1.06 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Provincial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Mathematical calculations identifying the number of negative air units required for each enclosed area to ensure four air exchanges per hour must be displayed at the entrance to the clean room.

- .3 All negative air units and vacuums must be HEPA filter efficiency tested, inspected, and maintained by a competent worker before each use of the negative air unit and vacuums. This is to ensure that the filter is not defective or damage and that there is no air leakage. HEPA filter testing must take place every six (6) months and all certificates detailing the outcome of the testing must be provided to the Consultant.
- .4 Provide and install one additional negative air unit than is required by air exchange calculations to be used as a back-up for each enclosure area.
- .5 Health and Safety:
 - .1 All construction must be done in accordance occupational health and safety requirements, the OHSA and all applicable regulations made under the OHSA
 - .2 Health and Safety Requirements for worker and visitor protection:
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
 - .1 At a minimum, a full-face non-powered air-purifying respirator (NAPR) equipped with P100 particulate filter cartridges, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction.
 - .1 Workers must have respirators fit-tested qualitatively or quantitatively prior to use. Instruction must be provided on the use, care and maintenance of respirator being used.
 - .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full-body covering including head covering with snug-fitting cuffs at wrists, ankles, and neck.
 - .3 CSA certified steel-toed lace-less rubber boots must be provided to all workers in every maximum precaution (Type 3) work area. Boots are to be stored in the Equipment and Access Room during abatement activities and only removed from the Asbestos Work Area when clearance air sampling has been completed and communicated by the Consultant. All boots are to be thoroughly washed prior to removal from the Asbestos Work Area or sealed in a 0.15 mm polyethylene bag and re-opened in another Asbestos Work Area.
 - .4 CSA-approved Class C hard hats must be worn in all work areas and thoroughly washed prior to removal from the Asbestos Work Area.

.2 Visitor Protection:

- .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
- .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

- .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.
- .3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
- .3 Health and Safety Requirements for worker or visitor entering the Asbestos Work Area:
 - .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering shower room, dirty room or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
 - .2 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .4 Health and Safety Requirements for worker or visitor exiting the Asbestos Work Area:
 - .1 Decontaminate protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing protective clothing. Place disposable protective clothing in Asbestos Waste Containers for disposal as asbestos waste. Be sure not to affect the seal between the face and the respirator during decontamination. Leave reusable items, except respirator, in dirty room. Still wearing the respirator, proceed naked to showers and be sure not to get HEPA filters wet. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering and be sure to cover respirator filters to avoid damage to HEPA filters from water; remove respirator; cover respirator filters with duct tape to avoid fibre fall-out; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or clean room.
 - .2 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.

1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Asbestos waste generated during the project will be removed daily from site in the appropriate Asbestos Waste Container as detailed in Ontario Regulation 278/05 and Ontario Regulation 347.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with the EPA, TDGA, and all regional and municipal regulations.

- .4 All asbestos waste transfer must occur by hand. It is not permitted that Asbestos Waste Containers be transferred by use of garbage chutes, mechanized belts or other means whereby the Asbestos Waste Containers may be caused to break or fail in any way during handling or transfer.
- .5 Disposal of asbestos waste generated by removal activities must comply with Provincial and Municipal regulations. All asbestos waste must be disposed of in appropriate Asbestos Waste Containers.
- .6 Provide waste manifests describing and listing waste generated and disposed of. Transport containers by approved means to licensed landfill for burial.

1.08 EXISTING CONDITIONS

- .1 Information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project provided in the Designated Substances Report.
- .2 Any interested parties must satisfy themselves of quantities and locations of ACMs identified in the Designated Substances Report.
- .3 Notify Consultant of suspected ACMs discovered during work and not apparent from specifications, or report pertaining to work. Do not disturb such materials pending written instructions from Consultant.

Part 2 Products

2.01 MATERIALS

- .1 Asbestos Waste Containers, as outlined in Definitions (Section 1.04)
- .2 FR polyethylene: minimum 0.25 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .4 Slow-drying sealer: non-staining, clear, water-dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
 - .1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.
- .5 Spray Adhesive: quick-drying aerosol contact cement used to bond FR polyethylene sheeting during enclosure construction.
 - .1 Spray adhesive must be free of methylene chloride.
- .6 Tape: fibre-reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .7 Wetting Agent: a non-ionic surfactant added to reduce water tension to allow thorough wetting of fibres.

Part 3 Execution

3.01 PREPARATION

- .1 All work must be done in accordance with occupational health and safety requirements, the OSHA and all applicable regulations made under the OSHA.
- .2 Refer to Designated Substances Report for a list of the identified designated substances at the Building.
- .3 Do not begin Asbestos Abatement work until:
 - .1 Arrangements have been made for disposal of waste.
 - .2 Arrangements have been made for containing, filtering, and disposing of waste water.
 - .3 Work areas and decontamination enclosures and parts of Building required to remain in use are effectively segregated.
 - .4 Tools, equipment, and materials waste containers are on hand.
 - .5 Arrangements have been made for Building security.
 - .6 Warning signs are displayed where access to contaminated areas is possible.
 - .7 Notifications have been completed and other preparatory steps have been taken.
 - .8 Consultant has given authorization to proceed.
- .4 Should scaffolding be required, it must be approved by a licensed Engineer in the Province of Ontario.
- .5 Asbestos Work Areas:
 - .1 Surround the Asbestos Work Area(s) with banner tape ensuring that all access points have restricted access.
 - .2 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other Building areas during work phase.
 - .3 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that generate dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.
 - At each access to Work Areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm). ATTENTION RISQUE D'EXPOSITION Á L'AMIANTE (25mm) PAS D'ENTRÉS SANS AUTORISATION (19mm) PORTER LES ÉQUIPEMENTS DE PROTECTION SPÉCIFIÉS (19mm) RESPIRER DES POUSSIÈRES D'AMIANTE PEUT REPRÉSENTER UN RISQUE Á LA SANTÉ (7mm)".
 - .5 The spread of dust from the Asbestos Work Area shall be prevented by:

- .1 Sealing off openings such as corridors, doorways, windows, elevator shafts, pipe penetrations, stairwells, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with duct tape.
- .2 Using upper seals to be constructed within each Asbestos Work Area to prevent the spread of dust or fibres into other areas of the Building and to prevent contamination of wall cavities or other spaces that are not accessible for cleaning.
- .3 Covering porous surfaces not being removed including all fire alarm systems, sensors and/or devices, flooring and pipe insulation with polyethylene sheeting sealed with duct tape and spray adhesive. Cover floors, where required, so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting, when possible.
- .4 Using enclosures of FR polyethylene that is impervious to asbestos (including one or more transparent window areas to allow observation of the entire Work Area from outside the enclosure), if the work area is not enclosed by walls.
- .5 Using curtains of FR polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.
- .6 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one weighted, curtained doorway when workers enter or exit.
- .7 Entire enclosure in each individual Asbestos Work Area, including upper seals, are to be constructed in such a fashion that they remain intact for the duration of asbestos abatement activities in the Asbestos Work Area, or until directed by the Consultant following the receipt of acceptable asbestos inspection and air monitoring reports
- .6 The spread of dust from the Asbestos Work Area shall also be prevented by:
 - .1 Creating and maintaining within the enclosed area, by installing a ventilation system equipped with a HEPA filtered exhaust unit, a negative air pressure of 0.02 inches of water, relative to the area outside of the enclosed area.
 - .2 Ensuring that replacement air is taken from outside the enclosed area and is free from contamination with any hazardous dust, vapour, smoke, fume, mist or gas.
 - .3 Using a device, at regular intervals, to measure the difference in air pressure between the enclosed area and the area outside it. This device must be calibrated within the last six months. Proof of calibration must be provided when requested.
- .7 Maintain emergency and fire exits from Asbestos Work area(s), or establish alternative exits satisfactory to Authority having jurisdiction.

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- .8 Where application of water is required for wetting ACMs, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools or provide 110 volt safety lighting if power is provided from a ground fault panel, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment. Contractor is responsible for providing qualified personnel to connect all utilities including the water and hydro.
- .9 After preparation of work areas and decontamination enclosure systems, remove materials. Spray debris in immediate work area with amended water through use of low pressure spraying device to reduce dust as work progresses.
- .6 Worker Decontamination Enclosure System:
 - .1 Build suitable framing for enclosures, and line with FR polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors and one layer on walls and ceiling.
 - .2 Build Weighted, Curtained Doorways between enclosures so that when workers or waste containers and equipment are moved through the doorway, one of two closures comprising doorway always remains closed.
 - .3 Worker Decontamination Enclosure System includes Dirty Room, Shower Room, and Clean Room, as follows:
 - .1 Dirty Room (Equipment and Access Room): build Equipment and Access Room between Shower Room and work areas, with two weighted, curtained doorways, one to Shower Room and one to Asbestos Work Area(s). Install waste receptor, and storage facilities for workers steel-toed lace-less rubber boots and protective clothing to be re-worn in work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least the number of workers composing the work team to undress comfortably. This area shall be temperature controlled and have a temperature maintained above 17 degrees Celsius.
 - .2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two weighted, curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower with hot and cold running water for every five workers. Provide constant supply of warm water. Provide all copper or high pressure flexible piping and necessary equipment to connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Consultant before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters. This area shall be temperature controlled and have a temperature maintained above 17 degrees Celsius.
 - .3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two weighted, curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly. This area shall be temperature controlled and have a temperature maintained above 17 degrees Celsius.

- .7 Waste and Equipment Decontamination Enclosure System:
 - .1 All waste and equipment decontamination to be conducted through a separate decontamination system. The designation of each room for equipment and waste decontamination is outlined below.
 - .1 Dirty Room (Staging Area): use dirty room/staging area for gross removal of dust and debris from Asbestos Waste Containers and equipment, labelling and sealing of Asbestos Waste Containers, and temporary storage pending removal to the Wash Down Room.
 - .2 Wash Down Room: Provide low pressure volume sprays for washing of Asbestos Waste Containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and all necessary equipment to connect to water sources and drains.
 - .3 Clean Room: use clean room to unload decontaminated Asbestos Waste Containers and equipment.
- .8 Maintenance of Asbestos Work Area(s):
 - .1 The Asbestos Work Area shall be inspected by a competent worker for defects in the enclosure, barriers and wash facility:
 - .1 At the beginning of each shift
 - .2 At the end of a shift if there is no shift that begins immediately after the first-named shift
 - .3 At least once each day on days when there are no shifts
 - .2 Defects observed during an inspection shall be repaired immediately and no other work shall be carried out in the work area until the repair.
 - .3 Maintain Asbestos Work Area(s) in tidy condition.
 - .4 Use smoke methods to test effectiveness of barriers when directed by Consultant.

3.02 SUPERVISION

- .1 Minimum of one Approved Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of ACM.

3.03 ASBESTOS REMOVAL

- .1 Before removing asbestos:
 - .1 Prepare Asbestos Work Area in accordance with section 3.01.
 - .2 Spray ACM with water containing specified wetting agent, using Airless Sprayer capable of providing "mist" application to prevent release of fibres. Saturate ACM sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .2 Remove saturated ACM in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack ACM in Asbestos Waste Containers.

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- .3 Seal Asbestos Waste Containers. Clean outside of Asbestos Waste Containers thoroughly with damp cloth. Remove from Asbestos Work Area to Staging Area. Clean external surfaces thoroughly again with damp cloth before moving outside of Asbestos Waste Containers to Wash Down Room. Wash outside of Asbestos Waste Containers thoroughly in Wash Down Room, and remove immediately through Clean Room and out of the enclosure. Ensure that Asbestos Waste Containers are removed from Clean Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of removal work, wire brush and wet-wipe or wet-sponge all surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .5 Asbestos Work Area will be considered clean when all visible dust and debris is removed from the substrate to which it was adhered and any other dust / debris in the Asbestos Work Area is removed and the entire Asbestos Work Area is deemed acceptable to the Consultant. No distinction will be made about the content of the dust or debris.
- .6 After wire brushing and wet-wiping or wet-sponging to remove visible asbestos, wet clean entire work area including Equipment and Access Room, and equipment used in removal process.
- .7 After acceptance of visual inspection by Consultant apply continuous coat of slow-drying sealer to surfaces of work area.

3.04 FINAL CLEANUP

- .1 Following cleaning specified in section 3.03, and when final forced clearance air testing shows that airborne fibre levels do not exceed 0.01 fibres/cc using forced air clearance methods inside the enclosure and Phase Contrast Microscopy (PCM) analysis as determined by NIOSH method 7400, proceed with final cleanup.
- .2 Remove FR polyethylene sheet by rolling it away from walls to centre of Asbestos Work Area. Vacuum visible asbestos-containing dust observed during cleanup, immediately, using HEPA vacuum equipment as directed by the Consultant.
- .3 Place FR polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in Asbestos Waste Containers.
- .4 Include in clean-up Work Area(s), Container and Equipment Decontamination Enclosure System, Worker Decontamination Enclosure System, and other contaminated enclosures.
- .5 Include in clean-up, sealed Asbestos Waste Containers and equipment used in Asbestos Work Area(s) and remove from Asbestos Work Areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .6 Conduct final visual inspection to ensure that no dust or debris remains on surfaces as result of dismantling operations. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible.
- .7 As work progresses, and to prevent exceeding available storage capacity on site, remove Asbestos Waste Containers and dispose of in authorized disposal area in accordance with requirements of disposal authority.

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3.05 INSPECTION

- .1 Prior to the beginning of the removal, Consultant will perform a pre-contamination inspection on the Asbestos Work Area(s). The pre-contamination inspection will be completed to ensure the integrity of the containment, that all required submittals have been reviewed or are on site and all equipment required for a Type 3 asbestos operations are on site. No work is to begin until this inspection has been deemed acceptable to the Consultant.
- .2 From beginning of work until completion of cleaning operations, Consultant to perform daily site inspections to collect air samples outside of the Asbestos Work Area(s) and to monitor contractor compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by the Consultant and/or may result in work stoppage, at no cost to the Owner.
- .3 Following completion of the work the Consultant must be contacted to complete a final visual inspection. This inspection must be organised by the Contractor with a minimum of twenty-four (24) hours' notice. Asbestos Work Area will be considered clean when all visible dust and debris is removed from the substrate to which it was adhered and deemed acceptable to the Consultant. No distinction will be made about the content of the dust or debris. This inspection is to take place in a dry environment.
- .4 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .5 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Consultant may order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.06 AIR MONITORING

- .1 From beginning of work until completion of final cleaning operations and reinstatement activities, Consultant to take air samples on daily basis outside of Asbestos Work Area(s).
 - .1 All air monitoring to be conducted in accordance with O. Reg. 278/05 and following NIOSH Method 7400.
 - .2 If air monitoring shows that areas outside Asbestos Work Area(s) are contaminated; enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area(s), as directed by the Consultant, at no cost to the Owner.
 - .3 Stop work when PCM measurements outside of the Asbestos Work Area exceed 0.05 f/cc and correct procedures, at no cost to the owner.
- .2 Consultant to take air samples inside the Asbestos Work Area(s) as required to establish the type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
 - .1 If fibre levels are above protection factor of respirators in use, stop abatement, apply means of dust suppression, and use higher protection factor in respiratory protection for persons inside enclosure.

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- .3 Final forced air clearance testing to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Consultant will perform clearance air testing within Asbestos Work Area using forced air clearance methods. Enclosure to remain in place until completion of final clearance air sampling.
 - Final forced air clearance testing results must show fibre levels of less than 0.01f/cc for all samples taken.
 - .2 If final forced air clearance testing results show fibre levels in excess of 0.01f/cc, re-clean Asbestos Work Area(s) and apply another acceptable coat of lock-down agent to surfaces at no cost to the Owner.
 - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc. Additional testing may be subject to Transmission Electron Microscopy analysis following the National Institute for Occupational Safety and Health method 7402.
 - .4 The number of air samples taken shall be in accordance with O. Reg. 278/05, para. 4 sub-section 18(6).

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .3 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .4 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .5 Section 02 82 17.02 Type 2 Silica Operations Intermediate Precautions
- .6 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .7 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions
- .8 Section 02 86 01 Mercury Precautions

1.2 REFERENCES

- .1 Comply with Provincial and local requirements, provided that in any case of conflict among those requirements or with these specifications the more stringent requirements shall apply. Work shall be performed under regulations and guidelines in effect at the time work is performed. Regulations and guidelines include but are not limited to the following:
 - .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05)
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - .3 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials
 Information System (WHMIS) Regulation, as amended (R.R.O. 1990,
 Reg. 860)
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
 - .6 Silica on Construction Projects, Ontario Ministry of Labour, updated April 2011
 - .2 Ministry of Environment (MOE)
 - .1 R.R.O. 1990, Regulation 347: General Waste Management, as amended (R.R.O., Reg. 347)
 - .2 Environmental Protection Act, R.S.O.1990, as amended (EPA)
 - .3 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)

- .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .4 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.3 **DEFINITIONS**

- .1 Approved Supervisor: A person who has charge of a workplace or authority over a worker and has received the appropriate training for that role. A supervisor is ultimately responsible to provide direction to workers on site and must follow the applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .2 Authorized Visitors: Owner Representative, Engineer, Consultant or designated representatives and representatives of regulatory agencies.
- .3 Banner Tape: Pre-printed cautionary warning banner tape that delineates the Silica Work Area(s).
- .4 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .5 Competent Worker: A worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .6 HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .7 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation. Testing should be conducted using dispersed oil particulate (DOP).
- .8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .9 Occupied Area: Any area of the building outside the Silica Work Area(s).
- .10 Owner: Maison de la Francophonie d'Ottawa.
- .11 Owner Representative: Individual competent in the processes to be completed as part of this specification section.
- .12 Silica Work Area: Area where work takes place which will, or may, disturb silica-containing material.
- .13 Examples of Type 1 Silica Operations:
 - .1 The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction.
 - .2 Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica.
 - .3 Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling.
 - .4 Working within 25 meters of an area where compressed air is being used to remove silica-containing dust outdoors.

1.4 SUBMITTALS

- .1 Before beginning work:
 - .1 Submit to Owner Representative satisfactory proof that every worker has had instruction and training in WHMIS, the hazards of crystalline silica exposure, the recognition of typical operations containing crystalline silica, personal hygiene, respirator requirements, proper work measures, and procedures, and in the use, cleaning, maintenance and disposal of respirators and protective clothing.
 - .1 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment
 - .2 Inspection and maintenance of equipment
 - .3 Disinfecting of equipment
 - .4 Limitations of equipment
 - .2 Instruction and training must be provided by a competent, qualified person.
 - .2 Submit proof satisfactory to Owner Representative that employees have respirator fitting and testing. Workers must be fit-tested (irritant smoke test) with respirator that is personally issued prior to beginning work.
 - .3 Submit proof of HEPA filter efficiency testing for all vacuums and negative air units in the Building. HEPA filter efficiency testing must be completed immediately prior to commencing work. Proof of this testing must be provided to the Owner Representative prior to commencing work.
 - .4 Submit Worker's Compensation Board status and transcription of insurance.
 - .5 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for all chemicals and/or materials to be used including, but not limited to, the following:
 - .1 Spray adhesive
 - .2 Amended water
 - .3 Slow-drying sealer

1.5 EXISTING CONDITIONS

- .1 Information pertaining to silica-containing materials to be handled, removed, or otherwise disturbed and disposed of during this project are provided in the Designated Substances Report.
- .2 Where an asbestos-containing material or lead-containing material is applied to a silicacontaining material scheduled for disturbance or demolition, the more stringent specification sections for asbestos or lead supersede.

1.6 WORKER AND VISITOR PROTECTION:

.1 Workers and visitors shall use, as a minimum; half-facepiece air purifying respirators fitted with P100 particulate filters. Contractors should refer to the Ministry of Labour's Guideline: *Silica on Construction Projects*, revised in 2011, for respirator requirements under all classifications of work for silica operations.

- .1 Respiratory protective devices shall be certified by the National Institute of Occupational Safety and Health (NIOSH) and fit-tested to the worker wearing it.
- .2 Ensure that no person required to enter a Silica Work Area has facial hair which affects the seal between respirator and face.
- .2 Protective Clothing: If requested by the worker, employer to provide workers with protective clothing that does not readily retain or permit penetration of crystalline silica dust. This clothing can be disposable type or reusable. If reusable clothing is used, it must remain in the Building for the duration of the project and be washed as required based on the level of contamination or as directed by the Owner Representative.
- .3 Every worker who enters the work area shall wear protective clothing.
- .4 Eating, drinking, chewing, and smoking are not permitted in the work area.
- .5 Before leaving the work area, workers shall decontaminate their protective clothing using a HEPA vacuum or by damp wiping. Store clean protective re-usable clothing in clean plastic bag for reuse, or, if protective clothing is not re-usable or not to be reused, dispose of as contaminated waste.
- .6 Ensure workers wash hands and face when leaving Silica Work Area. If washing facilities are not available, a washcloth, water basin and soap shall be made available directly outside the Silica Work Area.

1.7 VISITOR PROTECTION

- .1 Provide protective clothing and approved respirators to Authorized Visitors to the Silica Work Area(s).
- .2 Instruct Authorized Visitors in the use of protective clothing, respirators, and procedures.
- .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Silica Work Areas

1.8 NOTIFICATION

.1 Inform all contractors and subcontractors of the presence of crystalline silica identified in the contract documents.

Part 2 Products

2.1 MATERIALS

- .1 All materials brought to work site must be in good condition and free of crystalline silica dust, debris, and fibrous materials. Disposable items must be of new materials only.
- .2 Lock-down Agent: Sealant for purpose of trapping residual dust. Product must have flame spread and smoke development ratings both less than 50.
- .3 Polyethylene Sheeting: 0.15 mm minimum thickness unless otherwise specified, in sheet size to minimize joints.

2.2 EQUIPMENT

- .1 HEPA Vacuum: Vacuum with all necessary fittings, tools and attachments. All air must pass HEPA filter before discharge.
- .2 Portable Eye Wash Station: Portable eye wash station, minimum spray time of 15 minutes.

.3 Sprayer: Garden-type portable manual sprayer or water hose with spray attachment if suitable.

Part 3 Execution

3.1 SITE PREPARATION

- .1 Before beginning work, at each access to work areas, warning signs must be posted in sufficient number to warn of the hazard. If it is an indoor operation, signs must be posted at each entrance to the Silica Work Area(s). The signs must display the following information in large, clearly visible letters:
 - .1 There is a silica dust hazard.
 - .2 Access to the work area is restricted to authorized persons.
 - .3 Respirators must be worn in the work area.
- .2 Surround the Silica Work Area(s) with banner tape ensuring that all access points have restricted access.
- .3 Before beginning work, remove visible dust from surfaces in the work area where dust is likely to be disturbed during the course of the work. Use HEPA vacuum, or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate. Do not use compressed air to clean up or remove dust from any surface.
- .4 When work is indoors, provide general ventilation through the use of HEPA filtered exhaust unit exhausting to the exterior of the Building, if possible. There is to be a minimum of one (1) unit for each area where silica is being disturbed. The air flow of the mechanical ventilation system should be at least 50 cubic feet per minute per square foot of face area (0.25 m³/s per square meter of face area).
- .5 Other than loose material which shall be removed by HEPA vacuum, any material containing crystalline silica to be removed or disturbed should be thoroughly wetted before work unless wetting creates a hazard or causes damage. Use garden reservoir type low velocity fine mist sprayer or equipment appropriate for work being performed. Perform all work in a manner to reduce dust generation to lowest levels practicable.

3.2 CRYSTALLINE SILICA DISTURBANCE

- .1 Clean up after each operation is required to prevent dust containing silica from spreading.
- .2 Compressed air or dry sweeping must be avoided when cleaning a work area.
- .3 Compressed air must not be used for removing dust from clothing.
- .4 Workers exposed to silica must be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
- .5 Silica dust on personal protective clothing and equipment must be removed by damp wiping or HEPA vacuuming.
- .6 Contaminated personal protective clothing and equipment must be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust.
- .7 Owner Representative will perform cleanliness inspections and testing, as necessary, and inspect work for adherence to specification sections and guidelines.
- .8 Where practicable, apply one coat of lock-down agent to all surfaces in the Silica Work Area(s).

.9 Cleanup:

- .1 Frequently during the work, and immediately after completion of the work, clean up dust and waste containing crystalline silica using a HEPA vacuum or by damp mopping.
- .2 Perform final thorough cleanup of work areas and adjacent areas affected by the work using HEPA vacuum and damp mopping.

3.3 WASTE AND MATERIAL HANDLING

- .1 Clean up waste routes and loading area after each load. Use applicable specification sections where appropriate or requested by Owner Representative.
- .2 Cooperate with MOL and MOECC inspectors and immediately carry out instructions for remedial work, at no additional cost to Owner.

3.4 CLEANLINESS TESTING AND AIR MONITORING

- .1 Acceptance of the completed work and cleanliness of surfaces in the work area will be based on visual inspection, as required. The acceptable criteria for airborne crystalline silica dust concentrations within a work area are based on the type of crystalline silica present as outlined in applicable regulations and guidelines. All surfaces inside the work area, including all polyethylene used for dust control measures, should be free of visible dust and debris. Final visual inspections may be conducted before the dismantling of any containment system used during silica operations.
- .2 The Owner Representative may perform air monitoring inside and outside the Silica Work Areas. If airborne silica concentrations exceed 0.05 mg/m³ for Cristabolite and Tridymite or 0.1 mg/m³ for Quartz and Tripoli outside the work area, the contractor shall stop all work and modify work practices to reduce worker exposures to acceptable levels.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .3 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .4 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .5 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
- .6 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .7 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions
- .8 Section 02 86 01 Mercury Precautions

1.2 REFERENCES

- .1 Comply with Provincial and local requirements, provided that in any case of conflict among those requirements or with these specifications the more stringent requirements shall apply. Work shall be performed under regulations and guidelines in effect at the time work is performed. Regulations and guidelines include but are not limited to the following:
 - .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05)
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - .3 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials Information System (WHMIS) Regulation, as amended (R.R.O. 1990, Reg. 860)
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
 - .6 Silica on Construction Projects, Ontario Ministry of Labour, updated April 2011
 - .2 Ministry of Environment (MOE)
 - .1 R.R.O. 1990, Regulation 347: General Waste Management, as amended (R.R.O., Reg. 347)
 - .2 Environmental Protection Act, R.S.O.1990, as amended (EPA)
 - .3 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)

- .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .4 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.3 **DEFINITIONS**

- .1 Approved Supervisor: A person who has charge of a workplace or authority over a worker and has received the appropriate training for that role. A supervisor is ultimately responsible to provide direction to workers on site and must follow the applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .1 Authorized Visitors: Owner Representative, Engineer, Consultant or designated representatives and representatives of regulatory agencies.
- .2 Banner Tape: Pre-printed cautionary warning banner tape that delineates the Silica Work Area.
- .3 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .4 Competent Worker: A worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .5 HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .6 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation. Testing should be conducted using dispersed oil particulate (DOP).
- .7 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .8 Occupied Area: Any area of the building outside the Silica Work Area(s).
- .9 Owner: Maison de la Francophonie d'Ottawa.
- .10 Owner Representative: Individual competent in the processes to be completed as part of this specification section.
- .11 Silica Work Area: Area where work takes place which will, or may, disturb silica-containing material.
- .12 Examples of Type 2 Silica Operation:
 - .1 The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction without the use of wet coring procedures.
 - .2 The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials.
 - .3 The use of a power tool to remove silica-containing materials.
 - .4 The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials.

- .5 Tuckpoint and surface grinding.
- .6 Dry mortar removal with an electric or pneumatic cutting device.
- .7 The use of compressed air outdoors for removing silica dust.
- .8 Entry into area where abrasive blasting is being carried out for more than 15 minutes.

1.4 SUBMITTALS

- .1 Before beginning work:
 - .1 Submit to Owner Representative satisfactory proof that every worker has had instruction and training in WHMIS, the hazards of crystalline silica exposure, the recognition of typical operations containing crystalline silica, personal hygiene, respirator requirements, proper work measures, and procedures, and in the use, cleaning, maintenance and disposal of respirators and protective clothing.
 - .1 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment
 - .2 Inspection and maintenance of equipment
 - .3 Disinfecting of equipment
 - .4 Limitations of equipment
 - .2 Instruction and training must be provided by a competent, qualified person.
 - .2 Submit proof satisfactory to Owner Representative that employees have respirator fitting and testing. Workers must be fit-tested (irritant smoke test) with respirator that is personally issued prior to beginning work.
 - .3 Submit proof of HEPA filter efficiency testing for all vacuums and negative air units in the Building. HEPA filter efficiency testing must be completed immediately prior to commencing work and every 6 months it is in the Building. Proof of this testing must be provided to the Owner Representative prior to commencing work.
 - .4 Submit Worker's Compensation Board status and transcription of insurance.
 - .5 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for all chemicals and/or materials to be used including, but not limited to, the following:
 - .1 Spray adhesive
 - .2 Amended water
 - .3 Slow-drying sealer

1.5 EXISTING CONDITIONS

.1 Information pertaining to silica-containing materials to be handled, removed, or otherwise disturbed and disposed of during this project are provided in the Designated Substances Report.

.2 Where an asbestos-containing material or lead-containing material is applied to a silicacontaining material scheduled for disturbance or demolition, the more stringent specification sections for asbestos or lead supersede.

1.6 WORKER AND VISITOR PROTECTION:

- .1 Workers and visitors shall use as a minimum; full-facepiece air purifying respirators fitted with P100 particulate filters. Contractors should refer to the Ministry of Labour's Guideline: *Silica on Construction Projects*, revised in 2011, for respirator requirements under all classifications of work for silica operations.
 - .1 Respiratory protective devices shall be certified by the National Institute of Occupational Safety and Health (NIOSH) and fit-tested to the worker wearing it.
 - .2 Ensure that no person required to enter a Silica Work Area has facial hair which affects the seal between respirator and face.
- .2 Protective Clothing: If requested by the worker, employer to provide workers with protective clothing that does not readily retain or permit penetration of crystalline silica dust. This clothing can be disposable type or reusable. If reusable clothing is used, it must remain in the Building for the duration of the project and be washed as required based on the level of contamination or as directed by the Owner Representative.
- .3 Every worker who enters the work area shall wear protective clothing.
- .4 Eating, drinking, chewing, and smoking are not permitted in the work area.
- .5 Before leaving the work area workers shall decontaminate their protective clothing using a HEPA vacuum or by damp wiping. Store clean protective re-usable clothing in clean plastic bag for reuse, or, if protective clothing is not re-usable or not to be reused, dispose of as contaminated waste.
- .6 Ensure workers wash hands and face when leaving Silica Work Area. If washing facilities are not available, a washcloth, water basin and soap shall be made available directly outside the Silica Work Area.

1.7 VISITOR PROTECTION

- .1 Provide protective clothing and approved respirators to Authorized Visitors to the Silica Work Area(s).
- .2 Instruct Authorized Visitors in the use of protective clothing, respirators, and procedures.
- .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Silica Work Areas

1.8 NOTIFICATION

.1 Inform all contractors and subcontractors of the presence of crystalline silica identified in the contract documents.

Part 2 Products

2.1 MATERIALS

- .1 All materials brought to work site must be in good condition and free of crystalline silica dust, debris, and fibrous materials. Disposable items must be of new materials only.
- .2 Lock-down Agent: Sealant for purpose of trapping residual dust. Product must have flame spread and smoke development ratings both less than 50.
- .3 Polyethylene Sheeting: 0.15 mm minimum thickness unless otherwise specified, in sheet size to minimize joints.

2.2 EQUIPMENT

- .1 HEPA Vacuum: Vacuum with all necessary fittings, tools and attachments. All air must pass HEPA filter before discharge.
- .2 Portable Eye Wash Station: Portable eye wash station, minimum spray time of 15 minutes.
- .3 Sprayer: Garden-type portable manual sprayer or water hose with spray attachment if suitable.

Part 3 Execution

3.1 SITE PREPARATION

- .1 Before beginning work, at each access to Silica Work Areas, warning signs must be posted in sufficient number to warn of the hazard. If it is an indoor operation, signs must be posted at each entrance to the Silica Work Area(s). The signs must display the following information in large, clearly visible letters:
 - .1 There is a silica dust hazard.
 - .2 Access to the work area is restricted to authorized persons.
 - .3 Respirators must be worn in the work area.
- .2 Surround the Silica Work Area(s) with banner tape ensuring that all access points have restricted access.
- .3 Before beginning work, remove visible dust from surfaces in the work area where dust is likely to be disturbed during the course of the work. Use HEPA vacuum, or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate. Do not use compressed air to clean up or remove dust from any surface.

.4 Silica Work Areas:

- .1 Shut off air handling and ventilation systems and seal ventilation ducts to and from the Silica Work Areas to prevent silica dust dispersal to occupied areas during work phase.
- .2 The spread of dust from the work areas shall be prevented by:
 - .1 Using an enclosure of polyethylene or other suitable material that is impervious to silica dust.

- .1 Seal off openings such as corridors, doorways, windows, elevator shafts, pipe penetrations, escalators, stairwells, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with duct tape to ensure that each floor is separated from the next.
- .3 Maintain emergency and fire exits from work areas, or establish alternative exits as required and satisfactory to Authority having jurisdiction.
- .4 Maintenance of Silica Work Areas and Enclosures:
 - .1 The work areas shall be inspected by a competent worker for defects in the enclosure, barriers and wash facility:
 - .1 At the beginning of each shift;
 - .2 At the end of a shift if there is no shift that begins immediately after the first-named shift, and
 - .3 At least once each day on days when there are no shifts.
 - .2 Defects observed during an inspection shall be repaired immediately and no other work shall be carried out in the work area until the repair.
 - .3 Maintain Silica Work Area in tidy condition.
- .5 Provide general ventilation through the use of HEPA filtered exhaust unit exhausting to the exterior of the Building, if possible. There is to be a minimum of one (1) unit for each area where silica is being disturbed.

3.2 CRYSTALLINE SILICA DISTURBANCE

- .1 Other than loose material which shall be removed by HEPA vacuum, any material containing crystalline silica to be removed or disturbed should be thoroughly wetted before work unless wetting creates a hazard or causes damage. Use garden reservoir type low velocity fine mist sprayer or equipment appropriate for work being performed. Perform all work in a manner to reduce dust generation to lowest levels practicable.
- .2 Clean up after each operation is required to prevent dust containing silica from spreading.
- .3 Compressed air or dry sweeping must be avoided when cleaning a work area.
- .4 Compressed air must not be used for removing dust from clothing.
- .5 Workers exposed to silica must be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
- .6 Silica dust on personal protective clothing and equipment must be removed by damp wiping or HEPA vacuuming.
- .7 Contaminated personal protective clothing and equipment must be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust.
- .8 Owner Representative will perform cleanliness inspections and testing, as necessary, and inspect work for adherence to specification sections and guidelines.
- .9 Where practicable, apply one coat of lock-down agent to all surfaces in the Silica Work Area(s).

.10 Cleanup:

- .1 Frequently during the work, and immediately after completion of the work, clean up dust and waste containing crystalline silica using a HEPA vacuum or by damp mopping.
- .2 Perform final thorough cleanup of work areas and adjacent areas affected by the work using HEPA vacuum and damp mopping.

3.3 WASTE AND MATERIAL HANDLING

- .1 Clean up waste routes and loading area after each load. Use applicable specification sections where appropriate or requested by Owner Representative.
- .2 Cooperate with MOL and MOECC inspectors and immediately carry out instructions for remedial work, at no additional cost to Owner.

3.4 CLEANLINESS TESTING AND AIR MONITORING

- .1 Acceptance of the completed work and cleanliness of surfaces in the work area will be based on visual inspection, as required. The acceptable criteria for airborne crystalline silica dust concentrations within a work area are based on the type of crystalline silica present as outlined in applicable regulations and guidelines. All surfaces inside the work area, including all polyethylene used for dust control measures, should be free of visible dust and debris. Final visual inspections may be conducted before the dismantling of any containment system used during silica operations.
- .2 The Owner Representative may perform air monitoring inside and outside the Silica Work Areas. If airborne silica concentrations exceed 0.05 mg/m³ for Cristabolite and Tridymite or 0.1 mg/m³ for Quartz and Tripoli outside the work area, the contractor shall stop all work and modify work practices to reduce worker exposures to acceptable levels.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .3 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .4 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .5 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
- .6 Section 02 82 17.02 Type 2 Silica Operations Intermediate Precautions
- .7 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions
- .8 Section 02 86 01 Mercury Precautions

1.2 REFERENCES

- .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05)
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials Information System (WHMIS) Regulation, as amended (R.R.O. 1990, Reg. 860)
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
 - .6 Lead on Construction Projects, Ontario Ministry of Labour, updated April 2011
- .2 Ministry of the Environment and Climate Change (MOECC)
 - .1 R.R.O. 1990, Regulation 347: *General Waste Management*, as amended (R.R.O. 1990, Reg. 347)
 - .2 Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended (EPA)
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, as amended (TDGA)
- .4 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .5 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.3 **DEFINITIONS**

- .1 Action Level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 0.025 milligrams per cubic meter of air calculated as 8 hour time-weighted average (TWA). Intermediate (Type 2) precautions (see Specification Section 02 83 11) for lead abatement/disturbance operations are required for operations where airborne lead concentrations are greater than 0.05 milligrams per cubic meter of air within Lead Work Area(s).
- Approved Supervisor: a person who has charge of a workplace or authority over a worker and has received the appropriate training for that role. A supervisor is ultimately responsible to provide direction to workers on site and must follow the applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .3 Authorized Visitors: Owner Representative, Engineer, Consultant or designated representatives and representatives of regulatory agencies.
- .4 Banner Tape: Pre-printed cautionary lead warning banner tape that describes the lead hazard and delineates the Lead Work Area(s).
- .5 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .6 Competent Worker: a worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .7 Contractor: company or individual designated to complete the scope of work outlined in this specification section.
- .8 HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .9 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation and movement of the equipment. Testing should be conducted using dispersed oil particulate (DOP).
- .10 HVAC system: all components of the Heating, Ventilation and Air Conditioning system.
- .11 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.
- .12 Lead Work Area: area where actual disturbance of lead-containing materials takes place within an area segregated by banner tape or polyethylene enclosure.
- .13 Occupied Area: areas of Building or work site that is outside of the Lead Work Area(s).
- .14 Owner: Maison de la Francophonie d'Ottawa.
- Owner Representative: Individual competent in the processes to be completed as part of this specification section.
- Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .17 Type 1 Operations:
 - .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap.

- .2 Removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter.
- .3 Removal of lead-containing sheet metal.
- .4 Removal of lead-containing packing in a bell and spigot joint or similar material.
- .5 Removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping and sanding. See Specification Section 02 83 11 for intermediate precautions to be used in performing Type 2 lead operations such as removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools.
- .6 Demolition of less than one (1) square meter of drywall, plaster, concrete, concrete block, brick surface, building component or other material on which a lead-containing paint, coating or material is applied.

1.4 SUBMITTALS

- .1 Provide proof satisfactory to Owner Representative that suitable arrangements have been made to dispose of lead-containing materials and lead-contaminated waste in accordance with requirements of authority having jurisdiction.
- .2 Provide proof of Contractor's General and Environmental Liability Insurance.
- .3 Submit proof of HEPA filter efficiency testing for all vacuums and negative air units in the Building. HEPA filter efficiency testing must be completed prior to all vacuums and negative air units arriving in the Building and every six (6) months following that date for the duration of the project. Proof of this testing must be provided to the Owner Representative.

.4 Quality Control:

- .1 Provide Owner Representative necessary permits for transportation and disposal of lead-containing material(s) and lead-contaminated waste and proof that it has been received and properly disposed.
- .2 Provide proof satisfactory to Owner Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Lead Work Area, and aspects of work procedures and protective measures.
- .3 Submit proof satisfactory to Owner Representative that employees have respirator fitting and testing. Workers must be fit-tested (irritant smoke test) with a respirator that is personally issued prior to beginning work.
- .4 Submit Worker's Compensation Board status and transcription of insurance.

.5 Product data:

- .1 Provide documentation including Safety Data Sheets (SDSs) for all chemicals and/or materials to be used including, but not limited to, the following:
 - .1 Encapsulants
 - .2 Amended water
 - .3 Slow drying sealer

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

- .1 Health and Safety Requirements for worker and visitor protection:
 - .1 Protective equipment and clothing to be worn by workers and visitors in Lead Work Areas includes:
 - .1 NIOSH approved air purifying half-face respirator equipped with P100 particulate filter cartridges acceptable to Authority having jurisdiction and fit-tested to the worker wearing it.
 - .2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
 - .3 Protective clothing to cover hands and prevent ingestion of lead dust and particulate during and following work activities. This protection must be durable enough to withstand construction / demolition activities.
 - .2 Decontamination Requirements for workers:
 - .1 Remove gross contamination from clothing before leaving Lead Work Area. Place contaminated work suits in receptacles for disposal with other lead-containing materials. Upon completion of lead abatement / disturbance operations, thoroughly clean footwear using a HEPA vacuum before removing from Lead Work Area.
 - .3 Eating, drinking, chewing, and smoking are not permitted in the Lead Work Area.
 - .4 Ensure workers wash hands and face when leaving Lead Work Area. Facilities for washing are to be provided by Contractor.
 - .5 Ensure no person required to enter Lead Work Area has facial hair that affects seal between respirator and face.
 - .6 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to Lead Work Areas.
 - .2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Lead Work Areas.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Handle and dispose of hazardous materials in accordance with EPA, TDGA, Provincial and municipal regulations.
- .2 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.
- .3 Provide waste manifests describing and listing waste generated and disposed of. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Information pertaining to lead-containing materials to be handled, removed, or otherwise disturbed and disposed of during this project are provided in the Designated Substances Report.
- .2 Any interested parties must satisfy themselves of quantities and locations of lead-containing materials identified in the Designated Substances Report.
- .3 Notify Owner Representative of suspected lead-containing materials discovered during work and not apparent from drawings, specifications, or reports pertaining to work. Do not disturb such material pending written instructions from Owner Representative.
- .4 Where a lead-containing material is applied to an asbestos-containing material scheduled for disturbance or demolition, the specification sections for asbestos operations supersede.

Part 2 Products

2.1 MATERIALS

- .1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: 0.25 mm woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibre-reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .4 Slow-drying sealer: non-staining, clear, water-dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual dust or other residue.
- .5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.
 - .1 Label containers with pre-printed bilingual cautionary labels warning of lead hazard that are clearly visible when containers are ready for removal to disposal site.

Part 3 Execution

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead—containing materials.

3.2 PREPARATION

- .1 Work Area:
 - .1 Shut off and isolate HVAC system to prevent dust dispersal into other Building areas.
 - .2 Pre-clean fixed items and equipment within Lead Work Areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
 - .3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning methods. Do not use methods that generate dust, such as dry sweeping, or non-HEPA filtered vacuums.

- .4 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:
 - .1 CAUTION LEAD HAZARD AREA (25 mm).
 - .2 NO UNAUTHORIZED ENTRY (19 mm).
 - .3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
 - .4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
- .5 Surround the Lead Work Area with banner tape ensuring that all access points have restricted access.
- Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.
- .7 Water should be applied to all areas where lead removal / disturbance is to take place unless using water would create an additional hazard. Water is to be supplied by a low pressure sprayer appropriate to the work being done.
- .8 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.2 Worker Decontamination:

- .1 Worker Decontamination must consist of a washing facility including a wash basin, water, soap and clean towels. Workers must use these facilities to wash hands and face immediately following the work and prior to leaving the Building.
- .2 Unless considered contaminated, protective clothing must be disposed of in a general construction waste receptacle immediately adjacent to the Lead Work Area. Contaminated protective clothing that cannot be decontaminated must be disposed of as lead-contaminated waste.

3.3 INSPECTION

- .1 Perform inspection to confirm compliance with applicable specification sections and governing authority requirements. Deviations from these requirements not approved in writing by Owner Representative will result in work stoppage, at no cost to the Owner.
- .2 Owner Representative will inspect work for:
 - .1 Adherence to specification sections and guidelines.
 - .2 Final cleanliness and completion of work. Lead Work Area will be considered clean when all visible dust and debris is removed and level of cleanliness is deem acceptable to the Consultant. No distinction will be made about the content of the dust or debris.
 - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When lead dust migration from Lead Work Area occurs, Owner Representative may order work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.4 AIR MONITORING

- .1 From beginning of work until completion of final cleaning operations, the Owner Representative may collect air samples on a daily basis outside of Lead Work Areas.
 - .1 All air monitoring to be conducted in accordance with applicable Provincial Occupational Health and Safety Regulations and following NIOSH Method 7300.
- .2 Owner Representative may collect air samples inside the Lead Work Area(s) as required to determine airborne lead particulate levels and to establish type/level of respiratory protection to be used. Workers may be required to wear air sampling pumps for up to full-shift periods.
 - .1 If airborne lead particulate levels are above the protection factor of respirators in use; stop work, apply means of dust suppression, and use higher level or protection factor in respiratory protection for persons inside the Lead Work Area(s) as directed by the Owner Representative.
 - .2 If air monitoring demonstrates that areas outside the Lead Work Area(s) enclosures are potentially contaminated; segregate, maintain and clean these areas, in the same manner as that applicable to Lead Work Areas.
 - .3 Stop work when airborne lead particulate levels outside of the Lead Work Area(s) exceed 0.025 mg/m³ and modify work procedures accordingly.

3.5 FINAL CLEANUP

- .1 Following specified cleaning procedures, proceed with final cleanup.
- .2 Vacuum visible lead-containing particulate immediately, using a HEPA filtered vacuum.
- .3 Place polyethylene, tape, cleaning material, clothing, and other lead-contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Clean up Lead Work Areas, equipment and any other potentially lead-contaminated equipment or Building components.
- .5 Clean up sealed waste containers and equipment used in Lead Work Areas and remove from work areas, at appropriate time in cleaning sequence.
- .6 Conduct final inspection to ensure no dust or debris remains on surfaces as result of lead abatement / disturbance operations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .3 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .4 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .5 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
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- .7 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .8 Section 02 86 01 Mercury Precautions

1.2 REFERENCES

- .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 278/05: Designated Substance Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05)
 - .2 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - .3 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .4 R.R.O. 1990, Regulation 860: Workplace Hazardous Materials Information System (WHMIS) Regulation, as amended (R.R.O. 1990, Reg. 860)
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
 - .6 Lead on Construction Projects, Ontario Ministry of Labour, updated April 2011
- .2 Ministry of the Environment and Climate Change (MOE)
 - .1 R.R.O. 1990, Regulation 347: *General Waste Management*, as amended (R.R.O. 1990, Reg. 347)
 - .2 Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended (EPA)
- .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, as amended (TDGA)
- .4 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .5 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.3 **DEFINITIONS**

- .1 Action Level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 0.025 milligrams per cubic meter of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for Type 2 lead abatement/disturbance operations are required for operations where airborne lead concentrations are greater than 0.05 milligrams per cubic meter of air within Lead Work Area(s).
- .2 Approved Supervisor: A person who has charge of a workplace or authority over a worker and has received the appropriate training for that role. A supervisor is ultimately responsible to provide direction to workers on site and must follow the applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .3 Authorized Visitors: Owner Representative, Engineer, Consultant or designated representatives and representatives of regulatory agencies.
- .4 Banner Tape: Pre-printed cautionary warning banner tape that describes the lead hazard and delineates the Lead Work Area(s).
- .5 Building: Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario.
- .6 Competent Worker: A worker who is qualified to complete the work because of knowledge, training and experience to organize the work and its performance, and who is familiar with applicable regulations and guidelines that apply to this work including, but not limited to, those as outlined in References (Section 1.2).
- .7 HEPA: High Efficiency Particulate Air filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .8 HEPA Filter Efficiency Testing: test to measure the efficiency of all HEPA filtered equipment on site prior to installation and movement of the equipment. Testing should be conducted using dispersed oil particulate (DOP).
- .9 HVAC system: all components of the Heating, Ventilation and Air Conditioning system.
- .10 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.
- .11 Lead Work Area: area where actual disturbance of lead-containing materials takes place within an area segregated by banner tape or polyethylene enclosure.
- .12 Occupied Area: areas of Building or work site that is outside of the Lead Work Area(s).
- .13 Owner: Maison de la Francophonie d'Ottawa.
- .14 Owner Representative: Individual competent in the processes to be completed as part of this specification section.
- .15 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .16 Type 2 Operations:
 - .1 Welding or high temperature cutting of lead-containing coatings or materials outdoors only if short-term, non-repeated, and if the material has been stripped prior to welding or high temperature cutting.

- .2 Removal of lead-containing coatings or materials by scraping or sanding using non-power hand tools. Do not remove lead-containing coatings or materials using power tools that are not equipped with a HEPA filtered dust collection system.
- .3 Demolition of more than one (1) square meter of drywall, plaster, concrete, concrete block, brick surface, building component or other material on which a lead-containing paint, coating or materials is applied.

1.4 SUBMITTALS

- .1 Provide proof satisfactory to Owner Representative that suitable arrangements have been made to dispose of lead—containing material(s) and lead-contaminated waste in accordance with requirements of authority having jurisdiction.
- .2 Provide proof of Contractor's General and Environmental Liability Insurance.
- .3 Submit proof of HEPA filter efficiency testing for all vacuums and negative air units in the Building. HEPA filter efficiency testing must be completed prior to all vacuums and negative air units arriving in the Building and every six (6) months following that date for the duration of the project. Proof of this testing must be provided to the Owner Representative.

.4 Quality Control:

- .1 Provide Owner Representative necessary permits for transportation and disposal of lead-containing materials and lead-contaminated waste and proof that it has been received and properly disposed.
- .2 Provide proof satisfactory to Owner Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Lead Work Area, and aspects of work procedures and protective measures.
- .3 Submit proof satisfactory to Owner Representative that employees have respirator fitting and testing. Workers must be fit-tested (irritant smoke test) with respirator that is personally issued prior to beginning work.
- .4 Submit Worker's Compensation Board status and transcription of insurance.

.5 Product data:

- .1 Provide documentation including Safety Data Sheets (SDS) for all chemicals and/or materials to be used including, but not limited to, the following:
 - .1 Encapsulants
 - .2 Amended water
 - .3 Slow drying sealer

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Provincial and local municipal requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
 - .1 Health and Safety Requirements for worker and visitor protection:
 - .1 Protective equipment and clothing to be worn by workers and visitors in Lead Work Areas includes:

- .1 NIOSH approved air purifying half-face respirator equipped with P100 particulate filter cartridges acceptable to Authority having jurisdiction and fit-tested to the worker wearing it.
- .2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
- .3 Protective clothing to cover hands and prevent ingestion of lead dust and particulate during and following work activities. This protection must be durable enough to withstand construction / demolition activities.

.2 Decontamination Requirements for workers:

- .1 Remove gross contamination from clothing before leaving Lead Work Area. Place contaminated work suits in receptacles for disposal with other lead-contaminated materials. Upon completion of lead abatement / disturbance operations, thoroughly clean footwear using a HEPA vacuum before removing from Lead Work Area.
- .3 Eating, drinking, chewing, and smoking are not permitted in the Lead Work Area.
- .4 Ensure workers wash hands and face when leaving Lead Work Area. Facilities for washing are to be provided by Contractor.
- .5 Ensure no person required to enter Lead Work Area has facial hair that affects seal between respirator and face.
- .6 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to Lead Work Areas.
 - .2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Lead Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Handle and dispose of hazardous materials in accordance with EPA, TDGA, Provincial and municipal regulations.
- .2 Disposal of lead waste generated by removal activities must comply with Provincial and municipal requirements. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.
- .3 Provide waste manifests describing and listing waste generated and disposed of. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Information pertaining to lead-containing materials to be handled, removed, or otherwise disturbed and disposed of during this project are provided in the Designated Substances Report.
- .2 Any interested parties must satisfy themselves of quantities and locations of lead-containing materials identified in the Designated Substances Report.

- .3 Notify Owner Representative of suspected lead-containing materials discovered during work and not apparent from drawings, specifications, or reports pertaining to work. Do not disturb such material pending written instructions from Owner Representative.
- .4 Where a lead-containing material is applied to an asbestos-containing material scheduled for disturbance or demolition, the specification sections for asbestos operations supersede.

Part 2 Products

2.1 MATERIALS

- .1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: 0.25 mm woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibre-reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .4 Slow-drying sealer: non-staining, clear, water dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead dust or other residue.
- .5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.
 - .1 Label containers with pre-printed bilingual cautionary labels warning of lead hazard that are clearly visible when containers are ready for removal to disposal site.

Part 3 Execution

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead-containing materials.

3.2 PREPARATION

.1 Before beginning work remove visible dust from surfaces in the work area where dust is likely to be disturbed during the course of the work. Use HEPA vacuum, or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate. Do not use compressed air to clean up or remove dust from any surface.

.2 Work Area:

- .1 Shut off and isolate HVAC system to prevent dust dispersal into other Building areas.
- .2 Pre-clean fixed items and equipment within Lead Work Areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
- .3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning methods. Do not use methods that generate dust, such as dry sweeping, or non-HEPA filtered vacuums.
- .4 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:
 - .1 CAUTION LEAD HAZARD AREA (25 mm).

- .2 NO UNAUTHORIZED ENTRY (19 mm).
- .3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
- .4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
- .5 Surround the Lead Work Area with banner tape ensuring that all access points have restricted access.
- Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.
- .3 Provide general ventilation through the use of HEPA filtered exhaust unit exhausting to the exterior of the Building, if practicable. There is to be a minimum of one (1) unit for every 30 square meters (300 square feet) of lead-contaminated material surface area to be disturbed.
- .4 Prevent the spread of dust and debris from the Lead Work Area by using measures appropriate to the work to be done including:
 - .1 Using polyethylene or other suitable material that is impervious to lead dust to seal off openings such as corridors, doorways, windows, elevator shafts, pipe penetrations, escalators, stairwells, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with duct tape to ensure that the Lead Work Area is segregated and that each floor is separated from the next.
 - .2 HEPA vacuums must be available and operational at all times when lead-containing materials may be disturbed.
 - .3 Provide additional HEPA vacuums as directed by the Consultant to ensure Lead Work Areas remain clean.
 - .4 Water must be applied to all areas where lead abatement / disturbance is to take place unless using water would create an additional hazard. Water is to be supplied by a low pressure sprayer appropriate to the work being done.
 - .5 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.5 Worker Decontamination:

- .1 Worker Decontamination must consist of a washing facility including a wash basin, water, soap and clean towels. Workers must use these facilities to wash hands and face immediately upon finishing work and prior to leaving the Building.
- .2 Unless considered contaminated, protective clothing must be disposed of in a general construction waste receptacle immediately adjacent to the Lead Work Area. Contaminated protective clothing that cannot be decontaminated must be disposed of as lead-contaminated waste.

3.3 INSPECTION

- .1 Perform inspection to confirm compliance with applicable specification sections and governing authority requirements. Deviations from these requirements not approved in writing by Owner Representative will result in work stoppage, at no cost to the Owner.
- .2 Owner Representative will inspect work for:

- .1 Adherence to specific procedures and materials requirements.
- .2 Final cleanliness and completion of work. Lead Work Area will be considered clean when all visible dust and debris is removed and level of cleanliness is deem acceptable to the Consultant. No distinction will be made about the content of the dust or debris.
- .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When lead dust migration from Lead Work Area occurs Owner Representative may order work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.4 AIR MONITORING

- .1 From beginning of work until completion of final cleaning operations, the Owner Representative may collect air samples on a daily basis outside of Lead Work Areas.
 - .1 All air monitoring to be conducted in accordance with applicable Provincial Occupational Health and Safety Regulations and following NIOSH Method 7300.
- .2 Owner Representative may take air samples inside the Lead Work Area(s) as required to determine airborne lead particulate levels and to establish the type/level of respiratory protection to be used. Workers may be required to wear air sampling pumps for up to full-shift periods.
 - .1 If airborne lead particulate levels are above the protection factor of respirators in use; stop work, apply means of dust suppression, and use higher level of protection factor in respiratory protection for persons inside the Lead Work Area(s) as directed by the Owner Representative.
 - .2 If air monitoring demonstrates that areas outside the Lead Work Area(s) are potentially contaminated; segregate, maintain and clean these areas, in the same manner as that applicable to Lead Work Areas.
 - .3 Stop work when airborne lead particulate measurements outside of the Lead Work Area(s) exceed 0.025 mg/m³ and modify work procedures accordingly.

3.5 FINAL CLEANUP

- .1 Following specified cleaning procedures, proceed with final cleanup.
- .2 Vacuum visible lead-containing particulate immediately, using a HEPA filtered vacuum.
- .3 Place polyethylene, tape, cleaning material, clothing, and other lead-contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Clean-up Lead Work Areas, equipment and any other potentially lead-contaminated equipment or Building components.
- .5 Clean-up sealed waste containers and equipment used in Lead Work Areas and remove from work areas, at appropriate time in cleaning sequence.
- .6 Conduct final inspection to ensure no dust or debris remains on surfaces as result of lead abatement / disturbance operations.

2018/04/18

Part 1 General

1.01 SUMMARY

.1 Remove and dispose off-site all mercury-containing fluorescent light tubes and bulbs, along with any other mercury-containing materials, from the Maison de la Francophonie d'Ottawa building located at 2720 Richmond Road, in Ottawa, Ontario (the "Site") in accordance with this specification section, as a minimum. See section 1.02 Related Sections for further information.

1.02 RELATED SECTIONS

- .1 Report titled "Pre-Demolition Designated Substances Review Maison de la Francophonie d'Ottawa (Former Grant School), 2720 Richmond Road, Ottawa, Ontario (Golder Project No.: 1791616), dated April 18, 2018 and herein referred to as the "Designated Substances Report"
- .2 Section 02 82 00.01 Type 1 Asbestos Operations Minimum Precautions
- .3 Section 02 82 00.02 Type 2 Asbestos Operations Intermediate Precautions
- .4 Section 02 82 00.03 Type 3 Asbestos Operations Maximum Precautions
- .5 Section 02 82 17.01 Type 1 Silica Operations Minimum Precautions
- .6 Section 02 82 17.02 Type 2 Silica Operations Intermediate Precautions
- .7 Section 02 83 10 Type 1 Lead Operations Minimum Precautions
- .8 Section 02 83 11 Type 2 Lead Operations Intermediate Precautions

1.03 REFERENCES

- .1 Comply with Provincial and local requirements provided that, in any case of conflict among those requirements or with these specifications, the more stringent requirements shall apply. Work shall be performed under regulations and guidelines in effect at the time work is performed. Regulations and guidelines include but are not limited to the following:
 - .1 Ministry of Labour (MOL)
 - .1 Ontario Regulation 490/09: *Designated Substances* (O. Reg. 490/09)
 - .2 Ontario Regulation 213/91: *Construction Projects*, as amended (O. Reg. 213/91)
 - .3 R.R.O. 1990, Regulation 860: *Workplace Hazardous Materials Information System (WHMIS) Regulation*, as amended (R.R.O. 1990, Reg. 860)
 - .4 Code for Respiratory Equipment for Mercury, 2000
 - .5 Occupational Health and Safety Act, R.S.O. 1990, Chapter O.1 (OHSA)
 - .2 Ministry of the Environment and Climate Change (MOECC)
 - .1 R.R.O. 1990, Regulation 347: *General Waste Management*, as amended (R.R.O. 1990, Reg. 347)
 - .2 Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended (EPA)
 - .3 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, as amended (TDGA)
 - .4 U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)

- .1 NIOSH Manual of Analytical Methods (NMAM), 5th ed., DHHS (December, 2017)
- .5 Canadian Standards Association (CSA)
 - .1 Z94.4-11 (R2016) Selection, Use, and Care of Respirators

1.04 **DEFINITIONS**

- .1 Consultant: individual competent in the processes to be completed as part of this specification section with authority to provide direction on behalf of the Owner.
- .2 Owner: Maison de la Francophonie d'Ottawa.

1.05 INSTRUCTION AND TRAINING

- .1 Before beginning work:
 - .1 Ensure that all workers likely to handle mercury-containing items are trained in the use of a Mercury Spill Kit, are trained in the handling of mercury, and are familiar with applicable regulations that apply to this work as outlined in References (Section 1.03).

1.06 EXISTING CONDITIONS

- .1 Information pertaining to mercury-containing materials and equipment to be handled, removed, or otherwise disturbed during this project are included in the Designated Substances Report.
- .2 Any interested parties must satisfy themselves of quantities and locations of mercury-containing materials and equipment identified in the Designated Substances Report.
- .3 Notify Consultant of suspected mercury-containing materials discovered during work and not apparent from Specifications or reports pertaining to work. Do not disturb such material pending written instructions from Consultant.

Part 2 Products

2.01 MATERIALS

- .1 Cardboard Containers: New or used cardboard boxes as approved by the Consultant. Suitable for packaging of fluorescent light tubes and bulbs to prevent breakage of tubes and bulbs.
- .2 Containment Drums: New 20 L metal pails with handles and sealable lids. Free from rust and punctures.
- .3 Drum Liners: clear polyethylene bags, 0.15 mm thick.
- .4 Vermiculite: pre-packed, Industrial Grade 3, containing no asbestos.
- .5 Label: Number 4 Severe Hazard Label, completed as Health 3, Fire 1, Environment 4, and Reactivity 1.

2.02 EQUIPMENT

- .1 Mercury Spill Response Kit consisting of:
 - .1 High Efficiency Particulate Air (HEPA) vacuum dedicated for use with mercury spills.
 - .2 Half-mask respirator equipped with a mercury vapour cartridge and an end-of service-life indicator, or with a cartridge and an end-of-service-life indicator in combination with N-, R-, or P-series particulate filter with 95, 99 or 100% efficiency that meet the requirements of the *Code for Respiratory Equipment for Mercury*.
 - .3 Surgical gloves to prevent skin exposure when handling droplets of mercury.
 - .4 Neutralizing compound such as 20% calcium polysulfide or 20% sodium thiosulfide to clean spilled surfaces.

Part 3 Execution

3.01 PACKAGING OF FLUORESCENT TUBES AND BULBS

- .1 Carefully remove fluorescent light tubes and bulbs from fixtures and place in cardboard containers.
- .2 Place tubes and bulbs in container as they are removed from fixtures. Ensure that tubes and bulbs are packaged in a manner to prevent breakage.
- .3 Avoid rough handling of tubes and bulbs to avoid breakage.
- .4 Store full containers in a specified location at the project site as directed by the Owner and/or Consultant until the contractor has arranged for appropriate removal and disposal of these containers from the project site.

3.02 PACKAGING OF OTHER MERCURY MATERIALS

- .1 Place polyethylene Drum Liner in Containment Drum. Pour a minimum of 100 mm layer of vermiculite into liner. Place mercury items in Containment Drum in a manner to prevent breakage. When full or all items are placed in Containment Drum, seal liner bag with duct tape and place label on outside of Containment Drum.
- .2 Avoid rough handling of mercury items to avoid breakage.
- .3 Store Containment Drums in a specified location at the project site as directed by the Owner and/or Consultant until the contractor has arranged for appropriate removal and disposal from the project site.

3.03 WASTE MANAGEMENT

- .1 When mercury-containing equipment has been packaged:
 - .1 Co-ordinate transportation and disposal with licensed landfill and/or recycling facility designated to receive the waste and provide details in writing to the Consultant.
 - .2 Comply with applicable Provincial and Municipal laws and regulations for generation of mercury waste.
 - .3 Use licensed carrier authorized by Provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended waste treatment facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by Provincial regulations.

- .6 Only trained personnel may handle, offer for transport, or transport dangerous goods.
- .7 Provide photocopy of shipping documents and waste manifests to Consultant.
- .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Consultant.
- .9 Report discharge, emission, or escape of hazardous materials immediately to Consultant and appropriate Provincial authority. Take reasonable measures to control release.
- .2 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .3 Report spills or accidents immediately to Consultant. Submit a written spill report to Consultant within 24 hours of incident.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 American Concrete Institute:
 - .1 ACI 303-12, Guide to Cast-in-Place Architectural Concrete Practice.
- .2 CSA International:
 - .1 CAN/CSA A23.1-09, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA A23.2-09, Methods of Test for Concrete.
 - .3 CAN/CSA 086-09, Engineering Design in Wood.
 - .4 CAN/CSA O121-08 (R2013), Douglas for Plywood.
 - .5 CAN/CSA O151-09, Canadian Softwood Plywood.
 - .6 CAN/CSA O153-13, Poplar Plywood.
 - .7 CAN/CSA O325-07 (R2012), Construction Sheathing.
 - .8 CAN/CSA O437-93 (R2011) Series, Standards for OSB and Wafer Board.
 - .9 CAN/CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
 - .10 CAN/CSA S269.3-M92 (R2013), Concrete Formwork, National Standard of Canada.
- .3 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 QUALITY PLAN

.1 Concrete formwork to be in accordance with the Quality Plan in Section 03 30 00 – Cast-in-Place Concrete.

1.3 EXAMINATION

.1 Prior to construction of forms and/or placement of concrete, carefully examine all Contract Documents and shop drawings which affect this work. Report any discrepancies to the Consultant for their direction.

1.4 STORAGE AND HANDLING

.1 Deliver, store, and handle all materials in accordance with the Quality Plan.

1.5 FALSEWORK AND FORMWORK DESIGN AND REVIEW

- .1 Design, construct, and dismantle falsework and formwork in accordance with the requirements of CAN/CSA A23.1, CSA S269.1, CSA S269.3, and ACI Standard SP4 unless more stringent tolerances are specified.
- .2 Submit erection drawings in accordance with Division 01.
- .3 Provide erection drawings for formwork that show the design criteria for the use of the formwork.

Include verification of erection and use of formwork in the Quality Plan. Formwork erection drawings shall be sealed by a Professional Engineer registered in the Province of Ontario. Only formwork/falsework drawings accepted by the Quality Plan will be received by the Consultant.

.4 Prior to placing concrete, ensure Quality Plan steps have been undertaken, including: obtaining a letter sealed by falsework designer confirming that falsework has been constructed in accordance with design requirements and is suitable for intended use.

1.6 ACTION AND INFORMATION SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Submit the following items for approval:
 - .1 Quality Plan in Section 03 30 00 Cast-in-Place Concrete.
 - .2 Formwork/falsework drawings.

1.7 COORDINATION OF QUALITY PLAN WITH WORK ON SITE

.1 Attend the pre-construction meeting as outlined in the Quality Plan submitted as part of Section 03 30 00.

1.8 PROPRIETARY PRODUCTS

.1 All proprietary products to be applied/installed in strict accordance with the manufacturer's published recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 For non-exposed concrete or concrete without special architectural features, use wood and wood product formwork materials to CSA-0121, CSA-086, CSA 0437 Series, or CSA-0153. Materials to bear grade marks, or to be accompanied by certificates, test reports, or other proof of conformity.
- .2 For exposed concrete or concrete with special architectural features, use formwork materials to stricter requirements of CSA-A23.1/ A23.2 and ACI-303.
 - .1 Form liner to be new factory coated high density overlaid Douglas for plywood to CSA 0121.
- .3 Tubular column forms round, spirally wound laminated fiber forms, internally treated with release material.
 - .1 Spiral pattern not to show in hardened concrete.
- .4 Apply non-reactive form release agent prior to placing reinforcing unless noted otherwise.
- .5 Falsework to CSA-S269.1.

2.2 FORM TIES

- .1 Unexposed Concrete Surfaces snap ties, coil ties, or she-bolts to suit application.
- .2 Exposed or Architectural Concrete Plastic cone type snap ties or coil ties which break off or are removable 1.5" inside concrete surface. Non-shrink, non-metallic grout to be installed after removal of tie and plastic cone.

PART 3 - EXECUTION

3.1 ERECTION

- .1 Verify lines, levels, and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Construct formwork strong, tight, braced and tied so as to maintain shape and position within tolerances specified in CAN/CSA A23.1. Top form ties shall not be located within 6" of the top of the concrete placement.
- .3 Camber all formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Positive means of adjustment (wedges or jacks) or shores and struts to be provided and all settlement taken up during concrete placing operation.
- .4 Align form joints and make watertight. Keep form joints to minimum.
- .5 Provide temporary cleanout and inspection openings.
- .6 Install 1" triangular wood chamfer strips in corners of forms for all corners of columns, walls, beams, and equipment bases which will be exposed in the finished structure.
- .7 Install 1" triangular drip on all exterior slab soffits set 2" back from edge of slab.
- .8 All formwork shall be left in place until concrete has attained sufficient strength to support its own weight plus all likely construction loads.
- .9 Minimum stripping time for vertical formed surfaces for elements not exceeding 10' in height and 16" in depth shall be 24 hours.
- .10 Minimum stripping time for suspended structural elements shall be 7 days provided that sufficient structural strength of concrete can be demonstrated to the satisfaction of the Consultant.
- .11 Minimum stripping time for multi-levelled, staged suspended construction shall be determined in accordance with reshoring methods proposed by Contractor. Consultant to review stripping and reshoring methodology prior to placing concrete.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM A 775/A 775M-07b (2014), Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .2 ASTM A 1064/A 1064M-13, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2 CSA International:
 - .1 CAN/CSA A23.1-09, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .3 CAN/CSA S413-07(R2012), Parking Structures.
 - .4 CAN/CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC):
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.2 QUALITY PLAN

.1 Concrete reinforcement to be in accordance with the Quality Plan in Section 03 30 00 where applicable.

1.3 STORAGE AND HANDLING

.1 Deliver, store, and handle all materials in accordance with the Quality Plan.

1.4 ACTION AND INFORMATION SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Prepare reinforcing steel shop drawings that conform to the construction drawings with respect to placement, quantity, and size of reinforcing steel bars. Reinforcing steel shop drawings shall be reviewed and accepted in accordance with the Quality Plan prior to forwarding on to the [Consultant].
- .3 Forwarded shop drawings shall be in a single, complete set in order that all details may be read in conjunction with plans, elevations, and all other dependent details. Quantity and format of shop drawings are to be in accordance with Division 01. Reproduction of Contract Documents will not be acceptable as Shop Drawings.
- .4 All materials, finishes, and loadings shall be clearly illustrated. Submittals shall clearly define any abbreviations.
- .5 Where shop drawings are re-submitted, clearly illustrate all revisions from previous submissions using revision marks and "bubbles".
- .6 All details and sections to be to a scale of not less than 1:25.

- .7 Provide elevation drawings of all walls, cross referenced to plan drawings. Provide drawings for each differing section of steel arrangement. Do not indicate various areas on one detail.
- .8 Indicate placement of reinforcement at all openings, depressions, spandrels, and sleeves. Show bar supports, hangers, inserts, water stops, anchor bolts, etc.
- .9 Shop drawings shall correspond to each detail on drawing. Each wall, slab, etc. to be separately listed. Bar lists shall be reviewed only for general conformity, quantities are not checked in detail.
- Detail to requirements of CAN/CSA-A23.1 and RSIC, Reinforcing Steel Manual of Standard Practice. Ensure adjustments are made in detailing of reinforcing steel for splices and development lengths. Splice lengths are to be based on bar position within section (e.g. top bars) and reinforcement coatings (e.g., epoxy).
- .11 The construction drawings show reinforcing steel placement for the project that shows the intent of reinforcing of concrete elements. These drawings can accomplish this description through the use of nomenclature such as similar and typical, indicating similar arrangements of reinforcing steel within concrete elements but potential variation of formed dimensions and lengths to accommodate the intended final construction.
- .12 The reinforcing steel shop drawings shall be of sufficient detail to allow for a clear understanding of the fabrication limits, quantity, and placement of all reinforcing steel on the project. Fabrication of reinforcing steel prior to acceptance through the Quality Plan shall not be at the risk of the Consultant for back charge if fabricated reinforcement is not suitable for the project due to modifications in the shop drawings.
- .13 Submit reinforcing steel mill certificates.

1.5 COORDINATION OF QUALITY PLAN WITH WORK ON SITE

.1 Attend the pre-construction meeting as outlined in the Quality Plan submitted as part of Section 03 30 00.

1.6 SUBSTITUTES

.1 Substitution of different size bars permitted only upon written approval of Consultant.

1.7 PROPRIETARY PRODUCTS

.1 All proprietary products to be applied/installed in strict accordance with the manufacturer's published recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Reinforcing bars - to CSA G30.18, Grade 400 deformed billet steel. Provide Grade 400W where welding of reinforcing is required.

- .2 Welded wire fabric to ASTM A1064M-13, supplied in flat sheets.
- .3 Slab bolisters and high chairs to suit application. Exposed concrete bolisters and chairs to be plastic or stainless steel.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

- .1 Place and protect reinforcing steel in accordance with CAN/CSA-A23.1.
- .2 Before placing, clean all reinforcement of any loose scale, dirt, or any other coatings which would impair the bond.
- .3 Place reinforcement accurately and secure in place by use of chairs, spacers, and hangers.
- .4 Specified cover to reinforcing steel as required in CSA/CAN-A23.1, except as noted below:
 - .1 Concrete deposited against and permanently exposed to earth surface 3".
 - .2 Concrete deposited in forms but exposed to earth or weather 2".
 - .3 Walls interior 1" exterior 11/4".
 - .4 Slabs interior 1" exterior 11/4".
 - .5 Beams and columns interior 1½" (to stirrups and ties) exterior 2".
- .5 Development length to be 1.4 x Class 'A' for tension, and 1.4 x compression development length.
- Lap splices to be Class 'B' for tension and 1.3 x compression development length for compression. All lap splices to be 2' minimum.
- .7 Provide corner bars to match longitudinal reinforcing at all intersections (including footings) unless otherwise indicated.
- .8 Straightening or rebending of reinforcing bars is not permitted. Discard bars with bends or kinks not shown on bar lists.
- .9 Adequately support slab and stair bars on continuous high chairs to resist against weight of workmen and equipment.
- .10 Welding of reinforcing shall not be performed without prior approval of methods by Consultant. All welding shall conform to CSA Standard W186 and shall only be performed by welders certified by the Canadian Welding Bureau.
- .11 Unless otherwise noted, provide additional reinforcing at openings in slabs and walls as noted on drawings.
- .12 Unless otherwise noted, provide hooked ends at all reinforcing terminated at openings.

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3.2 INSERTS AND OPENINGS

.1 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Consultant before placing of concrete.

END OF SECTION

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PART 1 - GENERAL

1.1 STANDARDS

- .1 Standards listed below govern minimum quality of work required under this Section:
 - .1 American Concrete Institute:
 - .1 AC1 301-10 "Specifications for Structural Concrete".
 - .2 ACI 303-12 "Guide to Cast-in-Place Architectural Concrete Practice".
 - .3 SP-4, 7th edition, "Formwork for Concrete".
 - .4 SP-66-04 "ACI Detailing Manual 2004".
 - .2 ASTM International:
 - .1 ASTM A 82/A 82M-07 "Standard Specification for Steel Wire, Plain, for Concrete Reinforcement".
 - .2 ASTM A 123/A 123M-13 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products".
 - .3 ASTM C 260/C 260M-10a "Standard Specification for Air-Entraining Admixtures for Concrete".
 - .4 ASTM C 309-11 "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete".
 - .5 ASTM C 494/C 494M-13 "Standard Specification for Chemical Admixtures for Concrete".
 - .6 ASTM C 1017/C 1017M-07 "Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete".
 - .7 ASTM D 1751-04(2013)e1 "Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)".
 - .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 19.24-M90 "Multicomponent. Chemical-Curing Sealing Compound".
 - .2 CAN/CGSB-25.20-95 "Surface Sealer for Floors".
 - .3 CAN/CGSB-37.2-M88 "Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Damp-proofing and Waterproofing and for Roof Coatings".
 - .4 CAN/ CGSB 41-GP-35M (Withdrawn) "Polyvinyl Chloride Water Stop".
 - .5 CAN/CGSB-51.34-M86(R1988) "Vapour Barrier, Polyethylene Sheet for Use in Building Construction".
 - .4 CSA International:
 - .1 CAN/CSA A23.1-09 "Concrete Materials and Methods of Concrete Construction".
 - .2 CAN/CSA A23,2-09 "Methods of Test for Concrete".
 - .3 CAN/CSA-A23.3-04(R2010) "Design of Concrete Structures".
 - .4 CAN/CSA A283-06 (R2011) "Qualification Code for Concrete Testing Laboratories".
 - .5 CAN/CSA A3000-13 "Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)".
 - .6 CAN/CSA G40.20/G40.21-13 "General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel".
 - .7 CAN/CSA G164-M92 (Withdrawn) "Hot Dip Galvanizing of Irregularly Shaped Articles".
 - .8 CAN/CSA 086-09 "Engineering Design in Wood".
 - .9 CAN/CSA O121-08 (R2013) "Douglas Fir Plywood".
 - .10 CAN/CSA O151-09 "Canadian Softwood Plywood".
 - .11 CAN/CSA O153-13 "Poplar Plywood".
 - .12 CAN/CSA O325-07 (R2012) "Construction Sheathing".
 - .13 CAN/CSA O437-93 (R2011) Series "Standards for OSB and Wafer Board".
 - .14 CAN/CSA S269.1-1975 (R2003) "Falsework for Construction Purposes".
 - .15 CAN/CSA S269.3-M92 (R2013) "Concrete Formwork, National Standard of Canada".

- .16 CAN/CSA W186-M1990 (R2012) "Welding of Reinforcing Bars in Reinforced Concrete Construction".
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets.
- .6 Reinforcing Steel Institute of Canada (RSIC):
 - .1 RSIC "Reinforcing Steel Manual of Standard Practice".

1.2 PERFORMANCE BASED SPECIFICATION

- .1 The concrete materials supplied for this project will be provided by the Performance Based Specification. For each concrete element to be constructed the following criteria will be provided:
 - Structural criteria including strength at age:
 - Class of exposure of concrete;
 - Any permeability requirements;
 - Specific aggregate size to limit shrinkage and improve placement performance;
 - Flatness and durability of finish.

QUALITY PLAN 1.3

- .1 Develop and implement a Quality Plan that verifies the concrete work meets the project specifications. The Quality Plan shall be of sufficient detail to demonstrate the performance requirements of the project have been met. The completed steps of the Quality Plan shall be communicated to the Consultant in a manner and frequency to facilitate the Owner's Quality Assurance Plan process.
- .2 The Quality Plan shall describe, as a minimum, the following plans and procedures:
 - .1 Identify the personnel responsible for implementation and oversight of the quality control plan for this section in an organization chart. Describe the roles and responsibilities of each person listed.
 - .2 Provide samples of Contractor's quality control inspection and data logging forms to be used on the project. The quality control forms shall, as a minimum, include the following:
 - .1 Shop Drawing Review and Sign Off;
 - .2 Formwork Inspection;
 - .3 Reinforcing Inspection;
 - .4 Inspection of Concrete Accessories, Inserts, and Openings;
 - .5 Concrete Pour Request:
 - .6 Concrete Placement Log:
 - .7 Curing Log;
 - .8 Concrete Cylinder Log;
 - .9 Waterproofing Log and Inspection:
 - .10 Final Concrete Inspection;
 - Quality plan shall include procedural steps for review of shop drawings by the Contractor prior to submission to the Consultant.
 - Describe quality control procedural steps related to:
 - .1 Formwork and Falsework;
 - .2 Reinforcing;
 - .3 Concrete Placement, Testing, Finishing and Curing;
 - .4 Mock-ups;
 - .5 Hot and Cold Weather Work, including: methods of preparation, curing, heating, insulation, and temperature monitoring;

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- .6 Coordinating with the Owner's Quality Assurance Plan. Indicate anticipated timeframes for scheduling of general conformance reviews by Engineer;
- .7 Coordination of Material Testing;
- .8 Review of installation of proprietary systems by manufacturer's representative;
- .9 Defective Concrete, including: identification, documentation, submission of proposed repair procedures, and follow-up inspection;
- .5 Risk Management: list and describe any anticipated project specific risks associated with this section and outline proposed means of mitigation.
- .3 The Quality Plan shall be prepared taking into account the specific requirements of this project. Generic quality plans that, in the Engineer's reasonable opinion, fail to address the specific requirements of this project will be returned 'Revise and Resubmit'.
- .4 Submit Quality Plan in accordance with Division 01. Acceptance of the Quality Plan by the Engineer shall be considered a prerequisite for concrete placement. Failure of the Contractor to coordinate the timely submission of a complete Quality Plan, which ultimately results in the delay of the start of concrete work, shall not be at the risk of the Owner for back charge.

1.4 EXAMINATION

.1 Prior to construction of forms and/or placement of concrete, carefully examine all Contract Documents and shop drawings which affect this work. Report any discrepancies to the Consultant for their direction.

1.5 SOIL INSPECTION

- .1 Owner will appoint a Soils Consultant to test compaction of backfill material under slab on grade and to verify bearing capacity of foundation subgrade. Notify Soils Consultant a minimum of 48 hours prior to placement of concrete or compacted backfill. Do not place concrete or compacted backfill until underlying subgrade material has been inspected and accepted.
- .2 Soils Consultant will be paid from cash allowance carried in Division 01. Supply all necessary cooperation.
- .3 If final footing elevations differ from those shown on drawings due to unsuitable soil conditions, contract sum to be adjusted on basis of unit prices tendered. Only changes instructed by Consultant and recommended by Soils Consultant will be accepted.

1.6 STORAGE AND HANDLING

.1 Deliver, store, and handle all materials in accordance with the Quality Plan. Ensure all concrete materials are handled in accordance with CSA A23.1.

1.7 FALSEWORK AND FORMWORK DESIGN AND REVIEW

.1 Design, construct, and dismantle falsework and formwork in accordance with the requirements of CAN/CSA A23.1, CSA S269.1, CSA 269.3, and ACI Standard SP4 unless more stringent tolerances are specified.

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- .2 Provide erection drawings for formwork that shows the design criteria for the use of the formwork. Include verification of erection and use of formwork in the Quality Plan. Formwork erection drawings shall be sealed by a Professional Engineer registered in the Province of Ontario. Only formwork/falsework drawings accepted by the Quality Plan will be received by the Consultant. Quantity and format of shop drawing are to be in accordance with Division 01. Reproduction of Contract Documents will not be acceptable as Shop Drawings.
- .3 Prior to placing concrete, ensure Quality Plan steps have been undertaken, including: obtaining a letter sealed by falsework designer confirming that falsework has been constructed in accordance with design requirements and is suitable for intended use.

1.8 CONCRETE MATERIALS ACTION AND INFORMATION SUBMITTALS

- .1 Submit in accordance with Division 01.
 - .1 Concrete mix designs.
 - .2 Product and material samples as requested.
 - .3 Proposed curing methods.
- .2 Provide all concrete samples required as part of the Owner's Quality Assurance Plan.

1.9 COORDINATION OF QUALITY PLAN WITH WORK ON SITE

- .1 Pre-construction Meeting: convene pre-construction meeting one week prior to beginning concrete work.
 - .1 Ensure key personnel, site supervisor, and Consultant attend.
- .2 Prior to placement of concrete ensure all inspection processes and assembled documentation has been carried out to conform to the Quality Plan.
- .3 Notify the Consultant at least 48 hours in advance of the proposed placement of concrete. Upon notification the Consultant may elect to review the contents of the Quality Plan to assess if the work is proceeding in general conformance with the contract documents. The Consultant may elect to review the work on site and prepare appropriate record of observations for the Owner.

1.10 PROPRIETARY PRODUCTS

.1 All proprietary products to be applied/installed in strict accordance with the manufacturer have published recommendations.

PART 2 - PRODUCTS

2.1 CONCRETE

- .1 All constituent materials shall conform to the requirements of CAN/CSA-A23.1.
- .2 Concrete mix design shall comply with requirements of CAN/CSA-A23.1 based on Alternative No. 1 in Table 5. Ready-mix concrete to be proportioned mixed and delivered in accordance with CAN/CSA-A23.1.

- .3 Submit acceptable recent records of tests to justify use of desired supplier. Recent records to include compressive strength, air content and air-void system tests. Where doubt exists as to quality of concrete provided by a proposed supplier, Consultant may, at his discretion, order Contractor to arrange for an alternative, acceptable source of supply at no extra cost or delay to Owner.
- .4 Pump mix designs shall not be modified from normal concrete mix designs by the changing cement content or quantities of coarse and fine aggregate. Specifically fine aggregate contents shall not be increased, nor coarse aggregate contents reduced to accommodate pumping.
- .5 Admixtures other than air entraining and water reducing agents are not permitted unless approved by Consultant. Calcium chloride shall not be used.
- .6 Use 3/4" aggregate unless noted otherwise.
- .7 Minimum compressive strength and class of concrete to be used:

Use	Compressive Strength	Exposure	Water/Cement Ratio
Unshrinkable Concrete Fill	7 MPa	N	-
Mud Slabs/Lean Concrete	15 MPa	N	-
Interior concrete stairs, slab on grade, foundation walls, piers and structural slabs not exposed to freezing or thawing	30 MPa	N	0.55
Exterior stairs, slab on grade and concrete walks, perimeter foundation walls and piers	35 MPa	C-1	0.55

2.2 ADMIXTURES

- .1 Air Entraining Admixture: to ASTM C 260.
- .2 Chemical Admixtures: to ASTM C 494. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .3 Water Reducing Agent: to ASTM C 494, non-chloride.
- .4 Retardation Agent: to ASTM C 494, non-chloride.
- .5 Superplasticizer: to ASTM C 494, use only when approved by Consultant.

2.3 CURING COMPOUNDS

.1 Consultant to approve use of curing compounds in all liquid retaining structures. If approved, use only potable water approved compounds for curing in liquid retaining structures.

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2.4 FLOOR SEALERS

.1 Natural coloured floors (hardened or unhardened). Standard of Acceptance: Sealtight HIAC by W.R. Meadows; Florseal WB by Sika, Sealhard 400 by Sternson.

2.5 FLOOR SURFACE HARDENERS

.1 Shake-applied non-metallic aggregate. Standard of Acceptance: Diamag 7 by Sika; Mastercron by BASF Building Systems; Sealtight type 'R' by W.R. Meadows.

2.6 EXPANSION JOINT FILLER AND SEALANT

- .1 Refer to drawings for configurations of expansion/construction joint details.
- .2 Joint Filler: Potable water approved pre-compressed expanding foam joint filler (waterproof). Standard of Acceptance: DSM System by Emseal for exterior applications, and SUBMEARSEAL System by Emseal for interior applications or approved equivalent.
- .3 Sealant: Two component potable water approved sealant to match floor finish and breaker tap or foam back-up rod. Standard of Acceptance: Sikaflex 2C NS EZ Mix by Sika Canada or approved equivalent.

2.7 EXPANSION JOINT BOARD FILLER

.1 Expansion joint board filler to be expanded polystyrene board (EPS) Type 1 density.

2.8 ISOLATION JOINT FILLER

.1 For Isolation Joints: Standard of Acceptance: Deck-O-Foam by W.R. Meadows or approved equivalent.

2.9 SAWCUT JOINT FILLER

.1 Sawcut Control Joints - self-levelling two component epoxy urethane filler. Standard of Acceptance: Loadflex by Sika or approved equivalent.

2.10 GROUT

.1 Nonshrink, Premixed Non-metallic Grout: Standard of Acceptance: V-3 Grout by W.R. Meadows; Master Flow 713 Plus by BASF Building Systems, M-Bed by Sika; CPD non-shrink grout by CPD.

2.11 BONDING AGENT

.1 Latex Bonding Agent: Standard of Acceptance: Surfacrete by Sternson; Intralok by W.R. Meadows; CPD Latex Adhesive by CPD or approved equivalent.

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2.12 ANCHORS

- .1 All proprietary anchoring products to be as specified on drawings and installed (including standard depth of embedment) as per manufacturer's published recommendations.
- .2 Standard of Acceptance: Hilti (Canada) Products, Hilti Hit-HY 200 Adhesive Anchor System, AISI 316 stainless steel or approved equivalent, unless noted on drawings. Minimum 400 MPa yield strength, 500 MPa ultimate strength.

2.13 WATERSTOPS

.1 Urethane PVC Waterstops to CGSB 41-GP-35M (Withdrawn), central bulb, ribbed profile, size as noted on drawings. Standard of Acceptance: SEALTIGHT PVE Waterstops by W.R. Meadows, PVC Waterstops by Southern Metal & Plastic Products, and PVC Waterstops by Siku Greenstreak. PVC Waterstops to be NSF61 approved.

2.14 REPAIR PRIMER

.1 Concrete Patch Repair Primer: Standard of Acceptance: SIKATOP Armtec 110 by Sika Canada or approved equivalent.

2.15 SELF-LEVELING PATCHING MORTAR

.1 Self-leveling patching mortar for horizontal patching. Standard of Acceptance: SIKATOP III Plus by Sika Canada or approved equivalent.

2.16 NON-SAG PATCHING MORTAR

.1 Non-sag patching mortar for vertical, overhead and other applications indicated. Standard of Acceptance: SIKATOP 123 Plus by Sika Canada of approved equivalent.

2.17 MIGRATING CORROSION INHIBITOR

.1 Migrating corrosion inhibitor applied to all saw cut edges and concrete repair locations where reinforcing bars have been exposed. Standard of Acceptance: SIKA Ferroguard 903 by Sika Canada or approved equivalent.

2.18 CEMENTITIOUS WATERPROOFING

.1 Cementitious waterproofing applied as per manufacturer's recommendations as detailed on Contract Drawings. Standard of Acceptance: SIKATOP Seal 107 by Sika Canada or approved equivalent.

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2.19 WATERPROOF EXPANSION JOINT SYSTEM

.1 Waterproof expansion joint system for liquid retaining structures and repair of existing joints, as indicated on drawings. Standard of Acceptance: SIKADUR Combiflex System by Sika Canada or approved equivalent.

2.20 NEOPRENE BEARING PADS

.1 Neoprene bearing pads to be premium grade, thickness as indicated, Grade 50, Durometer A.

2.21 NON-SLIP STAIR AND LANDING INSERTS

.1 Base of heat treated extruded aluminum alloy, abrasive filler to be a mixture of aluminum oxide and silicon carbide granular in epoxy matrix, abrasive shall project a minimum of 1.5 mm above finished surface. Nosing insert to be full length of stair less 3mm clearance. Colour to be selected by Consultant from manufacturer's full product line. Standard of Acceptance: Type 238 super grit safety treads by Wooster Products Inc. or approved equivalent.

PART 3 - EXECUTION

3.1 COLD WEATHER REQUIREMENTS

- .1 Carry out cold weather concreting in accordance with the requirements of CAN/CSA A23.1 and the Contractor's Quality Plan.
- .2 When the air temperature is at or below 5°C or there is a likelihood of it falling to that limit within 24 hours of placing, employ suitable means to maintain temperature of all concrete surfaces between 10°C and 21°C for at least 3 days after placing. Provide sufficient thermometers, in accordance with CAN/CSA A23/1.
- .3 Remove or replace any portion of concrete allowed to freeze prior to reaching a compressive strength of at least 10 MPa. Do not place concrete on frozen surfaces.
- .4 Provision shall be made for venting of all combustion products from gas-fired heaters. Repair any concrete damaged by carbonation.

3.2 HOT WEATHER REQUIREMENTS

- .1 Carry out hot weather concreting in accordance with requirements of CAN/CSA A23.1 and the Contractor's Quality Plan.
- .2 When the air temperature is above 27°C, curing shall be by water spray, wet sand or burlap and <u>not</u> by curing compounds.
- .3 Monitor concrete temperatures for walls and slabs 20" thick or more. After temperature has peaked, control rate of cooling to ambient temperature at a rate of 0.5°C per hour to prevent cracking.

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- .4 Do not place concrete with material temperature higher than 25°C. Concrete with temperature higher than 25°C on arrival at the site will be rejected.
 - .1 formwork is built.

3.3 PLACING

- .1 Place concrete in accordance with CAN/CSA-A23.1.
- .2 Notify Consultant before concrete is placed, so that he may, at his discretion, review all preparations for conformance with requirements of the Quality Plan.

3.4 CONSTRUCTION JOINTS

- .1 Locate construction joints as noted on drawings. Any additional construction joints shall be located so as not to impair the structural integrity of the finished structure and shall be reviewed and accepted by Consultant.
- .2 Prepare all existing concrete surfaces in accordance with CAN/CSA-A23.1. All laitance and foreign matter shall be removed and the surface mechanically roughened to partially expose aggregate.
- .3 Waterstops to be installed in all construction joints in liquid retaining structures and below grade structures. Waterstops to be installed in accordance with manufacturer's instructions.

3.5 INSERTS AND OPENINGS

- .1 Set sleeves, ties, hangers, waterstops, anchor bolts and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 8" not indicated on structural drawings must be approved by Consultant.
- No sleeves, ducts, pipes or other openings shall pass through beams, column capitals or columns, except where specifically detailed on structural drawings or reviewed by Consultant.
- .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Consultant before placing of concrete.
- .4 Fully coordinate locations and sizes of sleeves and openings shown on structural drawings with architectural, mechanical and electrical drawings.
- .5 Set all anchor bolts using templates provided by appropriate trade requiring same. Securely fasten anchor bolts in place to maintain correct position and alignment during concreting. Misplaced anchor bolts shall be considered defective concrete and shall be removed and replaced or otherwise corrected to Consultant's satisfaction.

3.6 FLOOR FINISHING

.1 Finish floors in accordance with CAN/CSA-A23.1 utilizing expert tradesmen whose only occupation is floor finishing.

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- .2 Slab and floor tolerance measurements shall be made in accordance with the Straightedge Method as specified in CAN/CSA-A23.1 and in accordance with the Contractor's Quality Plan.
 - .1 Unless otherwise noted, the floor finish of all interior floor areas is classified as Class B.
 - .2 Unless otherwise noted, use a steel troweled finish. Finished surface to be free of any trowel marks, uniform in texture and appearance. On surfaces intended to support floor coverings, remove by grinding any defects of sufficient magnitude to show through the floor coverings. Two troweling are required on exposed concrete floors.
 - .3 Tolerances: true plan within +/- 1/4" (Class B) of specified elevation. Compliance with the designated tolerances will be considered satisfactory if 90% of the measurements are less than or equal to the tolerances specified.
 - .4 Tolerances: true plan within 1/4" (Class B) of specified elevation. Compliance with the designated tolerances will be considered satisfactory if 90% of the measurements are less than or equal to the tolerances specified.
 - .5 Carefully slope floor surface to floor drains as indicated. Take special care to ensure a uniform, positive slope.

3.7 STAIRS AND LANDINGS

- .1 Finish stair and landings with a non-slip trowel finish.
- .2 Unless otherwise noted, install non-slip inserts, one per tread and landing.
- .3 Unless otherwise noted, seal stair and landing concrete surfaces.

3.8 CURING

- .1 Cure all concrete in accordance with the requirements of CAN/CSA-A23.1.
- .2 Curing methods and materials to be in accordance with the Contractor's Quality Plan.
- .3 Cure vertical surfaces by leaving forms in place or with curing compounds.
- .4 Cure concrete floor slabs using fabric kept continuously wet.
- .5 Moist cure liquid retaining structures for 14 days using weeping hoses, continuous ponding or other approved means.
- .6 Seal all floor areas and concrete toppings with two coats of an approved sealing compound. Preparation of surfaces, quantities used application procedures and installation precautions to be in strict compliance with manufacturer's stated recommendations and directions.

3.9 FORM GREASE REMOVAL

.1 All newly cast concrete to receive any proprietary waterproofing/sealing agent to be water blasted and/or prepared to manufacturer's requirements. Consult manufacturer's literature for requirements prior to applying any products to newly cast concrete.

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3.10 PATCHING

- .1 Remove all defective and honeycombed concrete down to sound concrete in accordance with the Quality Plan.
- .2 Patch with expanding grout and latex bonding agent in accordance with CAN/CSA-A23.1 to match adjacent surfaces.
- .3 Patch all cone tie holes with an approved non-metallic, non-shrink mortar except in exposed architectural concrete.
- .4 Install grey plastic set back plugs in cone tie holes of exposed concrete after removal.

3.11 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

- .1 Repair cracks in the completed structures in accordance with the Quality Plan, employing a suitable approved polyurethane injection technique to make such cracks completely watertight after repair.
- .2 Remove surface injections materials following completion of work and finish affected areas to match surrounding concrete.

3.12 GROUTING

- .1 Do all grouting around pipes, under equipment bases, under base plates, etc. as indicated in accordance with the manufacturer's instructions, with an approved non-metallic, non-shrink mortar.
- .2 In water retaining structures and below grade, use an approved expanding metallic grout for grouting around pipes, etc., passing through wall, etc.
- .3 Void under structural steel base plates to be completely filled with an approved non-shrink grout. Exercise extreme care to ensure that no voids are left under base plates and that full bearing of base plate on supporting concrete is attained.

3.13 SLABS-ON-GRADE

- .1 Prior to placing concrete, verify that subgrade has been compacted and accepted by Soils Consultant.
- .2 Unless otherwise indicated, divide interior slabs-on- grade into panels not exceeding 390 ft² in area of 20 ft. in length by means of keyed construction joints or saw cut control joints as detailed. Aspect ratio of panels shall not exceed 1:1.5 maximum. Saw cutting of joints shall be performed within 8 to 10 hours of placing, as soon as concrete has attained sufficient strength to resist ravelling and before any shrinkage cracks have appeared.
- .3 Fill all saw cut joints with an approved control joint sealant.
- .4 Unless noted otherwise place reinforcement or welded wire fabric mesh 2" below top surface of concrete slabs-on-grade. Support reinforcement or mesh on precast concrete chairs with embedded tie wires.

.5 Form keyed or dowelled construction joints any location where casting of slab must be interrupted. Provide 5/8" diameter by 36" long smooth steel rods at 16" centres across joint at mid-height. Grease or wrap rod to prevent bond on one side of joint.

3.14 EXTERIOR SLABS AND STAIRS

- .1 Brooms finish all exterior slabs and stairs. Seal with 2 coats approved sealer.
- .2 On exterior slabs-on-grade provide control joint pattern at 48" on centre each way unless otherwise detailed and install 1/2" pre-moulded joint filler every second joint.

3.15 EQUIPMENT BASES INERTIA SLABS

- .1 Carefully examine the architectural, mechanical, and electrical drawings, specifications and shop drawings for requirements. This work is not necessarily shown on structural drawings.
- .2 Layout of all concrete bases, curbs, pits, etc., for mechanical and electrical work to be responsibility of trades responsible for Work of those sections.
- .3 Unless otherwise indicated, bases shall rest on the concrete floor slab.
- Provide all reinforcing for bases, curbs, pits, etc. Set all anchor bolts, sleeves and other miscellaneous metal items which are required to be embedded or attached to concrete. Anchor bolts, sleeves and other miscellaneous metal items, including setting templates for same, shall be supplied by Contractors requiring same. Reinforcing for bases shall be 15M @ 12" each top and bottom plus 1-15M perimeter bar top and bottom, unless noted otherwise.
- .5 Finish exposed parts of the bases and curbs with cement mortar. Fill voids, trowel smooth, level edges and corners to provide a neat appearance to the Consultant's approval. Harden exposed faces of curbs and bases in accordance with the requirements of this Section.
- Provide grouting approximately 1" thick between equipment base plates and concrete. The space between base plates and concrete shall be completely filled with grout. Grout shall consist of non-shrinking type and be premixed. Clean surface of concrete and wet same prior to grouting. Do not remove levelling wedges before grout attains its final set. Fill voids left by removal of wedges with grout and finish exposed surface of grout to make neat appearance.

3.16 ALTERATIONS TO EXISTING CONCRETE

- .1 Remove existing concrete as designated via saw cutting or chipping. Where existing reinforcing is to be incorporated into new construction, removal shall be via chipping only.
- .2 Existing concrete surfaces to be roughened and existing reinforcing thoroughly cleaned prior to casting new concrete. Provide additional dowelled reinforcing as noted.
- .3 Apply approved bonding agent at interfaces between new and existing concrete.
- .4 Fill existing small openings with non-shrink concrete mortar as approved by Consultant.

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- .5 Seal joints between existing and new concrete construction by epoxy injection and other approved methods if necessary to attain water tightness.
- .6 Where new openings expose existing reinforcing apply migrating corrosion inhibitor to all cut surfaces. Apply non-sag cementitious patching mortar to uniform 25 mm thickness to provide a smooth finished surface.

3.17 **ANCHORING SYSTEMS**

.1 Contractor to have proprietary anchoring system manufacturer's representative on site for initial application of all proprietary anchoring systems.

3.18 WATERPROOFING OF EXPANSION JOINTS (NEW AND EXISTING)

Contractor to have representative of expansion joint manufacturer on site for initial installation of .1 expansion joint waterproofing systems to verify application.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Supply on-site supervision, labour, tools, equipment and all materials required to execute all work described in this section.

1.2 SCOPE OF WORK

- .1 Work in this section included cleaning of all existing masonry surfaces in contract area, new masonry and reinstalled existing masonry.
- .2 Cleaning of persistent stains or deposits. Stones shall be cleaned for purposes or removing stains and soiling without damaging the surface of the stone either physically or chemically.
- .3 Application of graffiti protection coating.
- .4 It is not the intention to have a surface cleaned to an original new appearance.

1.3 SUBMITTALS

.1 Provide data sheets of products and materials used on project for approval before work commences.

1.4 QUALITY ASSURANCE

- .1 Submit test results in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit three (3) copies of test results describing cleaning used for cleaning of each test patch.
- .3 Proceed with cleaning upon written approval by Consultant.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Do not use chemical cleaners when temperature is out of range described by manufacturer.
- .2 Provide shading to wall to avoid cleaning in full, hot, sunlight.
- .3 Do not clean if there is risk of chemical spray being blown onto publicly accessible areas.

1.6 EXISTING CONDITIONS

- .1 Report to Consultant conditions of deteriorated masonry or pointing found during cleaning.
- .2 Advise Consultant of potential cleaning problems.
- .3 Do not clean areas of deteriorated masonry without prior written approval of Consultant.

MASONRY CLEANING

1.7 SCHEDULING

- .1 Complete Work within approved schedule time. Do not change Schedule without written approval of Consultant.
- .2 Coordinate cleaning work schedule with other work on site.
- .3 Respect minimum curing of 28 days after repointing before general water cleaning work.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Use clean potable water free from contaminants.
- .2 Treat water that has high metal content before use in cleaning.
- .3 Use air free from oil or other contaminants.
- .4 Use masking material to approval of Consultant.
- .5 Use non-ionic surfactant (detergent) in concentration less than 2% by volume.
- .6 Use hydrofluoric acid (HF) based cleaner in concentration less than 5% by volume. Include Orthophosphoric acid 0.25% by volume.
- .7 Use ammonium hydroxide (ammonium) based cleaner for calcareous stone.
- .8 Use sodium hexametaphosphate (Calgon or NaHMP) to dissolve gypsum-bound soiling.
- .9 Use xylene to remove graffiti and other stains.
- .10 Use Fuller's Earth as poultice medium.
- .11 Use non-ferrous or plastic mesh as support mechanism for poultice.
- .12 Use glycerine as thickener to slow evaporation.
- .13 Use othophosphoric acid or oxalic acid and sodium slat of EDTA in poultice to treat iron stains.
- .14 Use ammonium hydroxide, chlorinated hydrocarbon solvent, non-ionic surfactant, water in poultices to remove grease stains.
- .15 Vapour permeable graffiti protection costing: Use FACEAL OLEO HD, by ECO-GRAFFITI (no equivalent approved).

2.2 TOOLS AND EQUIPMENT

- .1 Use only brushes with natural or soft plastic bristles.
- .2 Use only scrapers of wood or plastic.

- .3 Use water pumps fitted with accurate pressure regulators and gauges capable of being preset and locked at maximum specified levels.
 - .1 Water pumps to have rating of 500 psi.
- .4 Use air compressors equipped with on-line oil filters to avoid spraying oil onto masonry.
- .5 Use gun equipped with pressure gauge at nozzle end.
- .6 Use plastic or non-ferrous metal piping and fittings.
- .7 Use nozzles that give nebulized droplet spray. Use nozzles with 12 mm fan shape opening.

2.3 TESTS

- .1 Do mock-up tests in accordance with Section 01 45 00 Quality Control.
- .2 Conduct tests on building to determine effectiveness of low pressure wash cleaning methods.
- .3 Tests should start with the gentlest cleaning techniques, whose aggressiveness should be raised in increments until acceptable level of cleaning is reached which causes no damage to the masonry units or assembly. Conduct low pressure tests on decorative work.
- .4 Conduct tests to determine effectiveness of 50 to 500 psi water pressures to 15 litres/minute flow rates and 15 to 25°C water temperatures, fan type nozzles.
- .5 Test pressure at each storey height to determine effect of "line drop" on effectiveness of water jets.
- .6 Test brushing and spraying as alternative to pressure washing. Use successful tests.
 - .1 Do not use acid on limestone, calcareous sandstone or glazed surfaces.
 - .2 When using chemicals, masonry to be cleaned must be saturated with water throughout the application of the chemicals to prevent infiltration.
- .7 Add increasing amount of surfactant until cleaning can be done efficiently.
- .8 Areas to be test cleaned to include all types of masonry units.
- .9 Locate test patches in inconspicuous places directed by Consultant.
- .10 Test patches to be 2 m square.
- .11 Notify Consultant 48 hours before commencing cleaning of each test patch:
 - .1 Do not start without approval of Consultant.
- .12 Determine effect of cleaning operations on surrounding historic material and plants.
- .13 Stop work when cleaning has detrimental effect on surrounding material and plants.
- .14 Proceed after written instructions are received from Consultant.
- .15 Protect masonry openings from water/chemical infiltration during cleaning.
- .16 Collect, neutralize and dispose of water and chemicals in accordance with contract requirements, applicable regulations and Canadian Environmental Assessment Act (CEAA).

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Place safety devices and signs near work areas as indicated and directed.
- .2 Seal or repair openings and joints where there is potential risk of water/chemical infiltration.
- .3 Cover surfaces not to be cleaned.
- .4 Dry brush or scrape accumulations from walls, ledges and cornices.
- .5 Cover and protect surfaces and non-masonry finishes to be cleaned.
- .6 Prepare lime trenches to contain acids.

3.2 PROTECTION

- .1 Mask or seal vents, windows and other openings to prevent water entry.
- .2 Mask wood, glass and metal adjacent to masonry.
- .3 Protect plants, gardens, shrubs from watering and chemicals. Construct lime filled trenches to neutralize effects of acid cleaners.
- .4 Hang sheeting material from scaffolding to enclose water spray.
- .5 Ensure workers wear eye, head and face protection and protective gloves, coveralls, boots and filter mask to MSHA/NIOSH standard.
- .6 Protect cleaned surfaces to be painted from contact with rain and snow.
- .7 Protect rainwater leaders, eaves troughs and gutters from being blocked by residue.
- .8 Protect finished Work from damage until takeover.
- .9 Protect adjacent Work from spread of dust and dirt beyond work areas.
- .10 Protect operatives and other site personnel from hazards.

3.3 EXECUTION OF CLEANING

- .1 Low to Moderate Pressure Water Cleaning:
 - .1 Pre-wet masonry surface when necessary. Work form bottom of wall upwards.
 - .2 Remove dirt with moderate-high pressure 50 to 500 psi wash-down at flow rate of 15 L/minute.
 - .3 Use 12 mm fan shape opening nozzle and lower pressure on carved work.
 - .4 Avoid prolonged wetting and excessive water penetration.
 - .5 Use previously tested chemical cleaners only approved by Consultant. Follow manufacturer's recommended dwell time.

- .6 Do not exceed maximum pressure at nozzle or have nozzle closer to masonry than approved by Consultant at tests.
- .2 Use bushing and scraping only to supplement water washing.
- .3 Soften and loosen heavy deposits with prolonged water spray, then brush. Remove thick incrustations with wooden or plastic scrapers.
- .4 Use chemical cleaners approved by Consultant for stain and soil removal.
- .5 Apply poultices as approved by Consultant based on tests.

3.4 CLEAN-UP

- .1 Rinse off masonry until no indications of chemicals are present and to satisfaction of Consultant.
- .2 Rinse from bottom to top and from top to bottom.
- .3 Clean up work area as work progresses. At end of each work day remove debris and waste from site.
- .4 Upon completion, clean and restore areas used for work to condition equal to that previously existing.

3.5 GRAFFITI PROTECTION COATING

- .1 Ensure that surface to be protected by coating is perfectly clean. Coating can be applied on dry or moist (not damp) surfaces.
- .2 Apply two coats according to manufacturer's instructions.
- .3 Ensure that first coat is completely dry before applying second coat.
- .4 Maximum temperature (ambient and surface) for application is 5°C. Coating cannot be applied in rain or frost.
- .5 May be applied by airless spray, low pressure atomization or, for small areas, by brushing to saturation.
- Areas to be left untreated must be covered carefully and the tools and equipment cleaned before the product dries by rinsing well with water.
- .7 Surplus product on the surface must be fully removed in order to obtain optimum performance.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- .1 Removal and reinstallation of corner stone.
- .2 Removal of all obsolete elements and anchors: signage, steel anchors and nails, pipes, lights, speakers, wiring, plumbing valves, wood wedges and bumpers.
- .3 Repointing:
 - .1 Ponctual repointing of brickwork.
 - .2 General repointing of stonework:
 - .1 Limestone base;
 - .2 Sandstone first floor string course;
 - .3 Repointing of window sills.
- .4 Replacement of brick units with matching bricks taken from demolished side entrance as shown on plans.
- .5 Stone repair:
 - .1 Injection or Dutchman of cracked and/or fractured stone units;
 - .2 Remodeling and filling of damaged stone units.
- .6 Stone supply: the cost to supply Natural Limestone instead of Limestone, as described in Section 04 20 00 (Manufactured Concrete Stone) for all stonework as indicated on the drawings (coping for existing well, repair or replacement, new module for wall work and others) and this section are to be an option Add-on Price for the Work as described herein. The Add-on Price is to be for the difference in supplying Natural Limestone versus manufactured concrete stone imitation as per Section 04 20 10 Masonry Products.

1.2 REFERENCES

- .1 Definitions:
 - .1 Raking: removal of loose/deteriorated mortar to a depth suitable for repointing until sound mortar, and/or 4x joint thickness and/or a specified mm depth mm is reached.
 - .2 Repointing: filling and finishing of masonry joints from which mortar is missing, has been raked out, or has been omitted.
 - .3 Tooling: finishing of masonry joints using tool to provide final contour.
 - .4 Low-pressure water cleaning: water soaking of masonry using less than 350 kPa (50 psi) water pressure, measured at nozzle tip of hose.
 - .5 Repair of Stone: mechanical or plastic repair, done to restore original appearance and function of partly deteriorated stones.
 - .6 Filling: material used to rebuild broken or deteriorated part of stone.
 - .7 Adhesive: material used to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.
 - .8 Mortar: material used to re-bed the stone element being repaired and to repoint adjacent mortar joints.
 - .9 Dogs: metal appliance for securing parts or members together by means of one or more projecting teeth or bent portions, lug, clamp.
 - .10 Fabricator: company having sufficient capacity to guarry, cut and deliver stonework on schedule.

- .11 Mason: company or person specializing in commercial stonework with ten (10) years experience. Employ skilled stonemasons on site to do necessary field cutting as stones are set.
- .2 CSA International:
 - .1 CSA A-371-F04, Masonry Construction for Buildings.
 - .2 CAN/CSA A179-04 (R2009), Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A82-06, Fired Masonry Brick Made from Clay or Shale.
- .3 ASTM International:
 - .1 ASTM C 144-04, Standard Specification for Aggregate for Masonry Mortar.
 - .2 ASTM A 276-08a, Standard Specification for Stainless Steel Bars and Shapes.
 - .3 ASTM C 207-06, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .4 ASTM C 270-07a, Standard Specification for Mortar for Unit Masonry.
 - .5 ASTM C 1713, Standard Specification for Mortar for the Repair of Historic Masonry.
 - .6 ASTM C 568, Standard Specification for Limestone Dimension Stone.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Record Documentation:
 - .1 Provide marked up set of drawings to provide referencing system to identify location of stone repairs.
 - .2 Provide photographic record of dismantled and rebuilt stonework.
- .3 Data Sheets:
 - .1 Provide data sheets of materials used on project for approval before work commences.
 - .2 Provide data sheets for stone quarry specifications.
- .4 Samples:
 - .1 Provide labeled samples of materials used on project for approval before work commences.
 - .2 Submit samples of replacement stones before masonry work begins.
 - .1 Submit two of each type of masonry unit specified limestone.
 - .2 Submit two of each type of masonry accessory specified.
 - .3 Submit two of each type of masonry reinforcement and tie proposed for use.
 - .3 Submit samples of replacement stones form stone supplier:
 - .1 One sample: sized and dressed to match existing stone units.
 - .4 Provide mortar samples in quantity and size specified in CAN/CSA A179.
- .5 Test and Evaluation Reports:
 - .1 Provide certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Provide laboratory test reports certifying compliance of mortar ingredients with specification requirements.

1.4 QUALITY ASSURANCE

- .1 Masonry Contractor:
 - .1 Use single Masonry Contractor for historical masonry work.

- .2 Masonry contractor to have ten years experience minimum in historic masonry work on projects of similar size and complexity to Work of this Contract.
- .3 Masonry contractor to have good level of understanding of structural behaviour of masonry walls when masonry work involves replacing or repairing stones and brick that are part of the structural masonry work.

.2 Masons:

- .1 Mason to have certificate of qualification with 10 years minimum experience in historic masonry work
- .2 Masons to have proof of license certification for propriety restoration mortars.

.3 Mock-ups:

- .1 Construct mock-up 1 m x 1 m to demonstrate raking and repointing procedures for each type of exterior masonry material specified in locations designated by Consultant.
- .2 Construct minimum one mock-up of a representative sample of each type of repair specified, with specified materials and methods.
- .3 Construct mock-up where directed by Consultant.
- .4 Notify Consultant a minimum of 48 hours prior to construction of the mark-up.
- .5 Allow mock-ups of plastic repairs to cure at least three (3) days.
- .6 Obtain Consultant's approval for colour match.
- .7 Construct mock-ups under supervision of Consultant to demonstrate a full understanding of specified procedures, techniques and formulations is achieved before work commences.
- .8 Work not to proceed prior to approval of mock-up.
- .9 Accepted mock-up will demonstrate minimum standard for this work. Mock-up will remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Store cementitious materials and aggregates in accordance with CAN/CSA A23.1.
 - .3 Store lime putty in plastic lined sealed drums.
 - .4 Keep material dry. Protect from weather, freezing and contamination.
 - .5 Ensure that manufacturer's labels and seals are intact upon delivery.
 - .6 Remove rejected or contaminated material from site.
 - .7 Avoid storage of stone. Deliver stone units to site when ready to introduce into the work.
- .3 Store materials in a dry area, supported free of ground.

1.6 AMBIENT CONDITIONS

- .1 Maintain masonry temperature between 5 degrees C and 25 degrees C for duration of work.
- Maintain sand temperature between 10 degrees C and 30 degrees C. Do not mix cement with water or with aggregate or with water-aggregate mixtures having higher temperature than 30 degrees C. Maintain mortar mix temperature between 10 degrees C and 30 degrees C.

- .3 Maintain a minimum temperature of 10 degrees C during and 48 hours after repair, throughout thickness of stone. Allow materials to reach minimum temperature of 10 degrees C prior to use.
- Maintain temperature between 21 degrees C and 24 degrees C during repair and 48 hours after, throughout thickness of stone. Provide temporary enclosures to maintain specified temperatures. Remove work exposed to lower temperatures as directed by Consultant. Refer to manufacturer's instructions for environmental requirements of products.
- .5 Hot weather requirements:
 - .1 Shade stones form direct sunlight with temporary cover.

PART 2 - PRODUCTS

2.1 MORTAR

- .1 Bedding mortar for bearing walls and window well:
 - .1 KING 1-1-6, type N (or approved equal).
- .2 Pointing mortar for bearing walls:
 - .1 MASONCARE 300, Type 0 (or approved equal).

2.2 BRICK

- .1 Existing Brick:
 - .1 Use bricks from demolition.
 - .2 Use hard, sound and clean old bricks salvaged on site only with Consultant's approval. Use only bricks without evidence of soluble salts.
- .2 New Face Brick:
 - .1 If quantity of bricks from demolition is not sufficient, submit for Consultant's approval, replacement bricks to match existing.
 - .2 Burned clay bricks: to CAN/CSA A82.
 - .1 Type: A.
 - .2 Grade: Grade EG Exterior Grade.
 - .3 Compressive Strength: 1.
 - .4 Size: to match existing.
 - .5 Colour: blend of orange, red and brown to match existing.
 - .6 Texture: combed-face finish matching existing.
 - .7 Maximum 24 hour cold water absorption: 8%.
 - .8 Maximum Saturation Coefficients: 0.78.

2.3 STONE REPAIR

- .1 Filling Mix:
 - .1 Premixed Sandstone Restoration Mortar: RECONSTEC 250 SANDSTONE (or approved equal). Formulated to closely match colour, texture and physical properties of stone to be patched.

.2 Adhesive Mix:

- .1 Proprietary stone adhesive, specially formulated for repair of broken stone units: RECONSTEC 700 (or approved equal). Mix proportions as recommended by manufacturer to obtain specified results. Formulated to closely match colour, texture and physical properties of stone to be repaired.
 - .1 For cracks between 0.5 mm to 2 mm, use RECONSTEC 700F.
 - .2 For cracks between 2.5 mm to 5 mm, use RECONSTEC 700M.

2.4 STONE REPLACEMENT

- .1 Obtain new stone from a single quarry source acceptable to Consultant. Ensure single quarry source has resources to provide materials of consistent quality and matching existing stone.
- .2 St. Marc Limestone, St. Marc des Carrières, Quebec (or approved equivalent).
- .3 Limestone characteristics:
 - .1 Stratification: low, bedding plane to within 15% of the horizontal trim of work.
 - .2 Density: 2.6.
 - .3 Cold Water Absorption: 0.69.
 - .4 Hot Water Absorption: 0.72.
 - .5 Compression Strength: 101.8 MPa.

.4 Stone Fabrication:

- .1 Cut stone to shape and dimensions and full to square with joints as indicated.
 - .1 Dress exposed faces true.
 - .2 Cut stone for copings to lay on its natural quarry bed.
- .2 Cut-in reglets for flashings where indicated.
 - .1 Execute profiled work from full size details and templates.
 - .2 Make exposed rises in true alignment and ease slightly to prevent snipping.
- .3 Cut stones for anchors, clamps and dowels.
 - .1 Do not cut holes in exposed surfaces.
 - .2 Finish exposed faces and edges of stones to comply with requirements indicated for finish and to match approved samples and field-constructed mock-up.

.5 Fabrication Tolerances:

- .1 Fabricate limestone dimension stone to following tolerances:
 - .1 Unit Length: plus or minus 1.5 mm.
 - .2 Unit Height: plus or minus 1.5 mm.
 - .3 Deviation from Square: plus or minus 1.5 mm with measurement taken using the longest edge as the base.
 - .4 Bed Depth: plus or minus 1.5 mm.

.6 Accessories:

- .1 Obtain each type of stone necessary, sealant and other materials from a single manufacturer.
- .2 Anchors, clamps, dowels: stainless steel Type 304;
 - .1 Dimensions: 2 mm to 26 mm threaded, for punctual repair of stone (Dutchman).
 - .2 Dimensions: 2 mm to 6 mm threaded, for repair with restoration mortar.
- .3 Sealant and backer rod:
 - .1 Non-staining type, in accordance with Section 07 92 00 Joint Sealants.

PART 3 - EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

- .1 Check for evidence or repairs, cracks, moisture, soluble salts contamination and other defects not noted on Contract Drawings and report to Consultant before starting Work.
- .2 Masonry inspection to be done jointly by Mason and Consultant at beginning of work, from scaffoldings, in order to confirm the exact scope of work. Particularly:
 - .1 Sounding of bulge at window lintel (front façade);
 - .2 Sounding of masonry along downspouts and at building corners;
 - .3 Verify brick joint at metal cornice and window sills;
 - .4 Determine area of brick repointing;
 - .5 Verify brick work at chimney.
- .3 Report in writing to Consultant areas of deteriorated masonry not previously identified.
- .4 Stop work in that area and report to Consultant immediately if there is evidence of hazardous materials.

3.2 PROTECTION OF IN-PLACE CONDITIONS

.1 Protect adjacent plant material and fragile surfaces.

3.3 PREPARATION

- .1 Prior to dismantling of existing coping stone at window well, identify stone units (numbering) on a plan for Consultant's approval.
- .2 Obtain Consultant's approval for tools to be employed prior to commencing work.
- .3 Obtain Consultant's approval for alternative repair methodology and tools to be employed prior to commencing work.
- .4 Move and lift stone units using means to prevent damage. Submit stone units dropped or impacted to Consultant for inspection and approval. Do not make holes or indentations for lewissons or dogs on stone surfaces.

3.4 SPECIAL TECHNIQUES

- .1 Examine mortar joints.
 - .1 Examine horizontal and vertical joints to determine which were struck first and whether they are the same style, as well as aspects of workmanship that establish authenticity of original work.
 - .2 Replicate the style selected by the Consultant.
- .2 Test mortar joints.
 - .1 Procedure of testing: examine joints visually for obvious signs of deteriorated masonry.
 - .2 Test joints not visually deteriorated as follows:

- .1 Test for voids and weakness by using hammers or other approved means.
- .2 Perform testing in cooperation with Consultant so that unsound joints can be marked and recorded.
- .3 Marking of stones.
 - .1 Ensure that temporary marking will remain in use, resistant to weather, handling and cleaning until final marking of stones.
 - .2 Remove markings and adhesive without damaging units:
 - .1 Brush with vegetable fibre brush, either dry or with water.
 - .2 Do not use solvent.

3.5 RAKING JOINTS

- .1 Use manual raking tool to obtain clean masonry surfaces.
 - .1 Remove deteriorated and adhered mortar from masonry surfaces to full depth of deteriorated mortar but in no case less than 2x joint thickness leaving square corners and flat surface at back of cut.
 - .2 Clean out voids and cavities encountered.
- .2 Remove mortar without chipping, altering or damaging masonry units.
 - .1 Clean surfaces of joints by compressed air without damaging texture of exposed joints or masonry units.
 - .2 Flush open joints and voids; clean open joints and voids with low pressure water and if not free draining, blow clean with compressed air.
 - .3 Leave no standing water.

3.6 BRICK SALVAGE

.1 Carefully clean and store bricks for reuse. Store and protect bricks in accordance with Article 1.8, Delivery, Storage and Handling.

3.7 BRICK REPLACEMENT

- .1 Brick Replacement:
 - .1 Coordinate bond pattern, coursing height and joint width with existing brickwork in area selected by Consultant.
 - .2 Mix and blend brick units within each pallet and with other pallets to ensure uniform blend of colour and texture.
 - .3 Except in cold weather, pre-wet bricks having an initial rate of absorption exceeding 30 g/minute 194 cm² to uniform degree of saturation, 3 to 4 hours before laying. Do not lay until surface is dry or damp only, with no standing water.
 - .4 Clean dust and brick fragments from slot. Before proceeding with Work, inspect cleaned surface with Consultant.
 - .5 Dampen surface of slots before applying mortar.
 - .6 Apply mortar and lay bricks. Lay bricks on full beds of mortar.
 - .7 Fill vertical joints buttered and placed full in face and back-up bricks and at vertical joint between wythes.
 - .8 Lay bricks and tool joints in one operation, tooling with a round jointer to provide smooth joints

- compressed uniformly concave.
- .9 Rake bedding mortar back to a minimum depth of 25 mm and make ready for pointing with pointing mortar in separate operation.
- .10 Provide minimum three (3) day damp cure to bedding mortar prior to pointing.
- .2 Apply pointing mortar:
 - .1 Fill raked joints with pointing mortar by layer.
- .3 Finish joints for brickwork:
 - .1 To match existing racked joints (dimensions $\frac{1}{2}$ x $\frac{1}{2}$). Colour to match existing.
- .4 Keep new mortar damp for three (3) days at a minimum temperature of 5°C.
 - .1 Clean finished brickwork as work progresses.
 - .2 Remove mortar splashing on exposed brickwork.
 - .3 Leave no mortar on face of bricks.
- .5 Remove mortar staining before it sets.
 - .1 Clean masonry with clean water and soft bristle brush only.
- .6 Inspect finished brickwork with Consultant.

3.8 REPAIR OF A FRACTURED STONE

- .1 Remove deteriorated portions of stone using low impact removal methods until sound surface is reached. Removal method to be approved by Consultant.
- .2 Rake out mortar joints of stones as indicated on Contract Drawings.
- .3 Remove elements that require minor repair. Do not damage existing Work.
- Drill holes suitable to size of broken stones, in each section at fracture. Fractures over 300 mm in length require additional dowels per 200 mm length of fracture.
- .5 For new stone inserts of undetermined size and weight:
 - .1 Determine diameter and length of dowels based on size and weight of new stone insert.
 - .2 Drill holes of diameter and depth as determined by dowel size.
- .6 Alight holes on each side of fracture.
 - .1 Use minimum two dowels per fracture.
 - .2 Cut dowels slightly shorter than full depth of hole. Minimum depth of holes to be 25 mm.
- .7 Ensure humidity, temperature, cleanliness and finish condition of stone is in accordance with epoxy resin manufacturer's instructions.
- .8 Reinstate consolidated element into work and repoint using specified bedding and pointing mortars. Joint profiles to match existing.

3.9 REFACING PARTLY DETERIORATED STONE WITH FILLING

.1 Remove dust from cavity and wet surfaces.

- .2 Undercut sound existing stone to provide keyed edge by drilling. Roughen stone surfaces to provide keys in back of cavity.
- .3 Install specified metal wire mesh, bars or stirrups as indicated.
- .4 Drill groves into sound stone, insert tiles and apply specified adhesive as directed by Consultant.
- .5 Use wood float and avoid excessive trowelling to prevent crazing.
- .6 Clean filling mortar residue from area surrounding patch. Sponge as many times as necessary with clean water. Do this before patching material sets.
- .7 Remove laitance with stiff, near-dry fibre brush.
- .8 Form mortar to match profile of surrounding stone.
- .9 Finish patch to match adjacent stone surface.
- .10 Cover repairs with damp cloths. Keep covering moist during curing period. Occasionally spray covering with water for several days.
- .11 Repoint with specified mortar. Joints to match existing.

3.10 STONE SUPPLY AND INSTALLATION

- .1 Cutting and Sizing of Stone:
 - .1 Coping Stones:
 - .1 Provide 1:10 slope on top face of stone unit, sloping down to both faces.
- .2 Moving Stones:
 - .1 Use nylon belt to lift stones to working level.
 - .2 Move stones horizontally in wheelbarrows, on carts or on sleds.
 - .3 Slide stones into place.
 - .4 Protect edges of stone from damage when hoisting and lifting from position. Use wood shims to isolate units from hoisting belts.
 - .5 Incorporate only damaged stone in Work.
- .3 Stone Replacement:
 - .1 Coordinate bond pattern, coursing height and joint width with existing brickwork in area selected by Consultant.
 - .2 Clean dust and stone fragments from slot. Before proceeding with Work, inspect cleaned surface with Consultant.
 - .3 Dampen surface of slots before applying mortar.
 - .4 Apply mortar and lay stones.
 - .1 Lay stones on full beds of mortar.
 - .2 Fill vertical joints buttered and placed full in face and at vertical joint between wythes.
 - .3 Lay stones and tool joints in one operation, tooling with a round jointer to provide smooth joints compressed uniformly concave.
 - .4 Rake bedding mortar back to a minimum depth of 50 mm and make ready for pointing with pointing mortar in separate operation.
 - .5 Provide minimum three (3) day damp cure to bedding mortar prior to pointing.

- .5 Apply pointing mortar.
 - .1 Fill raked joints with pointing mortar by layer.
- .6 Finish joints for stonework: concave.
 - .1 Colour: to match existing.
- .7 Keep new mortar damp for four (4) days at a minimum temperature of 5°C.
- .8 Clean finished stonework as work progresses.
 - .1 Remove mortar splashing on exposed stonework.
 - .2 Leave no mortar on face of bricks.
- .9 Remove mortar staining before it sets.
- .10 Clean masonry with clean water and soft bristle brush only.
- .11 Inspect finished work with Consultant.
- .4 Inserting Replacement Stone:
 - .1 Clean stone by washing with water and natural fibre brush before laying.
 - .2 Dampen surfaces of slot and apply bedding mortar.
 - .3 Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.
 - .4 Prop and anchor projecting stones until wall above is set.
 - .5 Set large stones on water soaked softwood wedges to support stone in proper alignment until mortar has set. Remove wedges when dry. Do not break off.
 - .6 Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.
 - .7 Install anchors, dowels and cramps. Use non-corrosive anchors to fix stone faceplates.
 - .8 Set stones to match alignment of adjacent stones in full bed of mortar with vertical joints buttered and placed full except where otherwise specified. Completely fill anchor, dowel and lifting holes and voids left by removed edges.

3.11 REPOINTING

- .1 Mixing of the first mortar batch to be prepared with the manufacturer's representative and the Consultant in attendance in order to obtain their approval to begin the work.
- .2 Dampen joints and porous masonry units.
- .3 Keep masonry damp while pointing is being performed.
- .4 Completely fill joint with mortar. If surface of masonry units has worn, rounded edges, keep pointing back from surface to keep same width of joint. Avoid feathered edges. Pack mortar solidly into voids and joints.
- .5 Build up pointing in layers not exceeding 12 mm in depth.
- .6 Allow each layer to set before applying subsequent layers. Maintain joint width.
- .7 Finish joints to match original profile. Tool, compact and finish using jointing tool or mason's slick to force mortar into joint.
- .8 Remove excess mortar from masonry face before it sets.

3.12 PROTECTION DURING CURING PROCESS

- .1 Cover completed and partially completed work not enclosed or sheltered at end of each work day. Membrane should extend to 0.5 mover surface area of work and be tightly installed to prevent finished work from drying out too rapidly.
- .2 Cover with waterproof tarps to prevent weather from eroding recently repointed material.
 - .1 Maintain tarps in place for minimum of two (2) weeks after repointing.
 - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- .3 Anchor coverings securely in position.
- .4 Damp cure:
 - .1 Provide damp cure for pointing mortars.
 - .1 Install and maintain wetted burlap protection during the curing process for a minimum of four (4) days.
 - .2 Wet mist burlap only. Ensure no direct spray reaches surface of curing mortar.
 - .3 Shade areas of work form direct sunlight and maintain constant dampness of burlap.
- .5 Protect from drying winds. Pay particular attention at corners of structure.
- .6 Maintain ambient temperature of minimum 5°C after repointing masonry for:
 - .1 Minimum seven (7) days in summer.
 - .2 Minimum thirty (30) days in cold weather conditions using dry heated enclosures.

3.13 PROTECTION OF WORK

- .1 Protect adjacent work from marking or damage due to work. Protect adjacent finished work against damage that may be caused by ongoing work.
- .2 Prevent damage to stone surfaces and mortar joints that are to remain. Make good damage incurred.
- .3 Protect surrounding components from damage during work. Take utmost care not to damage historic fabric. Make good damage incurred. Obtain Consultant's approval for repair methodology.

3.14 CLEANING

- .1 Clean in accordance with Section 01 74 11 Cleaning.
- .2 Clean in accordance with Section 04 03 06 Masonry Cleaning.
- .3 Clean surfaces of mortar droppings, stains and other blemishes resulting from work of the contract as work progresses.
- .4 Clean masonry work surfaces after repairs have been completed and mortar has set. Clean brick surfaces of adhesive or mortar residue resulting from work performed without damaging masonry units or joints.
- .5 Remove droppings and splashings using clean sponge and water. Do further cleaning using stiff natural bristle brushes after mortar has attained its initial set and has not fully cured.

- .6 Obtain Consultant's approval of cleaning operations before starting cleaning work.
- .7 Protect vegetation and adjacent grounds from excessive water accumulation. Clean stone work surfaces after repairs have been completed and mortar has set.
- .8 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International):
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA A179-14, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A371-14, Masonry Construction for Buildings.
 - .4 CSA S304.1-14, Design of Masonry Structures.
 - .5 CSA-A3000-13, Cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014), Update No. 3 (2014).
- .2 International Masonry Industry All-Weather Council (IMIAC):
 - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- .3 South Coast Air Quality Management District (SCAQMD):
 - .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit copy of manufacturer's instructions, printed product literature and data sheets for masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit copy of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29 Health and Safety Requirements and Section 01 35 43 Environmental Procedures. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 Common Work Results for Masonry supplemented as follows:
 - .1 Submit laboratory test reports in accordance with Section 01 45 00 Quality Control: Tests and Mix Designs.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect masonry mortar and grout from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
 - .1 Refer to Section 04 05 00 Common Work Results For Masonry, Item 1.9 Site Conditions.
- Weather Requirements: CAN/CSA A371 International Masonry Industry All-Weather Council (IMIAC)
 Recommended Practices and Guide Specifications for Hot and Cold Weather Masonry
 Construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Mortar and Grout: to CAN/CSA A179.
- .3 Aggregate: supplied by one supplier, passing 1/16" sieve where 1/4" thick joints are indicated.
- .4 Mortar for interior/exterior masonry above grade:
 - .1 Loadbearing: Type S based on Proportion specifications for job prepared mortar/grout and Property specification for batch plant mortar/grout.
 - .2 Non-Loadbearing: Type S based on Proportion specifications for job prepared mortar/grout and Property specification for batch plant mortar/grout.
 - .3 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type M based on Proportion specifications for job prepared mortar/grout and Property specification for batch plant mortar/grout.
 - .4 Parapet walls: Type S based on Property specifications.
 - .5 Existing historic clay brick masonry: Non-cement base Type N to match existing mortar strength.
- .5 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for calcium silicate brick and concrete brick: Type O based on Proportion specifications.
 - .2 Mortar for stonework and stone veneer: Type N based on Proportion specifications.
 - .3 Mortar for grouted reinforced masonry: Type S based on Proportion specifications, 12.5 MPa.
 - .4 Mortar for pointing: Type N based on Proportion specifications.

- .6 Coloured mortar: use colouring admixture not exceeding 10% of cement content by mass or integrally coloured masonry cement, to produce coloured mortar to match approved sample.
 - .1 Manufacturer: Solomon Colours, Mississauga, Ontario, Contact John Ciente at Phone 647-224-4461, E-Mail jciente@solomoncolors.com, Web Site www.solomoncolors.com.
 - .2 Mortar pigments: SGS Concentrated A, H, and X Series Mortar Colours.
 - .1 Colour: As later selected by Consultant from manufacturer's complete colour range.
 - .2 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
 - .3 Material: Natural and synthetic, milled, blended iron oxides.
 - .4 Carbon added for darker colours shall not exceed 4 percent.
 - .5 Produce uniform and consistent colour.
 - .6 Inert, stable to atmospheric conditions, sunfast, weather resistant, alkali resistant, water insoluble, lime proof, and nonbleeding.
 - .7 Free of deleterious fillers and extenders.
 - .8 Particle Size: 95 to 99 percent minus 325 mesh.
 - .9 pH: 6.5 to 9.0.
 - .10 Compliance: ASTM C 979.
 - .11 Tests: ASTM C 91 and ASTM C 270. Exceed 1,800 psi (12.4 kPa) at 28 days strength requirement.
- .7 Non-Staining Mortar: use non-staining masonry cement for cementitious portion of specified mortar type.
- .8 Parging Mortar: Type N to CSA A179.
- .9 Water: clean and potable.
- .10 Lime:
 - .1 Hydrated Lime: to CAN/CSA A179, Type S.
- .11 Bonding Agent: epoxy type.
- .12 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 MORTAR MIXES

- .1 Pointing Mortar: Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour or more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
- .2 Stain Resistant Pointing Mortar: one part Portland cement, ¹/⁸ part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate to 2 percent of Portland cement by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry installation in accordance with manufacturer's written

instructions.

- .1 Visually inspect substrate in presence of Consultant.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 PREPARATION

- .1 Apply bonding agent to existing concrete surfaces.
- .2 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.4 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CAN/CSA A179 except where specified otherwise.
- .2 Apply parging in uniform coating not less than total 3/8" thick to exposed concrete, piers, walls, foundation walls, light standards and where indicated.

3.5 MIXING

- .1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand must be pre-approved by the Consultant.
- .2 Clean all mixing boards and mechanical mixing machine between batches.
- .3 Mortar must be weaker than the units it is binding.
- .4 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.6 MORTAR PLACEMENT

- .1 Install mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA A179.
- .3 Install mortar and grout to requirements of Section 04 05 00 Common Work Results for Masonry.

.4 Remove excess mortar from grout spaces.

3.7 GROUT PLACEMENT

- .1 Install grout in accordance with manufacturer's instructions.
- .2 Install grout in accordance with CAN/CSA A179.
- .3 Work grout into masonry cores and cavities to eliminate voids.
- .4 Do not install grout in lifts greater than 16", without consolidating grout by rodding.
- .5 Do not displace reinforcement while placing grout.

3.8 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 Common Work Results for Masonry supplemented as follows:
 - .1 Test and evaluate mortar prior to construction and during construction in accordance with CAN/CSA A179.
 - .2 Test and evaluate grout prior to construction and during construction to CAN/CSA A179; test in conjunction with masonry unit sections specified.
- .2 Manufacturer's Field Services: in accordance with Section 04 05 00 Common Work Results for Masonry.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

3.10 PROTECTION OF COMPLETED WORK

.1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International Inc.:
 - .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - .4 ASTM A580/A580M-15, Standard Specification for Stainless Steel Wire.
 - .5 ASTM A641/A641M-09a (2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .6 ASTM-A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- .2 Canadian Standards Association (CSA International):
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.
 - .3 CSA-A370-14, Connectors for Masonry.
 - .4 CAN/CSA A371-14, Masonry Construction for Buildings.
 - .5 CSA G30.18-[09] (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .6 CSA-S304.1-14, Design of Masonry Structures.
 - .7 CSA W186-M 1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC):
 - .1 Reinforcing Steel Manual of Standard Practice, 2004.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
 - .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for anchorage and reinforcing materials and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit copy of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29 - Health and Safety Requirements.
 - .2 Shop Drawings:
 - .1 Submit shop drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate horizontal and vertical spacing of cavity wall reinforcement and ties to suit application and wind load conditions.
 - .3 Submit shop drawings detailing bar bending details, anchorage details lists and placing drawings
 - .4 On placement drawings, indicate sizes, spacing, location, and quantities of reinforcement and connectors.
 - .3 Manufacturer's Instructions:
 - .1 Provide manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 Common Work Results for Masonry.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions, and manufacturer's warranty requirements. Comply with Section 04 05 00 Common Work Results for Masonry.

.4 Mock-ups:

- .1 Construct mock-ups in accordance with Section 01 45 00 Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry supplemented as follows:
 - .1 Construct mock-ups panel of anchorage installation.
 - .2 Sample panel: 10' x 10' using proposed procedures, anchorage material, connectors, reinforcement material, and workmanship.

1.4 FIELD MEASUREMENTS

.1 Make field measurements necessary to ensure proper fit of members.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle masonry anchorage and reinforcing materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect anchorage and reinforcing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - GENERAL

2.1 MATERIALS

- .1 Bar Reinforcement: Steel to CAN/CSA A371 and CAN/CSA G30.18, Grade 400.
- .2 Wire Reinforcement: to CSA-A371 and CSA G30.14, ladder type.
- .3 Connectors: to CAN/CSA A370 and CSA-S304.

- .4 Finish Schedule: Provide minimum level of corrosion protection for masonry connectors and horizontal reinforcing as outlined in CSA A370 and as follows:
 - .1 Interior Masonry (not subjected to moisture) unprotected carbon steel or with minimal zinc coating (mill galvanized).
 - .2 Interior Masonry (subject to moisture), below grade masonry (in contact with the ground), and above grade exterior masonry in buildings less than 42' in height (measured from the floor level of the first storey) hot dipped zinc galvanized after fabrication with minimum zinc coating in accordance to ASTM A153/A153M Class B wire ties/reinforcing 458 g/sq.m. and ASTM A123/A123M plates/strips/sheets 610 g/sq.m. (on each face).
- .5 Horizontal reinforcement for interior wall/ partitions: Refer to typical details on structural drawings.
- .6 Cavity wall reinforcement and ties:
 - .1 Type 1:
 - .1 3/16" diameter hot dip galvanized steel wire U-shaped ties, length to suit application, used in combination, with continuous hot dip galvanized steel ladder back-up reinforcing.
 - .2 Place horizontal reinforcement ties at minimum spacing of 16" o/c centered on metal studs and 16" o/c) vertically.
 - .1 Acceptable product: 'Double Adjustable Tie (D.A.T.) Wedge-Lok' and 'Adjustable Econo-Cavity-Lok Blok-Trus II', by Blok-Lok / Hohmann & Barnard Inc., Blok-Trus, or 'Fero Block Shear Connector c/w V-Tie and Insulation Support', by Fero, or approved alternate.
 - .2 Type 2:
 - .1 Dual-diameter barrel single screw veneer tie for attachment to metal stud construction complete with:
 - .1 Factory-installed EPDM washers to seal to face of insulation and air / vapor barrier.
 - .2 Thermal wings to create thermal break from steel, encapsulated in flame resistant plastic.
 - .3 Adjustable 2X-hook to orient pintles/hooks parallel to masonry joints.
 - .4 Length to suit application.
 - .2 Place horizontal reinforcement ties at minimum spacing of 16" o/c centered on metal studs and 16" o/c) vertically.
 - .3 Acceptable product:
 - .1 '2-Seal Thermal Wing Nut Anchor' by Blok-Lok /Hohmann & Barnard Inc., or approved alternate.
- .7 Acceptable Product: Blok-Lok 'BL-407' Blok-Lok / Hohmann & Barnard Inc., or approved alternate. Provide prefabricated assemblies for reinforcement at corners and intersections.
- .8 Anchors and Ties:
 - .1 Masonry to structural steel:
 - .1 Refer to Section 05 12 00 Structural Steel for masonry strap anchors and strap anchor connectors, unless otherwise indicated.
 - .2 For locations where masonry strap anchors cannot be provided provide veneer anchor system from flexible, triangular 3/16" ties, length to suit wall condition, and adjustable weldon or mechanical fastened column anchor straps from hot rolled flat bar sized to suit application.
 - .1 Acceptable material: 'Flex-O-Lok BLT9' and 'Flex-O-Lok Anchors', by Blok-Lok, or 'Cat-Tie System', by Fero, or equivalent by Hohmann & Barnard Inc., or approved alternate.
- .9 Corrosion Protection: as a minimum to CSA-S304.1, galvanized and CAN/CSA A370.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario, Canada.
- .2 Fabricate connectors in accordance with CAN/CSA A370.
- .3 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Consultant with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis.
- .2 Upon request inform Consultant of proposed source of material to be supplied.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage and reinforcing materials installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.3 PREPARATION

.1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

3.4 INSTALLATION

.1 Supply and install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371, CSA A23.1/A23.2 and CSA S304.1 unless indicated otherwise.

- .2 Prior to placing mortar grout, obtain Consultant's approval of placement of reinforcement and connectors.
- .3 Supply and install additional reinforcement to masonry as indicated.

3.5 BONDING AND TYING

- .1 Bond walls of two or more wythes using metal connectors in accordance with CSA-S304, CSA-A371 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CSA-A371 and as indicated.

3.6 VERTICAL/HORIZONTAL REINFORCING

- .1 Vertical reinforcing to be one piece from top of floor to underside of floor above. Reinforcing to be visible prior to grouting wall. Use suitable dowels between floors.
- .2 Where vertical reinforcement must be spliced between floors, follow a construction procedure that ensures specified lap lengths. Procedure to be approved by Consultant.
- .3 Where low-lift grouting is necessary and approved by the Consultant, comply with the height limitations of CSA A370, while ensuring specified lap lengths.
- .4 Notch bond beam blocks each side of openings if vertical jamb passes through lintel bearing.
- .5 Unless noted otherwise, install heavy duty ladder truss type horizontal joint reinforcement in all walls at 16" centres.
- .6 Unless noted otherwise, install full height vertical bar in grouted cores on both sides of all openings. Refer to Drawing for bar sizes.

3.7 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA-S304.1, CAN/CSA A371, and CAN/CSA A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA A371.
- .4 A "bond beam" course is to be formed from standard stretcher and pier blocks, with webs notched to receive the horizontal reinforcing or from purpose-made blocks over web knock-outs. Reinforcing to have 3/4" clear cover to top of masonry unit.
- .5 See Drawing S05 for standard bond beam reinforcing.
- .6 Bond beam reinforcing to be continuous unless noted otherwise.
- .7 Unless otherwise detailed, the first course above an opening greater than 16" in a concrete block wall is to be formed from "bond beam" blocks with a solid bottom. Horizontal reinforcement is to be placed in the middle of the block.

.8 Reinforcing to be continuous over the opening and to extend 8" each side, unless noted otherwise.

3.8 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CAN/CSA A371 and CAN/CSA A179 and as indicated.

3.9 ANCHORS

.1 Supply and install metal anchors in accordance with CAN/CSA A370 and CAN/CSA A371.

3.10 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.11 MOVEMENT JOINTS

.1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.12 FIELD BENDING

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars and connectors which develop cracks or splits.

3.13 FIELD QUALITY CONTROL

- .1 Site inspections in accordance with Section 04 05 00 Common Work Results for Masonry.
- .2 Obtain Consultant approval of placement of reinforcement and connectors, prior to placing mortar and grout.

3.14 FIELD TOUCH-UP

.1 Touch-up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.15 CLEANING

- .1 Clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.

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.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

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PART 1- GENERAL

1.1 REFERENCES

- .1 ASTM International Inc.:
 - .1 ASTM D 2240-05 (2010), Standard Test Method for Rubber Property Durometer Hardness.
- .2 Canadian Standards Association (CSA International):
 - .1 CAN/CSA A371-14, Masonry Construction for Buildings.
 - .2 CSA S304.1-14, Design of Masonry Structures.
- .3 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD):
 - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .2 Shop drawings to consist of flashing and installation details. Indicate sizes, spacing, location, and quantities of fasteners.

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 Common Work Results for Masonry.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 FIELD MEASUREMENTS

.1 Make field measurements necessary to ensure proper fit of members.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect masonry accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Control joint filler: closed cell neoprene sponge with tear strip, purpose-made for horizontal and vertical applications conforming to ASTM D1056, size and shape to suit application.
 - .1 Acceptable material: 'NS Neoprene Sponge', by Blok-Lok or approved alternate.
- .2 Lap adhesive: recommended by masonry flashing manufacturer.
- .3 Weep hole vents: Polyester compressible mesh sized to suit masonry unit and mortar joint, colour to match mortar or as approved by Consultant.
 - .1 Acceptable material: 'Weep Vent', by Mortar Net Solutions, or approved alternate.
- .4 Premanufactured Drip Plates: 3" wide smooth, factory-formed with 45° hemmed edge, complete with inside outside corners, Type 316 stainless steel finish.
 - .1 Acceptable product: 'Drip Plate by Blok-Lok / Hohmann & Barnard Inc., or approved alternate.
- .5 Mechanical Fasteners: Refer to Section 04 05 19 Masonry Anchorage and Reinforcing.

2.2 MOISTURE CONTROL

- .1 Weep Hole Protector:
 - .1 Pre-manufactured high density nylon or polyethylene open mesh, 10" high, thickness to suit cavity.
 - .1 Acceptable material: 'Mortar Net' by Mortar Net Ltd. or approved equivalent.
- .2 Grout Screens: 1/4" square monofilament screen fabricated from high-strength, non-corrosive polypropylene polymers to isolate flow of grout in designated areas.
 - .1 Size: to suit application.
 - .2 Acceptable material: '#MGS Mortar/Grout Screen' by Hohmann & Barnard, Inc., or approved alternate.

2.3 FLASHINGS

- .1 Flashings: Refer to Section 07 27 00.01 Air/Vapour Barriers.
- .2 Prefinished Metal Flashings: Refer to Section 07 62 00 Sheet Metal Flashing and Trim.

.3 Aluminum Flashings: Refer to Section 07 62 00 – Sheet Metal Flashing and Trim.

PART 3 - EXECUTION

3.1 **APPLICATION**

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

EXAMINATION 3.2

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant.

INSTALLATION: MATERIALS 3.3

- .1 Install continuous movement joint fillers in movement joints at locations indicated on drawings.
- .2 Lap adhesive: apply adhesive to flashing lap joints.
- .3 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.
- .4 Reglets: install reglets at locations indicated on drawings.

INSTALLATION: MOISTURE CONTROL 3.4

- .1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 24" on centre.
- .2 Weep hole protector: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.
- .3 Grout Screens: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.

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3.5 INSTALLATION: FLASHINGS

- .1 Build in flashings in masonry in accordance with CAN/CSA A371.
 - .1 Install drip plates and flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity is interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.
 - .2 In cavity walls and veneered walls, carry flashings over horizontal face of drip plates of exterior masonry, under outer wythe, then up backing not less than 6", and as follows:
 - .1 For masonry backing embed or bond flashing 1" in joint.
 - .2 For concrete backing, insert or bond flashing into reglets.
 - .3 For wood frame backing, staple flashing to walls behind water resistive paper, and lap joints 6" minimum.
 - .4 For gypsum board and glass fibre faced sheathing backing, bond to wall using manufacturer's recommended adhesive.
 - .5 Lap joints 6" and seal with adhesive.
- .2 Form flashing (end dams) at lintels, sills, and wall ends to prevent water from travelling horizontally past flashing ends.
- .3 Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall.

3.6 CLEANING

- .1 Clean in accordance with Section 01 74 11 Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International Inc.:
 - .1 ASTM E 336-14, Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.
- .2 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-A165 Series-14, CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.
 - .2 CAN/CSA A371-14 (R2009), Masonry Construction for Buildings.
 - .3 CSA S304.1-14, Design of Masonry Structures.
- .3 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for concrete masonry units and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit unit samples in accordance with Section 04 05 00 Common Work Results for Masonry.

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties and in accordance with Section 04 05 00 Common Work Results for Masonry. Test and Evaluation Reports: provide certified test reports in accordance with Section 04 05 00 Common Work Results for Masonry.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting in accordance with Section 04 05 00 Common Work Results for Masonry to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Offload concrete unit masonry packages using equipment that will not damage the surfaces.
 - .2 Do not use brick tongs to move or handle masonry.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Do not double stack cubes of concrete unit masonry.
 - .3 Cover masonry units with non-staining waterproof membrane covering.
 - .4 Allow air circulation around units.
 - .5 Installation of wet or stained masonry units is prohibited.
 - .6 Keep concrete unit masonry in individual cardboard packaging provided by manufacturer until units are ready to be installed.
 - .7 Store and protect concrete unit masonry from nicks, scratches, and blemishes.
 - .8 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).
 - .1 Classification: H/15/A/M.
 - .2 Size: metric modular as indicated.
 - .3 Special shapes: Provide bull-nosed units at all exposed corners, sills, and tops of walls. Provide purpose-made shapes for lintels, beams, and bond beams. Provide additional special shapes as indicated.
- .2 6" concrete block at Gymnasium.
 - .1 Classification: H/20/A/M for hollow units and S/20/A/M for solid unit.
 - .2 Size: metric modular as indicated.
 - .3 Special shapes: Provide bull-nosed units at all exposed corners, sills, and tops of walls. Provide purpose-made shapes for lintels, beams, and bond beams. Provide additional special shapes as indicated.

2.2 REINFORCEMENT

.1 Reinforcement in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.3 CONNECTORS

.1 Connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.4 FLASHING

.1 Flashing: in accordance with Section 04 05 23 - Masonry Accessories.

2.5 MORTAR MIXES

.1 Mortar and mortar mixes in accordance with Section 04 05 12 - Masonry Mortar and Grout.

2.6 GROUT MIXES

.1 Grout and grout mixes in accordance with Section 04 05 12 - Masonry Mortar and Grout.

2.7 CLEANING COMPOUNDS

- .1 Use low VOC products in compliance with SCAQMD Rule 1168.
- .2 Compatible with substrate and acceptable to masonry manufacturer for use on products.
- .3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.8 TOLERANCES

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation between units within specific job lot not to exceed 0.087".
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 0.087".
 - .3 Out of square tolerance not to exceed 0.087".
- .2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 0.087".
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 0.087".
 - .3 Out of square tolerance not to exceed 0.087".
 - .4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 0.087".

2.9 EXPOSED FACES

.1 Exposed Faces: Uniform texture, free of imperfections, indentations, and surface cracks impairing finish or appearance.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for concrete unit masonry installation in accordance with manufacturer's

written instructions.

- .1 Visually inspect substrate in presence of Consultant.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.
- .2 Commencing installation means acceptance of existing substrates.

3.2 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

- .1 Concrete block units:
 - .1 Bond: running.
 - .2 Coursing height: 7.87" for one block and one joint.
 - .3 Jointing: concave to all interior locations from floor level to one course above ceiling height and to underside of deck in exposed structure locations.

.2 Special Shapes:

- .1 Install bullnose block to the following locations unless otherwise indicated:
 - .1 All exposed interior wall corners, including interior face of exposed exterior wall corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
 - .2 All exposed partial height wall caps.
 - .3 Window sills.
 - .4 Exposed concrete block at window and door jambs exceeding 4" in depth.
- .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
- .3 End bearing: not less than 8" as indicated on drawings.
- .4 Install special site cut shaped units.

3.4 REINFORCEMENT

.1 Install reinforcing in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.5 CONNECTORS

.1 Install connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.6 FLASHING

.1 Install flashings: in accordance with Section 04 05 23 - Masonry Accessories.

3.7 MORTAR PLACEMENT

.1 Place mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

3.8 GROUT PLACEMENT

.1 Place grout in accordance with Section 04 05 12 - Masonry Mortar and Grout.

3.9 CONSTRUCTION

- .1 Cull out masonry units, in accordance with CAN/CSA A165 and approved range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.
- .2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves, and conduits.
- .3 Construct masonry walls using running bond unless otherwise noted.
- .4 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .5 Fit masonry closely against electrical and plumbing outlets so collars, plates, and covers overlap and conceal cuts.
- .6 Install movement joints and keep free of mortar where indicated.
- .7 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .8 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.
- .9 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .10 Tamp units firmly into place.
- .11 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean, and reset units in new mortar.
- .12 Tool joints concave to all interior locations from floor level to one course above ceiling height and to underside of deck in exposed structure locations.
- .13 After mortar has achieved initial set up, tool joints.
- .14 Do not interrupt bond below or above openings.

3.10 REPAIR/RESTORATION

.1 Upon completion of masonry, fill holes and cracks, remove loose mortar, and repair defective work.

.2 For surfaces to receive air/vapour barrier membranes, ensure substrates are smooth, sound, and free of voids, spalled areas, and loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone, and debris. Use repair materials and methods that are acceptable to air/vapour barrier membrane manufacturer.

3.11 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 Common Work Results for Masonry supplemented as follows:
 - .1 Concrete masonry units will be sampled and tested by independent testing agency appointed by Consultant and paid by Consultant under Section 01 21 00 Allowances in accordance with CSA S304.1.
 - .2 Notify inspection agency minimum of 48 hours in advance of requirement for tests.

3.12 CLEANING

- .1 Clean in accordance with Section 01 74 11 Cleaning, supplemented as follows.
 - .1 Progress Cleaning:
 - .1 Standard Concrete Unit Masonry:
 - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
 - .2 Architectural Concrete Unit Masonry:
 - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
 - .3 Prefaced Concrete Unit Masonry:
 - .1 Clean masonry as work progresses using soft, clean cloths, within few minutes after laying. Upon completion, when mortar has set so that it will not be damaged by cleaning, clean with soft sponge or clean cloths, brush, and clean water. Polish with soft, clean cloths.

3.13 PROTECTION

.1 Brace and protect concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

END OF SECTION

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PART 1 - GENERAL

1.1 STANDARDS

- .1 ASTM International:
 - .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A193/A193M-15, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Services and Other Special Purpose Applications.
 - .4 ASTM F1554-07a, Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
 - .5 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
 - .6 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric).
 - .7 ASTM A490M-14a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA):
 - .1 Handbook of the Canadian Institute of Steel Construction.
 - .2 CISC Guide for Specifying Architecturally Exposed Structural Steel (AESS) 2012.
 - .3 CISC/CPMA Standard 2-75, Quick Drying Primer for use on Structural Steel.
 - .4 CISC/CPMA Standard 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .4 Canadian Standards Association (CSA International):
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
 - .2 CSA-G164-M92 Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA-S16-14, Limit States Design of Steel Structures.
 - .4 CSA-S136-12, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
 - .7 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .8 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .9 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .5 Master Painters Institute:
 - .1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
 - .1 NACE No. 3/SSPC-6-06 Commercial Blast Cleaning.

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1.2 QUALIFICATIONS

.1 Fabrication and erection of structural steel to be performed only by firm fully approved by Canadian Welding Bureau to requirements of CSA Standard W47.1 (Division 1 or Division 2.1) and/or CSA Standard W55.3.

1.3 QUALITY PLAN

- .1 Develop and implement a Quality Plan that verifies the structural steel fabrication and erection is in conformance with this Section.
- .2 The Quality Plan shall describe, as a minimum, the following plans and procedures:
 - .1 Identify the personnel responsible for implementation and oversight of the quality control plan for this section in an organization chart. Describe the roles and responsibilities of each person listed.
 - .2 Provide samples of Contractor's quality control inspection forms to be used on the project. The quality control forms shall, as a minimum, include the following:
 - .1 Shop Drawing Review and Sign Off.
 - .2 Structural Steel Inspection Request.
 - .3 Deficiency Sign-Off.
 - .3 Quality plan shall include procedural steps for review of shop drawings by the Contractor prior to submission to the Consultant.
 - .4 Describe quality control procedural steps related to:
 - .1 Shop and site fabrication.
 - .2 Erection of structural steel.
 - .3 Welding.
 - .4 Metal fabrications, including stairs, handrails, guardrails, and platforms.
 - .5 Metal deck installation.
 - .6 Defective work, including: identification, documentation, submission of proposed repair details, and follow-up inspection.
 - .5 Risk Management: List and describe any anticipated project specific risks associated with this section or related sections and outline proposed means of mitigation.
- .3 The Quality Plan shall be prepared taking into account the specific requirements of this project. Generic quality plans that, in the Consultant's reasonable opinion, fail to address the specific requirements of this project will be returned 'Revise and Resubmit'.
- .4 The Quality Plan shall be submitted to the Consultant for review at least 10 business days prior to the scheduled commencement of shop fabrication. Allow five (5) business days for review of Quality Plan by Consultant. Acceptance of the Quality Plan by the Consultant shall be considered a prerequisite for structural steel erection. Failure of the Contractor to coordinate the timely submission of a complete Quality Plan, which ultimately results in the delay of the start of structural steel erection, shall not be at the risk of the Owner for back charge.
- .5 Submit details of Quality Plan to the Consultant for review.
- .6 The Owner will develop a Quality Assurance Plan for the purpose of verifying that the work of this Section meets with the specific requirements of the project. The Owner's Quality Assurance Plan will include inspection and testing of the work. The results of these inspections and tests will be shared with the Contractor. The Quality Assurance Plan carried out by the Owner will be paid for directly by the Owner.

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.7 It is acceptable for Quality Plan for work of this section to also include quality control procedures for work of related sections.

1.4 **INSPECTIONS**

- Site inspections to ensure conformance with this Section will be conducted by the inspection .1 company appointed by Consultant. Shop and site inspections to be performed only by a firm certified by the Canadian Welding Bureau for the requirements of CSA Standard W178 (Qualification of Welding Inspection Organizations) for buildings by visual methods.
- .2 Testing company services will be paid for by the Contractor from a cash allowance carried in Section 01 29 13.
- .3 All inspection procedures to be as outlined in CAN/CSA S16.
- .4 Shop inspections shall be conducted to visually inspect welding and fabrication procedures for conformance with reviewed show drawings and welding standards. Not less than one shop inspection will be conducted for each 10 tons or portion thereof, of structural steel and steel joists to be fabricated.
- .5 Site inspections, in general, are to check installation of high strength bolts, field welding procedures, and alignment and plumbness of framing after erection.
- Supply all necessary cooperation to facilitate shop and site inspections. Provide safe access and .6 working areas for testing on site.

1.5 **SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit connection design details, erection diagrams, and shop details for each member, hereafter referred to as shop drawings. Structural steel and joist shop drawings shall be reviewed and accepted in accordance with the Contractor's Quality Plan prior to forwarding on to the Consultant.
- .3 Shop drawings to be submitted in the form of reproducible tracing plus one set of white prints. Quantity and format of shop drawings are to be in accordance with Section 01 33 00. Reproduction of Contract Documents will not be acceptable as shop drawings.
- .4 Submit shop drawings in a single, complete set in order that all details may be read in conjunction with plans, elevations and all other dependent details.
- .5 All materials, finishes, and loadings shall be clearly illustrated. All submittals shall be made in English with any abbreviations clearly defined.
- Where shop drawings are re-submitted, clearly illustrate all revisions from previous submissions .6 using revision marks and "bubbles".
- .7 Structural steel shop drawings to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario in the employ of the steel fabricator to signify that fabricator's responsibilities with respect to detailing and connection design have been completed and reviewed for compliance with Contract Documents.

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- .8 Clearly show, in plan, all members, bridging, bracing, connections, steel lintels, hangers, etc.
- .9 For assemblies, components, and connections designated as AESS, clearly identify all of the following:
 - .1 Distinguish between shop and field welds and show size, length, and type of each weld.
 - .2 Grinding, finish, and profile of welds.
 - .3 Type and finish of bolts. Indicate which side of the connection bolt heads should be placed.
 - .4 Orientation of exposed seams in HSS members.
 - .5 Special tolerances.
 - .6 Erection requirements.
- .10 Provide details to illustrate spandrel beams, bracing and bridging systems, column and beam splices, bearing and base plates, framing at openings, connections and any other non-standard items or details required by Consultant.
- .11 Drawings to be prepared by fabricator in accordance with A.I.S.C. Structural Steel Detailing Manual.
- .12 Do not commence fabrication until complete set of shop drawings has been reviewed and accepted by the Consultant. Where fabrication is initiated prior to such review, all subsequently required revisions shall be at no cost to the Owner.
- .13 Submit mill test reports prior to fabrication of structural steel. Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project. Mill test reports to be certified by metallurgists qualified to practice in the Province of Ontario.
- .14 Provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.6 SAMPLES AND MOCK-UPS

- .1 Provide samples of AESS components as noted below:
 - .1 Surface preparation of bare steel.
 - .2 Finished and painted steel.
 - .3 Welds, including final profiling of welds.
 - .4 Reduced scale representation of completed welded and bolted connections.
- .2 Provide samples demonstrating each AESS Category finish requirements.
- .3 Samples are to be submitted to Consultant for review 30 days in advance of commencing full scale fabrication of AESS components.
- .4 Additional samples of elements indicated above may be required by the Consultant if the samples are not accepted. Additional samples to be completed to the satisfaction of the Consultant. All costs for samples to be by the Contractor. Where full scale fabrication is initiated prior to acceptance of samples, all subsequently required revisions shall be at no cost to the Owner.
- .5 Provide mock-up of specify element(s) of finished AESS components for reference. Accepted mock-ups will form the basis for minimum standard of workmanship.

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1.7 **EXAMINATION**

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- .1 Prior to fabrication, review all dimensions in conjunction with all Contract Documents. Report any conflicts or uncertainties for clarification.
- .2 Prior to erection, examine all site conditions and dimensions which may affect this work. Report any inconsistencies to Consultant for direction.

COORDINATION OF QUALITY PLAN WITH FABRICATION 1.8

- .1 Pre-fabrication Meeting: convene a pre-fabrication meeting one week prior to commencing erection of structural steel.
 - .1 Ensure key personnel, site supervisor, and Consultant attend.
- .2 Ensure shop inspection processes are carried out in conformance with the Quality Plan.
- .3 The Consultant may elect to review the contents of the Quality Plan to assess if fabrication is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work in fabrication. Supply all necessary cooperation to facilitate one (1) shop visit by Consultant.

COORDINATION OF QUALITY PLAN WITH WORK ON SITE 1.9

- .1 Pre-erection Meeting: convene a pre-erection meeting one week prior to commencing erection of structural steel.
 - .1 Ensure key personnel, site supervisor and Consultant attend.
- .2 Ensure field inspection processes are carried out in conformance with the Quality Plan.
- .3 Provide the Consultant with a 7 day 'look-ahead' schedule of planned erection of structural steel throughout the duration of the project.
- .4 Consultant may elect to review the contents of the Quality Plan to assess if the work is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work on site and prepare appropriate record of observations for the Owner. Supply all necessary cooperation to facilitate Consultant's review of work on site. Provide safe access and working areas for review and inspection on site.

1.10 **COORDINATION**

- .1 Review all Contract Documents and shop drawings related to all other trades which may affect this work. Report any discrepancies to Consultant for direction.
- .2 Cooperate with all other trades to fully coordinate all dimensions, openings, details, etc. which may be required during fabrication or erection.

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1.11 SUPPLY AND INSTALLATION OF MISCELLANEOUS ITEMS

- .1 Examine Contract Documents and shop drawings of all other trades and provide all items noted by Division 5.
- .2 Supply all built-in items such as anchor bolts, bearing plates, steel lintels, etc. unless noted otherwise. Turn over such built-in items to the trade responsible for installation.
- .3 Supply and install additional framing at all openings in steel deck equal to or greater than 18" wide across ribs.

1.12 STORAGE AND HANDLING

- .1 Store and handle steel members in accordance with the Contractor's Quality Plan to prevent damage which will impair adequacy or appearance of material in finished structure.
- .2 All members damaged during shipping, handling or erection shall be repaired to the satisfaction of the Consultant at no cost to the Owner.
- .3 Store joists in vertical position, blocked off ground in such a manner as to avoid overstraining and to keep them reasonably clean.
- .4 Take special precautions when erecting long slender joists or members. Do not release hoisting cables until the member is laterally supported by at least one line of bridging and/or bracing.
- .5 Erect finished AESS pieces using softened slings or other methods such that they are not damaged. Provide padding as required to protect elements while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural Steel:
 - .1 Hot rolled structural sections and bars Grade 350W to CAN/CSA G40.21 unless indicated otherwise.
 - .2 Hollow structural sections Grade 350W to CAN/CSA G40.21 manufactured to CAN/CSA G40.20, Class 'C' only, unless indicated otherwise.
 - .3 Angles and plates Grade 300W to CAN/CSA G40.2 unless indicated otherwise.
- .2 Bolts high strength to ASTM A325M with suitable nuts and hardened steel washers.
- .3 Anchor Bolts mild steel to ASTM A325-10 with suitable nuts and hardened steel washers, 3/4" diameter unless indicated otherwise. Provide template for trade responsible for installation.
- .4 Drill-in-Anchors:
 - .1 Expansion wedge type anchors: sizes as noted, Type 316 stainless steel. Standard of Acceptance: Hilti Kwik Bolt TZ or approved equivalent.
 - .2 Adhesive anchors: sizes as noted, type 316 stainless steel. Standard of Acceptance: Hilti HAS Rod secured with Hilti Hi HY 200 Adhesive Anchoring System (Safe Set) or approved equivalent.

- .5 Masonry Anchors:
 - .1 ¼" diameter galvanized continuous anchor strips (Type 'A') and ¼" diameter galvanized ties to suit application. Standard of Acceptance: Flex-O-Lok and Web Tie Flex-O-Lok by Blok-Lok or approved equivalent.
 - .2 4 x 1½ x 3/8" anchor lugs welded to all columns abutting masonry walls.
- .6 Welding Materials conforming to W48.3 and suitable for use intended.
- .7 Paint:
 - .1 Shop and touch-up paint to CISC/CPMA 2-75.
 - .2 Colour of shop applied primer: grey.
- .8 Galvanizing:
 - .1 Galvanizing to stricter requirements of ASTM A123/A123M-13, minimum zinc coating 600 g/m².
 - .2 Zinc-rich touch-up coating, ready mixed to CAN/CGSB-1.181-99. Standard of Acceptance: Fosroc Galvafroid distributed by W.R. Meadows or approved equivalent.

2.2 DESIGN AND FABRICATION

.1 All fabrication to comply with requirements of CAN/CSA S16. All welding to conform to requirements of CSA W59. Use only welders approved by Canadian Welding Bureau for class of work being performed.

.2 Fabrication

- .1 Fabricate structural steel not designated as AESS, in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Fabricate structural steel elements, connections, and assemblies designated as AESS in accordance with the requirements of CISC-AESS-Categories specified on drawings and in accordance with reviewed shop drawings and visual samples.
 - .1 Fabricate and assemble AESS elements, connections, assemblies in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Consultant.
 - .2 Fabricate AESS with surface quality consistent with the applicable CISC-AESS Category requirements and accepted visual samples.
 - .3 Appearance and quality of welds in AESS elements shall be consistent with applicable CISC-AESS-Category requirements and accepted visual samples. Assemble and weld built-up sections by methods that will maintain alignment of members to the required tolerances.
 - .4 Provide bolt type and finish specified. Place bolt heads as indicated on the approved shop drawings.
- .3 Substitutions of member sizes will be permitted only if equivalent stiffness and load carrying capacity are provided and no interference with other details will result. Substitutions, including all necessary modifications to the work of this Section and all other trades, to be at no cost to the Owner.
- .4 Design and detail connections in accordance with requirements of CAN/CSA S16-09 to resist forces, moments, shears and allow for movements indicated. Select or design connections to support reactions from maximum uniformly distributed load that can be safely supported by beam in bending, providing no point loads act on the beam and as minimum 75% of the shear capacity of the member, whichever is greater. Submit drawings and design calculations, sealed by a professional engineer registered in the province of Ontario, in accordance with project specifications.

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- .5 In general, framed connections with double angles, end connection plates or seated connections with top or side clip angles are acceptable. The Consultant may require the use of a specific connection type at his discretion, if considered necessary to ensure structural action assumed in design.
- .6 Provide torsional restraint of eccentrically loaded spandrel beams at connections to other beams or columns. Seated connections with top clip angles or framed connections with top and bottom clip angles are acceptable.
- .7 Design all splices to develop full capacity of member unless noted otherwise.
- .8 Design and detail all connections for vertical and horizontal diagonal bracing members to resist the specified loads in accordance with CAN/CSA S16. Where bracing loads are not specified, design connections to develop full tension capacity of member.
- .9 Detail and reinforce all slots, holes and openings in members so as to avoid overstressing. Construct re-entrant corners free from notches and with largest practical radii, with a minimum radius of 1/2".
- .10 Grind smooth or detail all butt welds, connections and splices in members, which will be exposed when construction is complete, so as to be as unobtrusive as possible. Appearance, location and details of exposed splices and connections to be to the Consultant's approval.
- .11 Detail sloping beams to permit level bearing at each support unless specifically indicated otherwise.
- .12 Unless sizes are indicated, design beam bearing plates in accordance with method presented in C.I.S.C. Handbook. Limit bearing stresses to 300 psi maximum on solid plain masonry and 1200 psi maximum on concrete.
- .13 Unless detailed otherwise, beams up to 12" deep to bear 8" onto walls, and beams over 12" deep to bear 16" onto walls. Where wall thickness limits length of bearing available, bear beams on full wall thickness.
- .14 Where masonry walls adjoin or continue past steel columns, install approved anchor lugs on columns to allow installation of vertically adjustable masonry ties at 16" on centre. Unless otherwise indicated, spacing shall commence at first joint above finished floor and end at last joint.
- .15 Where indicated and where steel beams or columns interrupt reinforced bond beams, field weld dowels to the steel member to match those in bond beam and of length sufficient to lap 36 bar diameters.
- .16 Stitch weld double angle members back to back to limit the slenderness ratio of each angle to less than that of the whole member.
- .17 Unless indicated otherwise, where steel deck changes direction of span, provide a continuous steel angle welded to ends of joists or top of beam to support deck. Refer to drawing for angle sizes. Install similar angle at all areas where continuity of support steel is interrupted or additional support for deck or metal forms is required due to framing details which cause span of deck or metal forms to exceed those intended on drawings.
- Unless indicated otherwise, where non load bearing masonry walls extend up to and parallel to underside of steel beams, install pairs of 3 x 3 x 1/4 in clip angles [150 mm] minimum length at 47" centres or as otherwise detailed to provide lateral support for walls. If wall is parallel to but offset from steel members, install sections of 3 x 3 x 1/4 in angle between primary framing members (i.e. joists or beams) at 47" centres to receive lateral support clip angles. If wall is perpendicular to joists or beams, install clip angles on bottom chord or flange of each primary framing member crossing wall.

- .19 For attachment of wood framing or blocking, provide 11/16" diameter drilled holes for 5/8" bolts unless noted. Space at 16" centres and stagger each side of flange or chord.
- .20 Install sag rods with double nuts, one above and one below each member to which they are attached. Stagger each side of member being supported unless indicated otherwise.
- .21 Unless indicated otherwise, column anchor bolts to be 3/4" diameter with minimum 12" embedment with headed stud or hardened steel nut and washer welded to end. "J" bolt type anchor bolts will not be permitted.

2.3 PREPARATION AND CORROSION PROTECTION

- .1 Clean structural steel to the requirements of SSPC SP3 as a minimum.
- .2 Apply one shop coat of primer paint except as follows:
 - .1 Do not paint surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 2" on all sides of joint.
 - .2 Do not paint contact surfaces of high strength bolted friction type connections where specified.
 - .3 Do not paint members of portions thereof which will be encased in, or in direct contact with, cast-in-place concrete.
- .3 Blast clean all steel members (including angle lintels, shelf angles, anchor plates and bolts, mechanical rooftop framing, etc.) which will be exposed to weather or a corrosive environment in finished structure, to requirements of SSPC SP6. Galvanize to stricter requirements of ASTM A 123/A 123M-13 or CAN/CSA-G164 (withdrawn).
- .4 Where members will be exposed to view in completed structure, carefully clean and paint so as to be free of imperfections which will mar finished painted surface.
- .5 After erection, touch-up all field bolts, field welds and all damaged or missing shop paint with one touch-up coat of paint.

2.4 BEARING PLATES

- .1 Provide bearing plates where steel deck bears on masonry or concrete. Minimum size 4" wide with 1/2" diameter x 4" long hooked anchors at 24" centres. Supply loose for building in by trade responsible for constructing wall.
- .2 Provide bearing plates for all beams or joists bearing on masonry or concrete. Minimum size 8" long x 3/8" thick x width of member plus 1". Supply loose for building in by trade responsible for constructing wall.

PART 3 - EXECUTION

3.1 ERECTION

.1 Erection of all structural steel members to conform to requirements of CAN/CSA S16.

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- .2 Make adequate provision for erection stresses and install adequate temporary bracing to withstand all loads to which structure may be subject during erection and subsequent construction, including loads due to wind, equipment and operation of same. Leave temporary bracing in place as long as necessary for safety or until walls and/or permanent bracing upon which frame depends for lateral stability and all connections thereto, are completed.
- .3 Supply beam and column anchor bolts for installation by trade constructing bearing surface. Prior to erection, check location and elevation of all anchor bolts and advise the Consultant of any discrepancies. Any corrective measures necessary to be approved by the Consultant.
- .4 Support column bases at minimum 4 points by leveling nuts to provide a minimum 1" non-shrink, non-metallic grout space below base plates.
- .5 Fabricate connections to comply with requirements of CAN/CSAS16-01. Field connections may be accomplished by welding or with high strength bolts. Bolted connections shall be pretensioned as per the requirements of CAN/CSA S16-01. Perform field welding carefully so as not to cause any damage to joists, structural steel, bridging or deck.
- .6 Do not weld across beam flanges or joist chord members.
- .7 The design incorporates rigid roof and floor diaphragms consisting of the roof/floor deck and continuous framing members. To ensure the required diaphragm action, design connections and splices in perimeter framing to develop full member capacity and weld perimeter framing member to each supporting member with minimum 1½" of 1/4" fillet weld.

END OF SECTION

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PART 1 - GENERAL

1.1 STANDARDS

- .1 ASTM International:
 - .1 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A 792/A 792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 1.181-Withdrawn, Ready-Mixed Organic Zinc-Rich Coating.
- .3 CSA International:
 - .1 CSA C22.2 No.79-1978(R2013), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
 - .2 CSA S16-14, Design of Steel Structures.
 - .3 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members.
 - .4 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA W48-14 "Filler Metals and Allied Materials for Metal Arch Welding".
 - .6 CSA W55.3-08(R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .7 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).
- .4 Canadian Sheet Steel Building Institute (CSSBI):
 - .1 CSSBI 10M-13, Standard for Steel Roof Deck.
 - .2 CSSBI 12M-13, Standard for Composite Steel Deck.
 - .3 CSSBI B13-06, Design of Steel Deck Diaphragms.

1.2 QUALITY PLAN

- .1 Develop and implement a Quality Plan that verifies the metal deck design and installation is in conformance with this Section.
- .2 Submit details of Quality Plan to the Consultant for review. It is acceptable for the Quality Plan for work of this section to be incorporated into the Quality Plan submitted for Section 05 12 23.
- .3 The Owner will develop a Quality Assurance Plan for the purpose of verifying that the work of this Section meets with the specific requirements of the project.

1.3 INSPECTIONS

- .1 Site inspections to ensure conformance with this Section will be conducted by testing company appointed by Owner.
- .2 Testing company services will be paid for by the Contractor from a cash allowance carried in Division 1.

All inspection procedures to be as outlined in CAN/CSA S16-09.

.3

- .4 Supply all necessary cooperation to facilitate site inspections. Provide safe access and working areas for testing on site.
- .5 Submit reports from each inspection and final report certifying that installation of all steel deck has been performed in accordance with Contract Documents.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Submit manufacturer's instructions, printed product literature and data sheets for steel decking and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop drawings to be submitted in the form of reproducible tracing plus one set of white prints. Quantity and format of shop drawings are to be in accordance with Division 1. Reproduction of Contract Documents will not be acceptable as shop drawings.
- .4 Submit shop drawings in a single, complete set in order that all details may be read in conjunction with plans, elevations and all other dependent details.
- .5 All materials, finishes, and loadings shall be clearly illustrated. All submittals shall be made in English with any abbreviations clearly defined.
- .6 Where shop drawings are re-submitted, clearly illustrate all revisions from previous submissions using revision marks and "bubbles".
- .7 Shop drawings to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario in the employ of the steel deck fabricator to signify that fabricator's responsibilities with respect to detailing and connection design have been completed and reviewed for compliance with Contract Documents.
- .8 Submit design calculations if requested by the Consultant.
- .9 Submit confirmation that steel deck fastener installers have been trained and certified by manufacturer or submit welders' certification.

1.5 COORDINATION

- .1 Review all Contract Documents and all shop drawings produced by all other trades which may affect this work. Report any discrepancies to the Consultant for direction.
- .2 Consult all trades to ascertain location and size of openings required in deck. Ensure that all steel framing required has been installed prior to erection.

1.6 COORDINATION OF QUALITY PLAN WITH WORK ON SITE

.1 Ensure field installation processes are carried out in conformance with the Quality Plan.

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.2 Consultant may elect to review the contents of the Quality Plan to assess if the work is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work on site and prepare appropriate record of observations for the Owner. Supply all necessary cooperation to facilitate Consultant's review of work on site. Provide safe access and working areas for review and inspection on site.

1.7 STORAGE AND HANDLING

- .1 Exercise care in storing, handling, and placing steel deck units to prevent damage which will impair adequacy or appearance of material in finished structure.
- .2 Damaged material to be replaced at no cost to the Owner.
- .3 If site storage is necessary, store materials in neat bundles stacked on wood blocking clear of ground and tilted slightly to ensure that no water lies on material and in accordance with manufacturer's recommendations.
- .4 Handle materials in accordance with safety provisions outlined in CSSBI Standards for Steel Roof Deck to avoid injury or damage.

1.8 DESIGN CRITERIA

- .1 Calculate structural design of metal decking in accordance with CSA S136 and CSSBI 10M, 12M, B13.
- .2 Support connection and side lap connection, including fastener configuration and specification, to be in accordance with CSSBI B13.
- .3 Metal decking to safely carry indicated dead, live, and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated. Maximum working stress to be 20,000 psi.

 Nominal core thickness indicated on contract drawings is minimum required and may have to be increased depending on section properties of deck utilized by deck manufacturer.
- .4 Deflection under live load only not to exceed 1/360th of span.
- .5 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CSA S16.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural steel for bearing plates, framing, miscellaneous angles hot rolled structural steel, Grade 350 W to CSA G40.21.
- .2 Hollow structural sections for deck support Grade 350 W to CAN/CSA G40.21.
- .3 Material manufacture and fabrication to be performed by a member company of Canadian Sheet Steel Building Institute (CSSBI).

- .4 Roof and Floor Deck: Base steel thickness and depth of profile as indicated on drawings.
 - .1 Standard of acceptance: VicWest RD938 or Canam P-3615.
- .5 Acoustic Roof Deck: Standard roof deck with factory perforations on vertical faces of flutes, complete with 17.5 kg/m³ minimum density fibrous glass insulation pads profiled to suit deck flutes.
 - .1 Standard of acceptance: Perforated Canam P-3606 steel deck with AF-110 fiberglass insulation strips and wood fibre panels or approved equivalent.
 - .2 Acoustically treated steel deck to be tested to ASTM C432 at an accredited acoustical facility and achieve a minimum average noise reduction coefficient of 0.70.
- .6 Metal Forms: non-cellular deck with 26 gauge 0.018" core thickness. Rib spacing to be 2½" on centres, rib depth to be 9/16".
 - .1 Standard of Acceptance: Canam P- 3012 or approved equivalent.
- .7 Composite Floor Deck: non-cellular composite deck with 20 gauge .036" core thickness. Rib spacing to be 6" on centres, rib depth to be 1½". Deck to be roll-formed with integral locking lugs to provide positive mechanical interlock and shear transfer between concrete fill and deck.
 - .1 Standard of Acceptance: VicWest HB 938 or Canam P-3615 Composite.
- .8 Touch-up paint: zinc rich anti-corrosion Galvafroid by W.R. Meadows.
- .9 Finishes:
 - .1 Galvanized to ASTM 653, Z275 designation.
 - .2 Prefinished factory applied baked acrylic, series 8000 colour with an underlying galvanized layer to ASTM 653, Z275 designation.
 - .3 Unless otherwise specified, provide galvanized finish except for surfaces designated as sitepainted (supply Wipe Coat) or as prefinished on Room Finish Schedule.
- .10 Closures as indicated and in accordance with manufacturer's recommendations.
- .11 Mechanical fasteners as indicated and accordance with manufacturer's recommendations.
- .12 Welding Materials conforming to W48.3 and suitable for use intended.
- .13 Cover plates, cell closures, and flashings: steel sheet with minimum base steel thickness of 22 ga. minimum. Metallic coating same as deck material.
 - .1 Primer: zinc rich, ready mix to CAN/CGSB-1.181.
 - .2 Caulking to Section 07901.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Prior to installation, examine all site conditions carefully and report any defects found to Consultant.

 Do not commence erection until corrective measures are completed to Consultant's satisfaction.
- .2 Prior to erection, visually inspect metal decking and inform Consultant of unacceptable conditions immediately upon discovery. Do not commence erection until corrective measures are completed to Consultant's satisfaction.
- .3 Make field measurements necessary to ensure proper fit of decking.

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.4 Review all Contract Documents and all shop drawings produced by all other trades which may affect this work. Report any discrepancies to Consultant for direction.

3.2 ERECTION

- .1 Erection as indicated and in accordance with CSA S136 and CSSBI 10M, 12M and in accordance with approved erection drawings.
- .2 Structural steel work: in accordance with CSA S136 and CSSBI 10M, 12M.
- .3 Ensure that all steel framing required has been installed prior to erection of metal deck.
- .4 Welding: in accordance with CSA W59.
- .5 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.
- .6 Welding to be performed by firms certified by the Canadian Welding Bureau for Division 1 or 2 under CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding or trained and certified by manufacturer.
- .7 Where double joists occur, weld deck to both joists at 12" centres staggered.
- .8 At locations where deck span changes direction, weld both deck sections to supporting steel at 6" centres.
- .9 Erect steel deck in accordance with CSA S136 and CSSBI 10M, 12M, B13 and in accordance with approved erection drawings.
- Span deck units over three or more supports. Supply in sheets of sufficient length to extend from high points of framing to low points. Bend as required to conform to slope of supporting steel.
- .11 Place and align units in their final position prior to making permanent connections, taking care to provide adequate temporary connections to resist construction forces, wind, etc.
- .12 Lap ends: to 2" minimum. Locate laps above framing members. Secure lapped units to each other and to supporting member with puddle welds at 6" centres.
- .13 Support connections and side lap connections to be in accordance with approved shop drawings.
- .14 Steel deck to have a minimum end bearing length of 2" on steel framing.
- .15 Blowholes will not be accepted. Where blowholes occur, replace deck unit, conceal with cover plate, or otherwise propose remedial measures to Consultant's satisfaction.
- At all locations where longitudinal deck edge bearing on perimeter member is less than 1", provide continuous 1½" x 1½" x 0.100" HSS to support top rib of deck. Weld HSS to perimeter member with 1½" of 1/4" fillet at 12" centres and weld top rib of deck to HSS with 3/4" diameter puddle welds at 6" centres.
- .17 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

- .18 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mil scale and other foreign matter.
- .19 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.
- .20 Install formed foam closures at underside of deck ribs where required to provide soundproofing across interior partitions and walls. Install formed neoprene closures at exterior walls.

3.3 CONNECTIONS

- .1 Install connections in accordance with CSSBI recommendations as indicated. Install proprietary fasteners in strict accordance with manufacturer's recommendations.
- .2 Contractor to have proprietary anchoring system manufacturer's representative on site for initial application of all proprietary anchoring systems to verify installation.

3.4 CLOSURES

.1 Install closures in accordance with manufacturer's recommendations.

3.5 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 Cut openings in deck as required by other trades. Coordinate with other trades as required to confirm size and location of all openings.
- .2 Openings up to 6" square require no reinforcing.
- .3 Openings with any one dimension between 6" and 12" to be reinforced as indicated on drawings.
- .4 Openings with any one dimension greater than 18" and areas of concentrated load to be reinforced in accordance with structural framing details, except as otherwise indicated. Weld deck to framing at 6" centres around openings.

3.6 PAINTING

.1 Touch-up all welds and all defects and damage in galvanized surfaces with zinc rich paint.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM A 123/A 123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A 792/A 792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 CSA International:
 - .1 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel Structures.
 - .2 CSA W55.3-08(R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
 - .4 CAN/CSA S136-12 Package, North American Specification for the Design of Cold Formed Steel Structural Members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members.
- .3 Canadian Sheet Steel Building Institute (CSSBI):
 - .1 CSSBI 50M-06, Lightweight Steel Framing Manual.
 - .2 CSSBI Fact Sheet #3 June 1994, Care and Maintenance of Prefinished Sheet Steel Building Products.
 - .3 CSSBI Technical Bulletin Vol. 7, No. 2 February 2004, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
 - .4 CSSBI S5-04, Guide Specification for Wind Bearing Steel Studs.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for structural metal studs and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
- .3 Indicate locations, dimensions, openings, and requirements of related work.
- .4 Indicate welds by welding symbols as defined in CSA W59.

.4 Samples:

- .1 Submit samples of framing components for review.
- .2 Submit duplicate 12" x 12" samples of each type.

- .5 Certificates: prior to beginning Work, submit: 2 certified copies of mill reports covering material properties.
- .6 Manufacturer's Engineer Reports:
 - .1 Submit written report from manufacturer's design Engineer responsible for shop drawings, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL. Include on the report stamp and seal of Engineer.

1.3 QUALITY ASSURANCE

- .1 Site Meetings: as part of Manufacturer's Services as described in PART 3 FIELD QUALITY CONTROL, schedule site visits, to review Work, as requested by Consultant.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect structural metal studs from nicks, scratches, and blemishes.
 - .3 Protect steel studs during transportation, site storage, and installation in accordance with CSSBI Sheet Steel Facts #3.
 - .4 Handle and protect galvanized materials from damage to zinc coating.
 - .5 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel: to CAN/CSA S136, fabricated from ASTM A 653/A 653M, Grade 340 steel.
- .2 Zinc coated steel sheet: quality to ASTM A 653/A 653M, with Z180 designation coating.
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008", length 3/8".
- .5 Anchors: concrete expansion anchors or other suitable drilled type fasteners.

- .6 Bolts, nuts, washers: hot dipped galvanized to ASTM A 123/A 123M, 380 g/m² zinc coating.
- .7 Touch up primer: zinc rich, to CAN/CGSB-1.181.

2.2 STEEL STUD DESIGNATIONS

.1 Colour Code: to CSSBI Technical Bulletin Vol.7, No. 2.

2.3 METAL FRAMING

- .1 Steel Studs: to CAN/CSA S136, fabricated from metallic coated steel, depth as indicated.
 - .1 As required on reviewed shop drawings but to minimum steel thickness of 1/16" / 18 ga.
- .2 Stud Tracks: fabricated from same material and finish as steel studs, depth to suit.
 - .1 Bottom track: single piece.
 - .2 Top track: two piece telescoping.
- .3 Deflection Ceiling Track: purpose made with 2½" leg x width to suit stud depth, pre-punched 1½" long slots spaced at 1" o/c.
 - .1 Acceptable Product: 'Multi-slot MST 250' by Bailey Metal Products Limited, or approved alternate.
- .4 Bridging: fabricated from same material and finish as studs, 1½" x ½" x 18 ga. minimum thickness.
- .5 Angle Clips: fabricated from same material and finish as studs, 1½" x 1½" x depth of steel stud, 18 ga. minimum thickness.
- .6 Tension Straps and Accessories: as recommended by manufacturer.
- .7 Acoustical Sealant: to Section 07 92 00 Joint Sealing.
- .8 Insulating strip: rubberized, moisture resistant 16 ga." thick cork closed cell neoprene strip, ½" wide, with self-sticking adhesive on one face, lengths as required.

2.4 SOURCE QUALITY CONTROL

.1 Ensure mill reports covering material properties are reviewed by Consultant.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for precast concrete installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate prior to commencing with Work of this section in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.

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.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 GENERAL

- .1 Weld in accordance with [CSA W59].
- .2 Certification of companies: to CSA W47.1 for fusion welding and CSA W55.3 for resistance welding.
- .3 Do structural metal stud framing work to CSSBI S5.
- .4 Frame all exterior walls with "load-bearing" or "wind bearing" 18 ga. metal studs (minimum) unless noted otherwise.

3.3 ERECTION

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at 31" on centre maximum, unless lesser spacing prescribed on shop drawings.
- .3 Erect studs plumb, aligned and securely attached with 2 screws minimum, unless lesser spacing and / or methods are otherwise indicated in the Contract Documents or reviewed shop drawings. Should discrepancies exist, use most stringent method to attach studs unless otherwise approved in writing by Consultant.
- .4 Seat studs into bottom tracks and two (2) piece telescoping top track.
- .5 Install studs at not more than 2" from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .6 Brace steel studs with horizontal internal bridging at 5'-0" maximum.
 - .1 Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .7 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
- .8 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. 2½" leg purpose made deflection ceiling tracks as specified.
- .9 Touch up welds with coat of zinc rich primer.
- .10 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .11 Install continuous insulating strip under studs and tracks around perimeter of sound control partitions.

3.4 ERECTION TOLERANCES

.1 Plumb: not to exceed 1/500th of member length.

- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than +/- 1/16" from design spacing.
- .4 Gap between end of stud and track web: not more than 1".

3.5 CUTOUTS

.1 Maximum size of cutouts for services as follows:

Member	Across Member	Along Member	Centre-to-Centre
Depth	Depth (in.)	Length	Spacing
92	1 ½" max.	4" max.	2' min.
102	1 ½" max.	4" max.	2' min.
152	2 ½" max.	4 ½" max.	2' min.

.2 Limit distance from centerline of last unreinforced cutout to end of member to less than 12".

3.6 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer's design engineer responsible for shop drawings verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 ACTION AND INFORMATIONAL SUBMITTALS. Include on the report stamp and seal of Engineer.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review Work as follows.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

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.2 Repair damage to adjacent materials caused by structural metal stud installation.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- .1 Provide components made of steel unless otherwise indicated.
- .2 Provide the following components as required and / or where indicated:
 - .1 Angle lintels. over all masonry openings unless otherwise indicated.
 - .2 Pipe railings
 - .3 Corner guards
 - .4 Interior access ladders.
 - .5 Exterior access ladders.
 - .6 Trench covers and frames
 - .7 Miscellaneous channel frames.
 - .8 Under counter support brackets.
 - .9 Wall and floor mounted bench supports.
 - .10 Masonry lateral support brackets.
 - .11 Bollards
 - .12 Other metal fabrications shown and not specifically covered in other Sections.
- .3 The above list is intended as a guide only and not to be considered as a complete list of all items to be provided. Examine drawings thoroughly to determine items and quantities required. The above list of items will not override items and quantities identified on Contract Drawings.
- .4 The Contractor is to coordinate the correct installation of any fabricated items including obtaining suitable templates and guides required for a top-quality installation. Items to be fabricated and supplied to the site for installation in a timely manner which does not impact schedules or quality of workmanship of the associated trades.
- .5 All exterior metal fabrications exposed to weather to be hot-dip galvanized, unless noted otherwise.

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM A 36/A 36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A 53/A 53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .3 ASTM A 123/A 123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .4 ASTM A269/A269M-14E1, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .5 ASTM A 307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .6 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
 - .7 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric).
 - .8 ASTM A490M-14a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).

- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/ Canadian Paint Manufacturer's Association (CPMA):
 - .1 Handbook of the Canadian Institute of Steel Construction.
 - .2 CISC Guide for Specifying Architecturally Exposed Structural Steel (AESS) (2012).
 - .3 CISC/CPMA Standard 2-75, Quick Drying Primer for Use on Structural Steel.
 - .4 CISC/CPMA Standard 1-73a, Quick Drying, One-Coat Paint for Use on Structural Steel.
- .4 Canadian Standards Association (CSA International):
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16-14, Design of Steel Structures.
 - .3 CSA-S136-12, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .4 CSA-S157-05, Strength Design in Aluminum.
 - .5 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
 - .7 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .8 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .5 Environmental Choice Program:
 - .1 CCD-047-98(R2005), Architectural Surface Coatings.
 - .2 CCD-048-98(R2006), Surface Coatings Recycled Water-borne.
- .6 Green Seal Environmental Standards (GS):
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .7 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.3 QUALIFICATIONS

.1 Metal fabrication to be performed only by firm fully approved by Canadian Welding Bureau to requirements of CSA Standard W47.1 (Division 1 or Division 2.1) and/or CSA Standard W55.3.

1.4 DESIGN REQUIREMENTS

- .1 Steel design to CSA-S16, Limit States Design of Steel Structures.
- .2 Aluminum design to CSA-S157, Strength Design in Aluminum.
- .3 Design ladders to the requirements of the Ontario Ministry of Labour Regulations and the Engineering Data Sheet 2-04 as a minimum standard.
- .4 Design of Metal Fabrications to be completed by Professional Engineer registered or licensed in the Province of Ontario, Canada who is qualified and experienced in the design work being performed.

1.5 QUALITY PLAN

- .1 Develop and implement a Quality Plan that verifies the metal fabrication and installation is in conformance with this Section.
- .2 Submit details of Quality Plan to Consultant for review. It is acceptable for the Quality Plan for work of this section to be incorporated into the Quality Plan included in Section 05 10 00 Structural Steel.
- .3 The Owner will develop a Quality Assurance Plan for the purpose of verifying that the work of this Section meets with the specific requirements of the project. The Owner's Quality Assurance Plan may include inspection or testing in addition to that implemented by the Contractor's Quality Plan.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing and bolts and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit electronic copy of WHMIS MSDS in accordance with Section 01 35 29 Health and Safety Requirements and 01 35 43 Environmental Procedures.
 - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada in the employ of the steel fabricator to signify the fabricator's responsibilities with respect to detailing and connection design have been completed and reviewed for compliance with the Contract Documents.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .3 For all aluminum fabrications, clearly indicated base metal yield strength (Fy) and reduced yield strength (Fwy) at welded heat affected zone.
- .4 Provide details to illustrate bracing and bridging systems, column and beam splices, bearing and base plates, connections and any other standard items or details required
- .5 Metal fabrication shop drawings shall be reviewed and accepted in accordance with the Contractor's Quality Plan prior to forwarding on to the Consultant.
- .6 Do not commence fabrication until complete set of shop drawings has been reviewed and accepted by the Consultant. Where fabrication is initiated prior to such review, all subsequently required revisions shall be at no cost to the Owner.

.4 Shop Drawing Design Engineer's Reports:

- .1 Submit written report from design Engineer responsible for shop drawings, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL. Include on the report stamp and seal of Engineer.
- .5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
- .2 Visually inspect substrate prior to commencing with Work of this section in presence of Engineer.
- .3 Inform Consultant of unacceptable conditions immediately upon discovery.
- .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

1.8 COORDINATION OF QUALITY PLAN WITH FABRICATION

- .1 Ensure shop fabrication is carried out in conformance with the Quality Plan.
- .2 The Consultant may elect to review the contents of the Quality Plan to assess if fabrication is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work in fabrication. Supply all necessary cooperation to facilitate shop visits by the Consultant.

1.9 COORDINATION OF QUALITY PLAN WITH WORK ON SITE

- .1 Ensure field installation processes are carried out in conformance with the Quality Plan.
- .2 Consultant may elect to review the contents of the Quality Plan to assess if the work is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work on site and prepare appropriate record of observations for the [Owner]. Supply all necessary cooperation to facilitate Consultant's review of work on site. Provide safe access and working areas for review and inspection of work on site.

1.10 GENERAL COORDINATION

- .1 Review all Contract Documents and shop drawings related to all other trades which may affect this work. Report any discrepancies to the Consultant for review.
- .2 Cooperate with all other trades to fully coordinate all dimensions, openings, details, etc. which may be required during fabrication or installation.
- .3 Supply all built-in items such as anchor bolt, bearing plates, steel lintels, etc. unless noted otherwise. Turn over such built-in items to the trade responsible for installation.
- .4 Pre installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 All metals to be new materials, free from corrosion or other defects impairing strength, durability or finished appearance, in all respects to uses required and subject to review of Consultant. Furnish samples for review as required. All materials to be of best commercial quality for purposes specified.
- .2 Hot rolled structural sections and bars: CAN/CSA-G40.21, Grade 350W.
- .3 Hollow structural sections (HSS): CAN/CSA-G40.21, Grade 350W, Class 'C' only, unless indicated otherwise.
- .4 Angles and plates: CAN/CSA-G40.2, Grade 300W, unless indicated otherwise.
- .5 Steel pipe: to ASTM A 53/A 53M standard weight, black galvanized finish...
- .6 Welding materials: to CSA W59.
- .7 Welding electrodes: to CSA W48 Series.
- .8 Bolts and anchor bolts: to ASTM A 307.
- .9 Aluminum sections and plates to be aluminum alloy 6061-T6 to B209-65 and B308-65 (CSA Alloy GS11N-T6). Structural sections to be 6351-T6 alloy.
- .10 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.
 - .1 Acceptable materials: 'Por-Rock', by Hallemite Products Ltd., or 'SET 15 Minute Anchoring Cement' by SET Products Ltd.
- .11 Sheet steel: hot dip galvanized, cold rolled, with stretcher level degree of flatness to ASTM A653/A653M; zinc coating designation Z275.
- .12 Shop primer for interior components: CAN/CGSB-1.40.
- .13 Zinc rich paint:
 - .1 Shop primer for exterior components to be painted: Inorganic zinc rich paint.
 - .2 Touch-up: CAN/CGSB-1.181.

- .1 Acceptable materials: 'Inorganic Coating 'No.2000.302', by Glidden, or equivalent product approved by Consultant.
- .14 Bituminous enamel: alkali resistant asphaltic coating.

2.2 FINISHES

- .1 Thoroughly clean steel of loose scale, rust, oil, dirt and other foreign matter. Suitably prepare steel surfaces by power tool cleaning to receive specified finishes.
- .2 Grind smooth sharp projections.
- .3 Remove oil and grease by solvent cleaning.
- .4 Apply coatings in the shop and before assembly. Where size permits, galvanize components after assembly.
- .5 Interior components: shop apply coat of primer to interior components after fabrication except where stainless steel, galvanized or zinc rich paint finish is required.
- .6 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .7 Exterior components to be painted, except where other finish is indicated: blast clean metal to "Near White Grade" (SSPC-SP-10) and spray apply a coat of zinc rich paint, maximum 1/8" thick.
- .8 Hot dip galvanize all exterior components not scheduled to be painted, components located within exterior building elements, and where indicated, interior components after fabrication in accord with the stricter requirements of ASTM A123/ A123 M, minimum coating weight 600 g/m2.
- .9 Apply coat of bituminous enamel to contact surfaces of metal components in contact with cementitious materials and dissimilar metals.
- .10 Stainless steel: AISI No. 4 finish.
- .11 Shop coat primer: to CAN/CGSB 1.40 and in accordance with Section 09 91 23 Interior Painting and Section 09 91 13 Exterior Painting.
- .12 Zinc primer: zinc rich, ready mix to CAN/CGSB 1.181 and in accordance with Section 09 91 23 Interior Painting and Section 09 91 13 Exterior Painting.

2.3 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.4 ANGLE LINTELS

- .1 Refer to Structural drawings for sizes and locations of steel angle lintels.
- .2 Steel angles: exterior and wet areas galvanized, interior dry areas prime painted, sizes indicated for openings. Provide 6" minimum bearing at ends.
- .3 Weld or bolt back-to-back angles to profiles as indicated.

2.5 PIPE RAILINGS

- .1 Steel pipe: 1 1/2" nominal outside diameter, formed to shapes and sizes as indicated.
- .2 Galvanize exterior and interior pipe railings after fabrication. Shop coat prime interior railings after fabrication.

2.6 CORNER GUARDS

- .1 Galvanized finish for exterior, prime paint for interior.
 - .1 Primer: maximum VOC limit 250 g/L to GS-11 when applied on-site.

2.7 INTERIOR ACCESS LADDER

- .1 Construct roof access ladder as follows:
 - .1 1/2" x 3/8" thick flat bar stringers, length as indicated, extending from floor to above top rung as indicated.
 - .2 1" diameter knurled solid steel rungs, minimum 24" wide, spaced at 12" o.c. vertically, welded to stringers.
 - .3 Attach stringers to walls with bent steel brackets. Size stringer and brackets as detailed but in steel thickness as sized and detailed by fabricator for intended use. Pre-drill holes for bolt fastening to stringers and anchorage to wall.
 - .4 Steel Safety Cage: where indicated, 2" x 3/8" thick flat horizontal and vertical bars as detailed.
 - .5 Shop prime steel under interior ladders in accordance with Section 099123, Painting.

2.8 EXTERIOR ACCESS LADDER

- .1 Construct roof access ladder as follows:
 - .1 1 5/8" x 1/8" thick stringers, length as indicated.
 - .2 1" diameter knurled solid steel rungs, minimum 24" wide, spaced at 12" o.c. vertically, welded to stringers.
 - .3 Attach stringers to walls with bent steel brackets. Size stringer and brackets as detailed but in steel thickness as sized and detailed by fabricator for intended use. Pre-drill holes for bolt fastening to stringers and anchorage to wall.
 - .4 Steel Safety Cage: where indicated, 2" x 3/8" thick flat horizontal and vertical bars as detailed.
 - .5 Hot dipped galvanized finish.

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2.9 TRENCH COVERS AND FRAMES

- .1 Steel fabricate from 1/4" thick raised pattern plate set in L 55 x 55 x 6 frame. Include anchors at 4'-0" on centre for embedding in concrete. Supply trench covers in 4'-0" removable lengths.
- .2 Finish: Galvanized finish for exterior, prime paint for interior.
 - .1 Primer: maximum VOC limit 250 g/L to GS-11 when applied onsite.

2.10 SERVICE TRENCH COVERS AND FRAMES

- .1 Anti-Slip Trench Covers and Frames:
 - .1 Anti-slip fiberglass reinforced plastic (FRP) items such as but not limited to trench covers and frames with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein in compliance to applicable local codes and standards.
 - .2 Fabricate structural trench covers and frames from fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
 - .3 Resins shall be fire retardant isophthalic polyester with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.
 - .4 All surfaces of structural planks shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas prior to receiving final finish. All glass fibers shall be well covered with resin to protect against exposure due to wear or weathering prior to receiving final finish.
 - .5 Protect all structural trench covers and frames from ultraviolet (UV) attack with:
 - .1 Integral UV inhibitors in the resin.
 - .2 Synthetic surfacing veil to produce a resin rich surface.
 - .6 All structural trench covers and frames shall have a tested flame spread rating of 25.
 - .7 Acceptable manufacturer:
 - .8 Fibergrate Composite Structures Inc., website: www.fibergrate.com, e-mail: info@fibergrate.com, or approved alternate.

2.11 CHANNEL FRAMES

- .1 Fabricate frames from steel, sizes of channel and opening as indicated.
- .2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.
- .3 Weld strap anchors to channel jamb frame at spacing as required by shop drawing engineer.
- .4 Finish: Galvanized finish for exterior, prime paint for interior.

2.12 MASONRY LATERAL SUPPORT BRACKETS

.1 Fabricate masonry lateral support brackets in sizes, shapes and quantities required to meet requirements of OBC and CSA-A30-94.

- .2 Provide channel or angle brackets to support tops of non-loadbearing masonry partitions where lengths exceed 16' between intersecting wall or supports.
 - .1 Place continuous channel in locations with exposed structure.
 - .2 Place angle bracket supports at maximum 4' from intersecting walls, corners and ends in locations not exposed to view.
 - .3 Refer to drawings for details.
- .3 Provide support brackets complete with all anchors and fasteners.
- .4 Shop prime steel under exposed masonry support brackets and cages in accordance with Section 09 90 00 Painting.

2.13 SLEEVES

.1 Provide Schedule 40 steel pipe sleeves for pipes passing through walls. Where walls are water retaining, sleeves to be complete with 6.5 x 75mm water bars. Sleeves to be unpainted in order to obtain improved bond to concrete.

PART 3 - EXECUTION

3.1 FABRICATION

- .1 Fabricate components in the shop in largest size practicable to minimize field jointing.
- .2 Fabricate components square, straight, true, fee from warpage and other defects. Accurately cut, machine file and fit joints, corners, copes and mitres.
- .3 Reinforce fabricated components to safely withstand expected loads.
- .4 Make joints in built-up sections with hairline joints in least conspicuous locations and manner.
- .5 Make allowance for thermal expansion and contraction when fabricating exterior Work.
- Joints shall be welded unless otherwise indicated and unless details of construction do not permit welding. Exposed welds shall be continuous and ground smooth.
- .7 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .8 Close exposed open ends of tubular members with welded on steel plugs.
- .9 Where Work of other Sections is to be attached to Work of this section, prepare Work by drilling and tapping holes, as required to facilitate installation of such other Work.
- .10 Work of this Section, supplied for installation under other Sections, shall be prepared as required ready for installation by: drilling, countersinking and tapping holes, forming shapes and cutting to required sizes.
- .11 Grind off mill stampings and fill recessed markings on steel components left exposed to view.
- .12 Follow recommendations of AISI Committee of Stainless Steel Producers when fabricating, joining,

welding, and finishing stainless steel components. Remove heat discolouration with mechanical, chemical or electrochemical means. Provide temporary protective coverings for all stainless steel components.

- .13 All aluminum fabrication to be by shop welding in an inert gas atmosphere in accordance with CSA Standards S157 and W47.2. Field joining by brazing not permitted.
- .14 Where possible, fit and shop assemble work, ready for erection.

3.2 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles as follows, unless otherwise indicated:
 - .1 To concrete and solid masonry with expansion type anchor bolts.
 - .2 To hollow construction with toggle bolts.
 - .3 To sheet metal with screws or bolts.
 - .4 To structural steel or plates with bolts or by welding.
 - .5 To wood with bolts or lag screws.
 - .6 Fill space between railing members and sleeves with non-shrink grout.
- .4 Provide all components required for anchoring. Make anchoring in concealed manner wherever possible. Make exposed fastenings, where approved by Consultant, neatly and of the same material, colour, texture and finish as base metal on which they occur. Keep exposed fastenings evenly spaced.
- .5 Chemical anchor system to be Hilti HIT-HY 200 adhesive anchoring system (safe set), unless noted otherwise.
- .6 Supply components for work by other trades in accordance with shop drawings and schedule.
- .7 Make field connections with bolts to CSA S16 or weld field connection.
- .8 Thread dimensions of galvanized or other plated materials to be such that nuts will thread over bolts, without rethreading or chasing.
- .9 All fastenings to be selected to avoid galvanic action between dissimilar metals.
- .10 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .11 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of.
 - .1 Primer: maximum VOC limit 250 g/L to GS-11.
- .12 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
 - .1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 FIELD QUALITY CONTROL

- .1 Shop Drawing Design Engineer's Field Services:
 - .1 Obtain written report from design engineer responsible for shop drawings verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 ACTION AND INFORMATIONAL SUBMITTALS. Include on the report stamp and seal of Engineer.
 - .2 Provide shop drawing design engineer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review Work as follows.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Once during progress of Work at 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

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PART 1 - GENERAL

1.1 STANDARDS

- .1 ASTM International:
 - .1 ASTM A36/A 36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A123/A 123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A193/A 193M-15, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Services and Other Special Purpose Applications.
 - .4 ASTM F1554-07a, Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
 - .5 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
 - .6 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric).
 - .7 ASTM A490M-14a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/ Canadian Paint Manufacturer's Association (CPMA):
 - .1 Handbook of the Canadian Institute of Steel Construction.
 - .2 CISC Guide for Specifying Architecturally Exposed Structural Steel (AESS) 2012.
 - .3 CISC/CPMA Standard 2-75, Quick Drying Primer for use on Structural Steel.
 - .4 CISC/CPMA Standard 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .4 Canadian Standards Association (CSA International):
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
 - .2 CSA-S16-14, Limit States Design of Steel Structures.
 - .3 CSA-S136-12, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .4 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
 - .6 CSA W48-14, Filler Metals and Allied Materials for Metal Arch Welding.
 - .7 CSA W55.3-08 (R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .8 CSA W59-13, Welded Steel Construction (Metal Arch Welding).
- .5 Master Painters Institute:
 - .1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.
 - .2 MPI-EXT 5.1-08, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
 - .1 NACE No. 3/SSPC-6-06, Commercial Blast Cleaning.

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1.2 QUALIFICATIONS

.1 Fabrication and erection of steel joists to be performed only by firm fully approved by Canadian Welding Bureau to requirements of CSA Standard W47.1 (Division 1 or Division 2.1) and/or CSA Standard W55.3.

1.3 QUALITY PLAN

- .1 Develop and implement a Quality Plan that verifies the steel joist fabrication and erection is in conformance with this Section.
- .2 Submit details of Quality Plan to the Engineer for review. It is acceptable for the Quality Plan for work of this section to be incorporated into the Quality Plan submitted for Section 05 12 23.
- .3 The Owner will develop a Quality Assurance Plan for the purpose of verifying that the work of this Section meets with the specific requirements of the project.

1.4 INSPECTIONS

- .1 Site inspections to ensure conformance with this Section will be conducted by testing company appointed by Consultant. Shop and site inspections to be performed only by a firm certified by the Canadian Welding Bureau for the requirements of CSA Standard W178 (Qualification of Welding Inspection Organizations) for buildings by visual methods.
- .2 Testing company services will be paid directly by the Owner.
- .3 All inspection procedures to be as outlined in CAN/CSA S16-14.
- .4 Shop inspections shall be conducted to visually inspect welding and fabrication procedures for conformance with reviewed show drawings and welding standards. Not less than one shop inspection will be conducted for each 10 tons or portion thereof, of structural steel and steel joists to be fabricated.
- .5 Site inspections, in general, are to check installation of high strength bolts, field welding procedures, and alignment and plumbness of framing after erection.
- .6 Supply all necessary cooperation to facilitate shop and site inspections. Provide safe access and working areas for testing on site.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Division 1.
- .2 Submit connection design details, erection diagrams, and shop details for each member, hereafter referred to as shop drawings. Structural joist shop drawings shall be reviewed and accepted in accordance with the Contractor's Quality Plan prior to forwarding on to the Consultant.
- .3 Shop drawings to be submitted in the form of reproducible tracing plus one set of white prints. Quantity and format of shop drawings are to be in accordance with Division 1. Reproduction of Contract Documents will not be acceptable as shop drawings.

- .4 Submit shop drawings in a single, complete set in order that all details may be read in conjunction with plans, elevations and all other dependent details.
- .5 All materials, finishes, and loadings shall be clearly illustrated. All submittals shall be made in English with any abbreviations clearly defined.
- .6 Where shop drawings are re-submitted, clearly illustrate all revisions from previous submissions using revision marks and "bubbles".
- .7 Steel joist shop drawings to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario in the employ of the steel fabricator to signify that fabricator's responsibilities with respect to detailing and connection design have been completed and reviewed for compliance with Contract Documents.
- .8 Clearly show, in plan, all members, bridging, bracing, connections, steel, etc.
- .9 Provide details to illustrate bridging systems, splices, bearing and base plates, special joist panels, framing at openings, connections and any other non-standard items or details required by Consultant.
- .10 Submit complete design calculations for all open web steel joists. Include section properties of all member components. Indicate size, type and spacing and connection details of bridging members. Provide details for member to member welding, bearing shoes, bearing plates, tie connections, etc. Indicate design loadings and live load deflections (expressed as a ratio of joist span). Joist calculations to be stamped and signed by Professional Engineer, registered in the Province of Ontario, who is responsible for their design.
- .11 Drawings to be prepared by fabricator in accordance with A.I.S.C. Structural Steel Detailing Manual.
- .12 Do not commence fabrication until complete set of shop drawings has been reviewed and accepted by the Consultant. Where fabrication is initiated prior to such review, all subsequently required revisions shall be at no cost to the Owner.
- .13 Submit mill test reports prior to fabrication of structural steel. Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project. Mill test reports to be certified by metallurgists qualified to practice in the Province of Ontario.
- .14 Provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.6 EXAMINATION

- .1 Prior to fabrication, review all dimensions in conjunction with all Contract Documents. Report any conflicts or uncertainties for clarification.
- .2 Prior to erection, examine all site conditions and dimensions which may affect this work. Report any inconsistencies to Consultant for direction.

1.7 COORDINATION OF QUALITY PLAN WITH FABRICATION

.1 Pre-fabrication Meeting: convene a pre-fabrication meeting one week prior to commencing erection of steel joists.

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- .1 Ensure key personnel, site supervisor, Consultant attend.
- .2 Ensure shop inspection processes are carried out in conformance with the Quality Plan.
- .3 The Consultant may elect to review the contents of the Quality Plan to assess if fabrication is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work in fabrication. Supply all necessary cooperation to facilitate two shop visits by Consultant.

1.8 COORDINATION OF QUALITY PLAN WITH WORK ON SITE

- .1 Pre-erection Meeting: convene a pre-erection meeting one week prior to commencing erection of steel joists.
 - .1 Ensure key personnel, site supervisor, Consultant attend.
- .2 Ensure field inspection processes are carried out in conformance with the Quality Plan.
- .3 Provide the Consultant with a 7 day 'look-ahead' schedule of planned installation of steel joists throughout the duration of the project.
- .4 Consultant may elect to review the contents of the Quality Plan to assess if the work is proceeding in general conformance with the Contract Documents. The Consultant may also elect to review and inspect the work on site and prepare appropriate record of observations for the Owner. Supply all necessary cooperation to facilitate Consultant's review of work on site. Provide safe access and working areas for review and inspection on site.

1.9 COORDINATION

- .1 Review all Contract Documents and shop drawings related to all other trades which may affect this work. Report any discrepancies to Consultant for direction.
- .2 Cooperate with all other trades to fully coordinate all dimensions, openings, details, etc. which may be required during fabrication or erection.

1.10 STORAGE AND HANDLING

- .1 Store and handle steel joists in accordance with the Contractor's Quality Plan to prevent damage which will impair adequacy or appearance of material in finished structure.
- .2 All members damaged during shipping, handling or erection shall be repaired to the satisfaction of the Consultant at no cost to the Owner.
- .3 Store joists in vertical position, blocked off ground in such a manner as to avoid overstraining and to keep them reasonably clean.
- .4 Take special precautions when erecting long slender joists. Do not release hoisting cables until the member is laterally supported by at least one line of bridging and/or bracing.

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PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural Steel:
 - .1 Hot rolled structural sections and bars Grade 350W to CAN/CSA G40.21 unless indicated otherwise.
 - .2 Hollow structural sections Grade 350W to CAN/CSA G40.21 manufactured to CAN/CSA G40.20, Class 'H' only, unless indicated otherwise.
 - .3 Joist material cold roll formed steel having a minimum yield stress of 375 MPa or hot rolled steel as above.
 - .4 Angles and plates Grade 300W to CAN/CSA G40.2 unless indicated otherwise.
- .2 Bolts high strength to ASTM A325M with suitable nuts and hardened steel washers.
- .3 Welding Materials conforming to W48.3 and suitable for use intended.
- 4 Paint:
 - .1 Shop and touch-up paint to CISC/CPMA 2-75.
 - .2 Colour of shop applied primer: grey.
- .5 Galvanizing:
 - .1 Galvanizing to stricter requirements of ASTM A123/A123M-13 or CAN/CSA-G164 (withdrawn), minimum zinc coating 600 g/m².
 - .2 Zinc-rich touchup coating, ready mixed to CAN/CGSB-1.181-99. Standard of Acceptance: Fosroc Galvafroid distributed by W.R. Meadows or approved equivalent.

2.2 DESIGN AND FABRICATION

- .1 Design, fabricate, and erect open web steel joists in accordance with CAN/CSA S16 to support design loads indicated on drawings. All concentrated point loads indicated on drawings are in addition to uniformly distributed roof or floor design loads unless otherwise noted.
- .2 Fabricate joists to depths indicated. Deflection under live load shall be limited to L/360 except as follows:
 - .1 L/500 for members supporting masonry (under total load).
 - .2 L/600 for members supporting folding doors or partitions, except where actual total deflection limitations are noted.
- .3 Shop mark ends of joists designed for non-uniform loads to define orientation.
- .4 Minimum length of horizontal leg of top chord angles shall be 1½". Minimum member thickness shall be 1/8". Do not use single angles or other unsymmetrical shapes as web members.
- .5 Provide shoe depths required to suit elevation of joist bearing surfaces and which will result in top of steel elevations noted.
- .6 Where joists frame onto supporting members from one side only, ensure that reaction point of joist is centred over centroid of support member.

- .7 Provide ceiling extensions where ceilings are indicated supported from joists on architectural drawings or in finish schedule.
- .8 Centre equipment supports, framing for openings, etc. over joist panel points or otherwise provide chord reinforcing or additional web members to transfer loads to panel points.
- .9 Align web members to allow mechanical and electrical services to be run through joists without interference.
- .10 Provide open panels in joists where necessary to accommodate ductwork or piping runs.
- .11 Do not cut, drill, or weld joists in the field unless authorized by Consultant. Members so modified shall be reinforced or replaced to the satisfaction of the Consultant. Attach mechanical and electrical services by means of clamping devices or U-bolt type connectors.
- .12 Design and space bridging to meet requirements of CAN/CSA S16 according to chord properties of ioists supplied.
- .13 Install additional lines of bridging at first interior bottom chord panel point of cantilevered joists or joists subject to wind uplift.
- .14 Where duct runs or equipment between joists necessitate removal of bridging, install a combination of horizontal and diagonal cross bridging between first two joists each side of section removed at each line affected. If two or more adjacent joist spaces are affected, install additional line of horizontal and diagonal cross bridging at each side of equipment, located as directed by Consultant.

2.3 PREPARATION AND CORROSION PROTECTION

- .1 Clean steel joists to the requirements of SSPC SP3 as a minimum.
- .2 Apply one shop coat of primer paint except as follows:
 - .1 Do not paint surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 2" on all sides of joint.
 - .2 Do not paint members of portions thereof which will be encased in, or in direct contact with, cast-in-place concrete.
- .3 Blast clean all steel joists which will be exposed to weather or a corrosive environment in finished structure, to requirements of SSPC SP6. Galvanize to stricter requirements of ASTM A123/A 123M-13.
- .4 Where members will be exposed to view in completed structure, carefully clean and paint so as to be free of imperfections which will mar finished painted surface.
- .5 After erection, touch-up all field bolts, field welds, and all damaged or missing shop paint with one touch-up coat of paint.

2.4 BEARING PLATES

.1 Provide bearing plates for all joists bearing on masonry or concrete. Minimum size 8" long x ³/₈" thick x width of member plus 1". Supply loose for building in by trade responsible for constructing wall.

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PART 3 - EXECUTION

3.1 ERECTION

- .1 Erection of all steel joists to conform to requirements of CAN/CSA S16.
- .2 Make adequate provision for erection stresses and install adequate temporary bracing to withstand all loads to which structure may be subject during erection and subsequent construction, including loads due to wind, equipment, and operation of same. Leave temporary bracing in place as long as necessary for safety or until walls and/or permanent bracing upon which frame depends for lateral stability and all connections thereto, are completed.
- .3 Weld joists bearing on steel members to the supporting member with two 1/4" fillet welds, each 1½" long, unless indicated otherwise or to suit joist connection design.
- .4 Fabricate connections to comply with requirements of CAN/CSAS16-09. Field connections may be accomplished by welding or with high strength bolts. Perform field welding carefully so as not to cause any damage to joists, structural steel, bridging or deck.
- .5 Do not weld across beam flanges or joist chord members.
- .6 Install all bridging, including end connections before any construction loads are placed on joists, except weight of workers necessary to install bridging.
- .7 Where bridging lines end at masonry or concrete walls, bolt bridging members to slotted holes in a vertical steel angle anchored securely to the wall. Bolts to be ½" diameter with vertical slots to permit a joist deflection of L/240 without binding.
- .8 Where bridging lines end at structural steel members or other types of construction, install a combination of diagonal and horizontal bridging between last two joists.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/National Particleboard Association (ANSI/NPA):
 - .1 ANSI/NPA A208.1-2009, Particleboard.
- .2 ASTM International:
 - .1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-11.3-M87, Hardboard.
 - .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.
 - .4 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .4 CSA International:
 - .1 CAN/CSA-A123.2-03(R2014), Asphalt Coated Roofing Sheets.
 - .2 CAN/CSA-A247-M86(R1996), Insulating Fiberboard.
 - .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .4 CSA O112.9-10(R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
 - .5 CSA O121-08(R2013), Douglas Fir Plywood.
 - .6 CSA O141-05(R2014), Softwood Lumber.
 - .7 CSA O151-09(R2014), Canadian Softwood Plywood.
 - .8 CSA O153-13, Poplar Plywood.
 - .9 CSA O325-07 (R2012), Construction Sheathing.
 - .10 .
- .5 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber 2010.

1.2 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Grading: 120, National Grading Rule for Dimension Lumber.
- .3 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

- .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
 - .1 S2S in accordance with the following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber, 1987 edition.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Post and timbers sizes: "Standard" or better grade.
- .3 Plywood, OSB and wood based composite panels: to CSA O325.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .6 Poplar plywood (PP): to CSA O153, standard construction.

2.2 ACCESSORIES

- .1 Eave protection: Refer to Section 07 31 13 Asphalt Shingles.
- .2 Air Barrier: Refer to Section 07 27 00 Air Barrier.
- .3 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm / 6 mil thick.
- .4 Sealants: in accordance with Section 07 92 00 Joint Sealants.
- .5 Nails, Spikes and Staples: to CSA B111.

- .6 Roof Sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy.
- .7 Fastener Finishes:
 - .1 Galvanizing: use galvanized fasteners for exterior work and interior highly humid areas pressurepreservative, and fire-retardant treated lumber.
 - .2 Stainless steel: use stainless steel alloy for exposed fasteners used for interior hardwood work.
- .8 Wood Preservative:
 - .1 Refer to Section 06 05 73 Wood Treatment for fire-retardant treated wood and preservative-treated wood.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

3.2 PREPARATION

- .1 Treat surfaces of material with wood preservative where indicated in accordance with Section 06 05 73 Wood Treatment.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Confirm compatibility of treated surfaces with adjacent materials. Notify Consultant of unacceptable conditions immediately upon discovery. Proceed with treatment only after approval of adjacent materials are deemed acceptable. Treat material as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 - .2 Wood furring strapping on outside surface of exterior masonry and concrete walls.
 - .3 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.3 PRESSURE TREATED COMPONENTS

- .1 Use preservative pressure treated lumber and plywood within exterior wall and roof systems and at other locations indicated in accordance with Section 06 05 73 Wood Treatment.
- .2 Where it is necessary to cut, bore or otherwise alter pressure treated components in the field, treat cut surfaces with heavy coat of wood preservative in accordance manufacturer's written recommendations.
- .3 Use fire retardant pressure treated plywood at backboards and where plywood is installed on steel stud framed wall, behind gypsum board and parapets extend beyond 600 mm / 2'-0".

3.4 MATERIAL USAGE

- .1 Roof Sheathing:
 - .1 Plywood, DFP or CSP sheathing grade, T&G edge, thickness as required to suit site conditions.
- .2 Exterior Wall Sheathing:
 - .1 Gypsum sheathing: refer to Sections 09 21 16 Gypsum Board Assemblies
- .3 All concealed locations except backboards: DFP or CSP, C grade, square edge, thickness as indicated.
- .4 Electrical equipment mounting boards:
 - .1 Plywood, DFP or CSP, G1S, A grade, square edge 19 mm / 3/4" thick.

3.5 FOAM GASKETS

- .1 Smooth top surface of foundation walls and other areas as indicated to receive foam gaskets to no greater variation than 6 mm / ¼" and brush off loose debris.
- .2 Unroll foam gasket on top surface of foundation wall or fasten to bottom of sill plate on tilt-up wall sections and to all locations indicated to receive foam gasket and tack in place by use of mechanical attachment or adhesive.
- .3 Butt all end and perpendicular joints tightly.
- .4 Pierce foam gaskets tightly around anchor bolt locations and other specified protrusions.
- .5 Set and anchor sill plates to foundation wall and other locations where indicated.

3.6 INSTALLATION

- .1 Install members true to line, levels and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .5 Install roof sheathing in accordance with requirements of OBC.
- .6 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.
- .7 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
 - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.

- .8 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .9 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .10 Install sleepers as indicated.
- .11 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .12 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .13 Countersink bolts where necessary to provide clearance for other work.
- .14 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI/NPA A208.1-09. Particleboard.
 - .2 ANSI/NPA A208.2-09, Medium Density Fibreboard (MDF) for Interior Applications.
 - .3 ANSI/HPVA HP-1-09, American National Standard for Hardwood and Decorative Plywood.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI):
 - .1 Architectural Woodwork Quality Standards, 1st edition, 2014.
- .3 ASTM International:
 - .1 ASTM A 123/A 123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM E84-15a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .5 CSA International:
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O121-08(R2013), Douglas Fir Plywood.
 - .3 CSA O141-05(R2014), Softwood Lumber.
 - .4 CSA O151-09(R2014), Canadian Softwood Plywood.
 - .5 CSA O153-13 Poplar Plywood.
- .6 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber 2010.
- .7 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .3 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .2 Indicate materials, thicknesses, finishes and hardware.
- .3 Samples:
 - .1 Submit for review and acceptance of hardwood.
 - .1 Indicate finish and jointing.
 - .2 Samples may be returned for inclusion into work.
 - .3 Submit duplicate 305 x 305 mm / 12" x 12" samples of hardwood bench material.

1.3 QUALITY ASSURANCE

- .1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).
- .2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.
- .3 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada to CAN/ULC-S104 and CAN/ULC-S105.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wood products from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 General:
 - .1 Provide lumber and panel materials to thicknesses indicated.
 - .2 Provide overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain (buff) balancing sheet.
 - .3 Provide wood grain pattern or solid colour as later selected by Consultant from manufacturers complete colour range.
- .2 Softwood lumber material, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CSA O141.
 - .2 CAN/CSA-Z809 or FSC or SFI certified.
 - .3 NLGA Standard Grading Rules for Canadian Lumber.
 - .4 AWMAC custom grade, moisture content as specified.
 - .5 Machine stress-rated lumber is acceptable.
- .3 Hardwood lumber, moisture content 5 9% or less in accordance:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC premium grade, moisture content as specified.
 - .3 CAN/CSA-Z809 or FSC or SFI certified.
 - .1 AN/CSA-Z809 or FSC or SFI certified.

- .4 Panel Material: urea-formaldehyde free:
 - .1 CAN/CSA-Z809 or FSC.
 - .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .4 Hardwood plywood: to ANSI/HPVA HP-1.
 - .5 Poplar plywood (PP): to CSA O153, standard construction.
 - .6 Particleboard: to ANSI A208.1.
 - .7 Hardboard: to CAN/CGSB-11.3.
 - .8 MDF (medium density fibreboard) core: to ANSI A208.2, thickness as indicated, density 769 kg/m², CAN/CSA-Z809
 - .9 Melamine Component Panels (MCP):
 - .1 Melamine resin impregnated paper, to ANSI A208.1/ASTM E1333, grade M3, density 630-700 Kg/m³, thermal-fused to particleboard core with matching edge binding, sanded, thickness as indicated.
 - .2 Colour (exposed to view, including open shelving): from MCP manufacturer's complete colour range, not more than four (4) colours for entire project. Colours will be solid colours, wood grains and/or metal finishes.

2.2 ACCESSORIES

- .1 Nails and Staples: to CSA B111; galvanized to ASTM A 123/A 123M for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood Screws: plain, type and size to suit application.
- .3 Splines: wood.
- .4 Adhesive and Sealants: in accordance with Section 07 92 00 Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products installation in accordance with manufacturer's written instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Perform finish carpentry to Quality Standards of (AWMAC).
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

- .1 Edge Banding: Install edge banding to all panel material of:
 - .1 Shelving.
 - .2 Gables.
 - .3 Trim.
 - .4 Wall panels.
 - .5 Support brackets.

.2 Fastening:

- .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
- .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
- .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
- .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.3 Standing and Running Trim:

- .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
- .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
- .3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.
- .4 Install door and window trim in single lengths without splicing.

.4 Paneling:

- .1 Secure paneling and perimeter trim using adhesive recommended for purpose by manufacturer. Fill nail holes caused by temporary fixing with filler matching wood in colour.
- .2 Secure paneling and perimeter trim using concealed fasteners.
- .3 Secure paneling and perimeter trim using counter sunk screws plugged with matching wood plugs.

.5 Shelving:

.1 Install shelving on ledgers and shelf brackets as indicated.

.6 Cabinet Hardware:

.1 Install cabinet and miscellaneous hardware as identified in Section 08 70 05 - Cabinet and Miscellaneous Hardware.

.7 Finishing Hardware:

.1 Install finishing hardware as identified in Section 08 71 00 - Door Hardware.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI A208.1-09. Particleboard.
 - .2 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
 - .3 ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.
- .2 ASTM International:
 - .1 ASTM E 1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
 - .2 ASTM D 2832-92(R2011), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .3 ASTM D 5116-10, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI):
 - .1 Architectural Woodwork Quality Standards Illustrated, Edition Two, 2014.
- .4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
 - .2 CAN/CGSB 11.3-M87, Hardboard.
- .5 CSA International:
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O112.10-08 (R2014), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
 - .3 CSA O121-08 (R2014), Douglas Fir Plywood.
 - .4 CSA O141-05(R2014), Softwood Lumber.
 - .5 CSA O151-09 (R2014), Canadian Softwood Plywood.
 - .6 CSA O153-13), Poplar Plywood.
 - .7 CSA-Z809-08, Sustainable Forest Management.
 - .8 CSA Z760-94-(R2001), Life Cycle Assessment.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .7 International Organization for Standardization (ISO):
 - .1 CAN/CSA-ISO 14040-06(R2011), Environmental Management-Life Cycle Assessment Principles and Framework.
 - .2 CAN/CSA-ISO 14041-98(R2003), Environmental Management-Life Cycle Assessment Goal and Scope Definition and Inventory Analysis.
- .8 National Electrical Manufacturers Association (NEMA):
 - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).
- .9 National Hardwood Lumber Association (NHLA):
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.

- .10 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber 2010.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

- .1 Submit shop drawings. Indicate details of construction, profiles, jointing, fastening and other related details.
- .2 Indicate materials, thicknesses, finishes and hardware.
- .3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.4 Samples:

- .1 Submit duplicate samples of hardwood bench top: 305 mm / 12" long unless otherwise specified or requested by Consultant.
- .2 Submit duplicate samples of laminated plastic for colour selection.
- .3 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

1.3 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.
- .3 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 Quality Control.
 - .1 Shop prepare one base cabinet unit, wall cabinet, counter top, and shelving unit, complete with hardware and shop applied finishes, and install where directed by Consultant.
 - .2 Allow 48 hours for inspection of mock-up by Consultant before proceeding with Work.
 - .3 When accepted, mock-up:
 - .1 Will demonstrate minimum standard for Work.
 - .2 May remain as part of finished work to Consultant approval.
 - .4 Do not proceed with work prior to receipt of written acceptance of mock-up by Consultant.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Protect millwork against dampness and damage during and after delivery.

- .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect architectural woodwork from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Softwood Lumber: unless specified otherwise, S4S, moisture content 15 % or less in accordance with following standards:
 - .1 CSA 0141.
 - .2 CAN/CSA-Z809 or FSC or SFI certified.
 - .3 NLGA Standard Grading Rules for Canadian Lumber.
 - .4 AWMAC custom grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Ensure manufacturing process adheres to Lifecycle Assessment (LCA) Standards to ISO 14040/14041 LCA Standards, CSA Z760-94 Life Cycle Assessment.
- .4 Hardwood Lumber: moisture content 5-9% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 CAN/CSA-Z809 or FSC or SFI certified.
 - .3 AWMAC custom grade, moisture content as specified.
- .5 Douglas fir plywood (DFP): to CSA O121, standard construction, CAN/CSA-Z809.
- .6 Canadian softwood plywood (CSP): to CSA O151, standard construction, CAN/CSA-Z809.
- .7 Hardwood plywood: to ANSI/HPVA HP-1, CAN/CSA-Z809.
- .8 Poplar Plywood (PP): to CSA O153, standard construction, CAN/CSA-Z809.
- .9 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, CAN/CSA-Z809
- .10 Birch Plywood: to AWMAC Paint Grade, CAN/CSA-Z809..
- .11 Hardboard:
 - .1 To CAN/CGSB-11.3, CAN/CSA-Z809
 - .2 MDF (medium density fibreboard) core: to ANSI A208.2, thickness as indicated, density 769 kg/m², CAN/CSA-Z809
- .12 Laminated plastic for flatwork: Refer to 06 47 00 Plastic Laminate Finishing.
- .13 Laminated plastic for postforming work: Refer to 06 47 00 Plastic Laminate Finishing.
- .14 Laminated plastic backing sheet: Refer to 06 47 00 Plastic Laminate Finishing.

- .15 Laminated plastic liner sheet: Refer to 06 47 00 Plastic Laminate Finishing.
- .16 Dividers: 19 mm / 3/4" MCP.
- .17 Edge Banding:
 - .1 Matching melamine and polyester overlay edge strip with self-adhesive.
 - .2 Edge filler to provide a smooth surface for paint finish.
- .18 Cabinet Hardware: Refer to Section 08 70 05 Cabinet and Miscellaneous Hardware.
- .19 Tackboard Material (TB1): 6 mm / ¼" thick, manufactured coloured cork laminated to 6 mm / 1/4" particleboard, colour as later selected by Consultant from manufacturer's complete colour range.
 - .1 Acceptable material: Krommenie / Forbo 'Bulletin Board' or approved alternate.
 - .2 Refer to drawings and schedule for locations.
- .20 T-mold (PVC): 38 mm x 5.4 mm / 1-1/2" x 7/32" thick PVC, colour from manufacturer's full colour range.
 - .1 Acceptable material: 'WH 4542WH', by Charter Industries, telephone 1-800-538-9088, or approved alternate.
- .21 Nails and Staples: to CSA B111.
- .22 Wood Screws: plain, type and size to suit application.
- .23 Splines: wood or plastic.
- .24 Sealant: Refer to Section 07 92 00 Joint Sealing.
- .25 Laminated Plastic Adhesive:
 - .1 Adhesive: urea resin adhesive to CSA O112.10, contact adhesive to CAN/CGSB-71.20, resorcinol resin adhesive to CSA O112.10, polyvinyl adhesive to CSA O112.10, two component epoxy thermosetting adhesive.
 - .2 Clear Wood Finishes: Refer to Section 09 91 23 Interior Painting.
 - .3 Paints: Refer to Section 09 91 23 Interior Painting.

2.2 MANUFACTURED UNITS

- .1 Manufactured MCP Units:
 - .1 Fabricate manufactured MCP units from Melamine Component Panels (MCP), unless otherwise noted.
 - .2 Counters:
 - .1 Flat plastic laminate on plywood (DFP) to all areas unless otherwise indicated.
 - .2 Post-formed plastic laminate where indicated.
 - .3 Under counter trims and filler strips: MCP.
 - .4 Kick plate: MDF.
- .2 Counters Without Cabinets:
 - .1 Countertops, nosing and under nosings: plastic laminate on 19 mm / 3/4" plywood (DFP), unless otherwise noted.
 - .2 Intermediate supports, locations as indicated but not more than 914 mm / 3'-0" o/c: MCP brackets as detailed, unless otherwise noted.

- .3 Wall support cleats: MCP, unless otherwise noted.
- .4 End gables: where indicated, MCP, unless otherwise indicated.
- .5 Backsplash: where indicated, same material as countertop.
- .6 Grommets: Locations as indicated.

.3 Lower Cabinet Units:

- .1 Countertops, nosing and under nosing, backsplash and sidesplash: flat plastic laminate on 19 mm / 3/4" plywood (DFP), unless otherwise noted.
- .2 Case body, backs, shelving unit inserts, doors and gables: Plastic laminate on 19 mm / 3/4" plywood (DFP), unless otherwise noted.
- .3 Drawers: fronts, sides, back and bottom from plastic laminate on 19 mm / 3/4" plywood (DFP), unless otherwise noted.
- .4 Kickplate: Plastic laminate on 100 mm x19 mm / 3/4" plywood (DFP), unless otherwise noted.

.4 Upper Cabinet Units:

.1 Case body, backs, shelving unit inserts, doors and gables: Plastic laminate on 19 mm / 3/4" plywood (DFP), unless otherwise noted.

.5 Bench tops:

.1 Bench Top (Seat): Solid maple.

.6 Closets:

- .1 Closet Shelf, apron cleats and intermediate support brackets: MDF, painted.
- .2 Closet Valance at Door:
 - .1 Plastic laminate 19 mm / 3/4" plywood (DFP) (all sides).
 - .2 Provide blocking as required.
- .3 Closet rod: refer to Section 08 70 05 Cabinet and Miscellaneous Hardware.

.7 Storage Units:

.1 Case body and shelves: Plastic laminate on 19 mm / 3/4" plywood (DFP), unless otherwise noted.

2.3 FABRICATION

- .1 Install architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), Custom grade except where specified otherwise.
- .2 Edge banding: Install edge banding to all panel material of:
 - .1 Case bodies.
 - .2 Shelving.
 - .3 Gables.
 - .4 Doors, drawer fronts, and false panels.
 - .5 Trim.
 - .6 Wall panels.
 - .7 Under counter skirts.
 - .8 Support brackets.
- .3 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.

- .4 Shop install cabinet hardware for doors, shelves, and drawers. Recess shelf standards unless noted otherwise.
- .5 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .6 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .7 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .8 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .9 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .10 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3660 mm / 12'-0". Keep joints 610 mm / 2'-0" from sink cutouts.
- .11 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .12 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .13 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .14 Apply laminated plastic liner sheet to interior of cabinetry.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.
 - .1 Visually inspect substrate prior to commencing with Work of this section.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Do architectural woodwork to Quality Standards of AWMAC.
- .2 Install prefinished millwork at locations shown on drawings.
 - .1 Position accurately, level, plumb straight.
- .3 Fasten and anchor millwork securely.
 - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.

- .4 Use draw bolts in countertop joints.
- .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.
- .7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
- .8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .9 Install prefinished aluminum grille where indicated as per manufacturer's written instructions.
- .10 Site apply laminated plastic to units as required.
 - .1 Adhere laminated plastic over entire surface.
 - .2 Make corners with hairline joints.
 - .3 Use full sized laminate sheets.
 - .4 Make joints only where indicated and/or approved by Consultant.
 - .5 Slightly bevel arises.
- .11 For site application, offset joints in plastic laminate facing from joints in core.
- .12 Apply joint sealant in accordance with Section 07 92 00 Joint Sealants.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces. Remove excess glue from surfaces.

3.4 PROTECTION

- .1 Protect millwork and cabinet work from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI 208.1-09, Particleboard.
- .2 ASTM International:
 - .1 ASTM D 2832-92(R2011), Standard Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.
 - .2 ASTM D 2369-10(2015)e1, Standard Test Method for Volatile Content of Coatings.
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI):
 - .1 Architectural Woodwork Quality Standards Illustrated, Edition 2, 2014.
- .4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .5 CSA International:
 - .1 CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
 - .2 CSA O121-08(R2013), Douglas Fir Plywood.
 - .3 CSA O151-09(R2013), Canadian Softwood Plywood.
 - .4 CSA O153-13, Poplar Plywood.
 - .5 CSA-Z809-08, Sustainable Forest Management.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .7 National Electrical Manufacturers Association (NEMA):
 - .1 ANSI/NEMA LD-3-05, High Pressure Decorative Laminates (HPDL).
- .8 Scientific Equipment and Furniture Association (SEFA):
 - .1 SEFA 8-99, Laboratory Furniture.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for laminate, adhesive, and core materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Submit duplicate samples of joints, edging, cutouts and post-formed profiles.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for laminate work for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect laminate, adhesive, and core materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 Manufacturer:
 - .1 Products by Wilsonart, Formica or Arborite will be acceptable unless otherwise indicated.
 - .1 Should an alternate product to these be specified, provide only the specified product or an approved alternate.

2.2 MATERIALS

- .1 Laminated plastic for general flatwork: to NEMA LD3.
 - .1 Laminated plastic for horizontal flatwork:
 - .1 Type: general purpose.
 - .2 Grade: HGS.
 - .3 Thickness: 1.2 mm / 0.039" thick.
 - .4 Standard of Acceptance: 'Type 107' General Purpose Laminate.
 - .2 Laminated plastic for vertical flatwork:
 - .1 Type: vertical surface.
 - .2 Grade: VGS.
 - .3 Thickness: 0.77 mm / 0.030" thick.

- .4 Standard of Acceptance: 'Type 335' Vertical Surface Laminate.
- .3 Pattern: Not more than four (4) colours as later selected by Consultant.
- .2 Laminated plastic for post-forming work: to NEMA LD3.
 - .1 Type: post-forming.
 - .2 Pattern: Not more than four (4) colours as later selected by Consultant.
- .3 Plywood Core: DFP, Forestry Stewardship Council (FSC) certified, solid two sides, 19 mm thick.
 - .1 CAN/CSA-Z809
- .4 Particleboard Core: to ANSI 208.1, Grade, sanded faces, Forestry Stewardship Council (FSC) certified, Urea-formaldehyde free, of thickness indicated.
 - .1 CAN/CSA-Z809.
- .5 Laminated plastic adhesive: As recommended by manufacturer.
- .6 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
- .7 Sealants: Refer to Section 07 92 00 Joint Sealants.
- .8 Draw bolts and splines: as recommended by fabricator.

2.3 FABRICATION

- .1 Comply with NEMA LD3, Annex A.
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3660 mm / 12'-0". Keep joints 610 mm / 2'-0" from sink cutouts.
- .5 Form shaped profiles and bends as indicated, using post-forming grade laminate to laminate manufacturer's instructions.
- .6 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .7 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .8 Apply laminated plastic liner sheet to interior of cabinetry unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for laminate, adhesive, and core materials installation in accordance with manufacturer's written instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm / 18" on centre, 75 mm / 3" from edge. Make flush hairline joints.
- .4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.
- .6 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated on reviewed shop drawings. Slightly bevel rises.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning:
 - .1 Clean to NEMA LD3. Annex B.
 - .2 Remove traces of primer, caulking, epoxy and filler materials and clean doors and frames.

3.5 PROTECTION

- .1 Cover finished laminated veneered surfaces with heavy kraft paper or put in cartons during shipment.
- .2 Protect installed laminated surfaces in accordance with manufacturer's written recommendations.
 - .1 Remove protection only immediately before final inspection.
- .3 Protect installed products and components from damage during construction.
- .4 Repair damage to adjacent materials caused by laminate, adhesive, and core materials installation.

END OF SECTION

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PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C 208-12, Specification for Cellulosic Fiber Insulating Board.
 - .2 ASTM C 591- 15, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - .3 ASTM C 612- 14, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
 - .4 ASTM C 726-12, Standard Specification for Mineral Fiber Roof Insulation Board.
 - .5 ASTM C 728-15, Standard Specification for Perlite Thermal Insulation Board.
 - .6 ASTM C 1126-15, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .7 ASTM C 1289-15, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - .8 ASTM E 96/E 96M-14, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .3 CSA Group:
 - .1 CSA B149 PACKAGE-15, Consists of B149.1, Natural Gas and Propane Installation Code and B149.2, Propane Storage and Handling Code.
- Health Canada/Workplace Hazardous Materials Information System (WHMIS). .4
- .5 Material Safety Data Sheets (MSDS). Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S102-10. Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S604-2012, Standard for Type A Chimneys.
 - .3 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - .4 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
 - .5 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.2 **ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- Product Data: .2
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 **DELIVERY, STORAGE AND HANDLING**

Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product .1 Requirements and with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified material from damage.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 INSULATION

- .1 Extruded polystyrene (XPS) for frost protection, foundation walls and cavity walls where indicated:
 - .1 Compliance: Closed cell, Type: 4 to CAN/ULC-S701.
 - .2 Compressive strength: 30 psi (210kPa).
 - .3 Thickness: as indicated.
 - .4 R-Value/inch (25.4 mm / 1"): RSI 0.88/R5.0.
 - .5 Size: total thickness indicated width to suit application.
 - .6 Edges: ship lapped for foundation walls and frost protection and below slabs.
 - .7 Acceptable materials: 'Styrofoam Brand SM', by Dow, or equivalent by Owens Corning, or approved alternate.
- .2 Stone/Mineral Wool Insulation for Exterior Cavity Walls:
 - .1 Compliance: ASTM C612 Type IVB and CAN/ULC-S702 Type 1 mineral fiber insulation.
 - .2 Fire Performance: ASTM E136 and CAN4 S114, non-combustible.
 - .3 Fire Performance, Surface Burning Characteristics: ASTM E84 (UL 723) and CAN/ULC S102, flame spread 0 and smoke developed 0.
 - .4 Water Vapor Transmission: ASTM E96: 27.2 to 33.1 perms (1555 to 1895 mg Pa.s.m²).
 - .5 Moisture Resistance: ASTM C1104, moisture sorption of: 0.03 to 0.07 percent.
 - .6 Thermal Resistance to ASTM C518 (C177),
 - .1 R-value of 4.2 to 4.3 per inch at 75 degrees F (RSI value 0.74 to 0.76 m m2K/W at 24 degrees C).
 - .7 Corrosive Resistance: ASTM C665, Corrosiveness to Steel Pass, ASTM C795, Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692.
 - .8 Density to ASTM C612, from 3.4 to 6.2 lbs/ft³ (70 kg/m³).
 - .9 Thickness: as indicated on drawings.
 - .10 Dimensions: to suit application.
 - .11 Acceptable material as required to suit thickness indicated:
 - .1 'CavityRock MD' or 'CavityRock DD' by Roxul Inc., or approved alternate.

2.2 ADHESIVE

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24.
 - .1 Acceptable product: Air-Bloc 21', by Henry Bakor, or approved alternate.

2.3 ACCESSORIES

- .1 Insulation Fasteners: mechanically driven insulation fasteners fabricated from high density polyethylene plastic, complete with zinc plated pin, holding diameter and fastener depth as recommended by manufacture to suit substrate, insulation type and thickness.
 - .1 Acceptable product: 'Ramset Insulfast Fastener' by Ramset, 'Grid-Mate PB Mechanical Fasteners' by Grid-Mate, or approved alternate.

PART 3- EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Prior to commencement of work ensure:
 - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 INSTALLATION

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm/3" from heat emitting devices such as recessed light fixtures, and minimum 50 mm/2" from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 vents.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been reviewed and accepted by Consultant.

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3.4 PERIMETER FOUNDATION INSULATION

- .1 Interior application: extend boards vertically below bottom of finish floor slab as indicated, installed on inside face of perimeter foundation walls.
- .2 Under slab application: extend from perimeter foundation wall as indicated. Lay boards on level compacted fill.

3.5 ROOF INSTALLATION

.1 Refer to Section 07 52 00 - Modified Bituminous Membrane Roofing.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C 553-13, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 ASTM C 665-12, Specification for Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - .3 ASTM C 1320-10, Standard Practice for Installation of Mineral Fibre Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canadian Gas Association (CGA):
 - .1 CSA ONT GAS CODE 1996 Ontario Gas Utilization Code, 1996 (Includes Energy Act, Regulation and CAN/CGA-B149.1-M95).
 - .2 CSA ONT PROPANE CODE 1996 Ontario Propane Code, 1996 (Includes Ontario Energy Act and Regulation and CAN/CGA-B149.2-M95).
- .3 Canadian Standards Association (CSA International):
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S604-M1991 (R2003, Type A Chimneys.
 - .2 CAN/ULC-S702-14, Standard for Mineral Fibre Insulation.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for blanket insulation and include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from damage.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 INSULATION

- .1 Stone/Mineral Wool Fibre Thermal Insulation for Exterior Stud Walls:
 - .1 Compliance: CAN/ULC-S702 Type 1 mineral fibre insulation.
 - .2 CCMC Evaluation Listing: 07210: Mineral Fibre Batt Insulation.
 - .3 Fire Performance: CAN4 S114, non-combustible.
 - .4 Fire Performance, Surface Burning Characteristics: ASTM E84 (UL 723) and CAN/ULC S102, flame spread 0 and smoke developed less than 5.
 - .5 Thermal Resistance:
 - .1 R-value of 9.5 (RSI 1.68) for 64 mm / 2 1/2".
 - .2 R-value of 13 (RSI 2.3) 89 mm / 3 1/2".
 - .3 R-value of 22 (RSI 3.96) 152 mm / 6".
 - .6 Certification: Greenguard indoor air quality certified.
 - .7 Density: to suit R-value.
 - .8 Dimensions: to suit stud type and spacing.
 - .9 Thickness: as indicated.
 - .10 Acceptable material: 'ComfortBatt' by Roxul Inc., or approved alternate.
- .2 Stone/Mineral Wool Interior Acoustic and Fire-Rated Partitions:
 - .1 Compliance: ASTM C612 Type 1, ASTM C665 Type 1, CAN/ULC-S702 Type 1, UL and ULC Design Numbers.
 - .2 Fire Performance: ASTM E136 and CAN4 S114, non-combustible.
 - .3 Fire Performance Surface Burning Characteristics: ASTM E84 (UL 723) and CAN/ULC S102, flame spread 0 and smoke developed 0.
 - .4 CAN/ULC S129 Smolder Resistance 0.09 percent.
 - .5 Air Erosion: UL 181, maximum air velocity 1000 fpm (5.08 m/s).
 - .6 Thermal Resistance: R-value of 4.1 per inch at 75 degrees F (RSI value 0.72 m2K/W at 24 degrees C).
 - .7 Acoustic Performance: ASTM E90, ASTM E413, ASTM C423, ASTM E1050.
 - .8 Corrosive Resistance: ASTM C665, Corrosiveness to Steel Pass, ASTM C795, Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692.
 - .9 Certification: Greenguard Indoor air quality certified.
 - .10 Density: ASTM C612, 2.8 lbs/ft3 (45 kg/m³).
 - .11 Dimensions: to suit application.
 - .12 Thickness: as indicated.
 - .13 Acceptable material: 'Roxul AFB Acoustical Fire Batts' by ROXUL Inc., or approved alternate.

2.2 ACCESSORIES

- .1 Insulation clips:
 - .1 Impale type, perforated 50 x 50 mm / 2" x 2" cold rolled carbon steel 0.8 mm / 0.03" thick, adhesive back, spindle of 2.5 mm / 3/32" diameter annealed steel, length to suit insulation, 25 mm / 1" diameter washers of self-locking type.
- .2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.

- .3 Staples: 12 mm / 1/2" minimum leg.
- .4 Tape: as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation application in accordance with manufacturer's written instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C 1320.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of sound ratings are maintained in partitions identified with STC ratings.
- .4 Do not compress insulation to fit into spaces.
- .5 Keep insulation minimum 75 mm / 3" from heat emitting devices such as recessed light fixtures, and minimum 50 mm / 2" from sidewalls of CAN/ULC-S604 Type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 vents.
- .6 Do not enclose insulation until it has been inspected and approved by Consultant.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.

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.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.
 - .2 ASTM C518-10, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - .3 ASTM C1338-14, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - .4 ASTM D1621-10, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - .5 ASTM D1622/D1622M-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - .6 ASTM D1623-09, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics (Type C sample).
 - .7 ASTM D2126-09, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - .8 ASTM D2369-10(2015), Standard Test Method for Volatile Content of Coatings.
 - .9 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
 - .10 ASTM D6226-10, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
 - .11 ASTM E96/E96M-14, Standard Test Methods for Water Vapor Transmission of Materials.
- .2 Canadian Urethane Foam Contractors' Association Inc. (CUFCA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .4 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S101-14, Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC-S127-14 Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Building Materials.
 - .4 CAN/ULC-S705.1-15, Standard for Thermal Insulation Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.
 - .5 CAN/ULC-S705.2-05, Standard for Thermal Insulation Spray Applied Rigid Polyurethane Foam, Medium Density, Application.
 - .6 CAN/ULC-S770-15 Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams.
 - .7 CAN/ULC-S774-09(R2014) Standard Laboratory Guide for the Determination of Volatile Organic Compound Emissions from Polyurethane Foam.
 - .8 Canadian Construction Materials Centre (CCMC) Evaluation Report CCMC 13588-L.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit copy of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

1.3 QUALITY ASSURANCE

- .1 Applicators to conform to manufacturer's quality assurance program.
- .2 Qualifications:
 - .1 Installer: person specializing in sprayed insulation installations with 5 years of experience.
 - .2 Applicator's qualifications: trained and experienced in application of spray urethane insulation, and be approved by system manufacturer.
 - .3 Manufacturer: company with minimum 5 years' experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.
- .3 Keep copy on site of spray foam manufacturer's current installation instructions and the manufacturer's installation manual or guide for transition membrane installation. Strictly follow manufacturer's instructions.
- .4 Health and Safety Requirements, Worker Protection:
 - .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
 - .2 Workers must wear gloves, respirators, long sleeved clothing, and eye protection when applying foam insulation.
 - .3 Workers must not eat, drink, or smoke while applying foam insulation.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

- .1 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .2 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .3 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Insulation:
 - .1 Spray polyurethane to CAN/ULC-S705.1.
 - .2 Performance Requirements:
 - .1 Water Vapour Permeance ASTM E96:41 ng/ Pa-s-sq m (0.70 Perms).
 - .2 Flame Spread Classification CAN/ULC S102: Flame Spread < 500.
 - .3 Hot Surface Performance ASTM C411: Passed when exposed to 93 degree C for 96 hours.
 - .4 Fungi Resistance ASTM C1338: No fungal growth after 28 day incubation.
 - .5 Long Term Thermal Resistance (LTTR): Conform to the following when tested to CAN/ULC S770.
 - .1 RSI 0.9 @ 25.4 mm/R5.1 @ 1 inch.
 - .2 RSI 1.9 @ 50.8 mm/R10.8 @ 2 inches.
 - .3 RSI 2.9 @ 76.2 mm/R16.5 @ 3 inches.
 - .4 RSI 4.0 @ 100 mm/R22.7 @ 4 inches.
 - .6 Physical Requirements:
 - .1 Colour: manufacturer's standard colour with Indicator Dye Technology.
 - .2 Density ASTM D1622: Minimum 28.9 kg/cu m (1.8 lb/cu ft).
 - .3 Compressive Strength ASTM D1621: 201 kPa (29.2 psi).
 - .4 Tensile Strength ASTM D1623:325 kPa (47.1 psi).
 - .5 Open Cell Content ASTM DD2856:6.0 %.
 - .6 Water Absorption ASTM D2842:0.6 % by volume.
 - .7 Sustainable Requirements:
 - .1 Zero ozone depleting blowing agents.
 - .2 Minimum Recycled Content: EcoLogo certified; >5% by weight.
 - .3 Eco-efficiency analysis: life cycle assessment approved by NSF or equivalent.
 - .8 Use spray foam from the following family of insulation types as per manufacturer's written recommendations to suit appropriate temperature range:
 - .1 Acceptable Products:
 - .1 'Foamsulate-Eco' by Premium Spray Products Canada Hesterman Technical Services Inc.
 - .2 'Polar Foam 7300' by Polyurethane Foam Systems Inc.
 - .3 'ProSeal (MD-C-200v3)' by Icynene.
 - .4 'Styrofoam Brand SPF CA' by Dow.
 - .5 'Walltite Eco' by BASF Canada.
 - .6 Or approved alternate.
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
- .3 Expansion/Deflection Joint Angles: Preformed angle comprising at least 0.5 mm/26 ga. steel core zinc coating, as stipulated in ASTM A653/A653M (galvanized steel G-90).

2.2 EQUIPMENT

.1 Comply with CAN/ULC S705.2 and the equipment manufacturer's recommendations for specific type of application.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sprayed insulation application accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 APPLICATION

- .1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.
- .2 Use primer where recommended by manufacturer.
- .3 Apply sprayed foam insulation in thickness as required to meet indicated minium R-Value.
- .4 Apply insulation to substrate free of all frost, high moisture content, dust, oil, grease, oxidization, or any other element that may affect this property.
- .5 Ensure metallic surfaces are free of oxidization. Apply primer in accordance with manufacturer's written instructions.
- .6 Do not apply spray foam insulation until the following Work is complete:
 - .1 Anchoring for exterior ladder to existing masonry.
 - .2 Primer where recommended by manufacturer.
 - .3 Transition Membrane and Thru-Wall Flashing Membrane is fully installed and reviewed by Consultant.
 - .4 Furring, blocking, and preparation work for window and door frames and mechanical metal louvers.
 - .5 Sub-girt clip angles and sub-girt framing angle for exterior cladding.
 - .6 Sheet Metal Vertical and Horizontal fire stopping.
 - .7 Mechanical and electrical work.
 - .8 Adjacent areas have been protected with drop sheets and/or masking tape to adjacent surfaces.
- .7 Apply sprayed foam insulation in consecutive layers not less than 12.5 mm /½" and no more than 50 mm /2" thick, for a total thickness as indicated.

- .8 Do not spray foam over expansion and deflection joints. Install 0.5 mm /26 ga. sheet metal angle 75 mm /3" wide x total foam insulation thickness on both sides of joints and install continuous strip of 25% compressed continuous mineral wool insulation in thickness to match depth of spray foam between angles to absorb deflections.
- .9 Apply spray foam to a maximum tolerance of +6 mm /¼" in relation to the specified thickness.
- .10 Avoid formation of sub-layer air pockets during spray foam application.
- .11 Avoid overspray foam to surfaces other than those indicated. Use drop sheets and/or masking tape to protect adjacent surfaces.
- .12 Remove overspray from non-prescribed surfaces once the foam has hardened. Do not damage adjacent surfaces. Assume responsibility for repair should adjacent surfaces become damaged during removal of overspray.
- .13 Upon completion of spray foam insulation, remove drop sheets and masking tape and protect spray foam work from other trades.
- .14 Complete subsequent coverage to applied insulating foam within the manufacturer's prescribed timeframe.
- .15 Apply spray foam in overlapping layers, to obtain a smooth, uniform surface.
- .16 Apply spray applied foam as follows to areas exceeding 30 lineal metres in either direction:
 - .1 Apply first layer in 3 m/10'-0" strips at 1 m/3' intervals. Following a curing period of \pm four (4) hours, spray foam to all unfilled spaces.
 - .2 In cold weather follow same procedure, for a minimum surface area of 15 lineal metres / 50'.
- .17 Do not spray foam any closer than 75 mm /3" from chimneys, heating vents, steam pipes, recessed lighting fixtures, and other heat sources. Do not spray insides of any exit openings or electrical junction boxes.
- .18 In temperatures below +10°C, mechanically adjusted transition membranes to manufacturer's written instructions.
- .19 Cover all mechanical fixtures with spray applied foam to reduce thermal bridges by means of galvanized spring clip for drywall, screwed 200 mm /8" through the membrane.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM E 1745-11, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - .2 ASTM E154/E154M-08A (2013)e1, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .3 ASTM E96/E96M-14, Standard Test Methods for Water Vapor Transmission of Materials.
 - .4 ASTM F 1249-13, Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
 - .5 ASTM E 1643-11, Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
- .2 American Concrete Institute (ACI):
 - .1 ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
- .4 Vapour Barrier / Vapour Retarder definition: the terms vapour barrier and vapour retarder are to be considered as one in the same throughout these documents.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Mock-Ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 Quality Control.
 - .2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box.
 - .3 Mock-up will be used to judge workmanship, substrate preparation, and material application.
 - .4 Locate where directed.
 - .5 Allow 48 hours for inspection of mock-up by Consultant before proceeding with vapour barrier work
 - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work to the approval of the Consultant.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 – PRODUCTS

2.1 SHEET VAPOUR BARRIER

- .1 Under Slab-On Grade Vapour Retarder:
 - .1 Plastic Vapour Retarder: from polyolefin resins puncture resistant, to ASTM E1745:
 - .1 Permeance: less than 0.01 Perms in accordance with ASTM E1745.
 - .2 Strength: ASTM E 1745 Class A.
 - .3 Thickness: [0.381] mm / [15] mil thick minimum.
 - .4 Joint Sealing Tape: self-adhesive tape plastic vapour retarder manufacturer for sealing vapour retarder seams and attachment to footings, protrusions, 100 mm / 4" wide.
 - .5 Acceptable products:
 - .1 Sheet Vapour Barrier: 'Stego Wrap Vapor Barrier' by Stego Industries, or 'Perminator' by W.R. Meadows.
 - .2 Vapour Barrier Tape: 'Stego Tape' by Stego Industries, or 'Perminator Tape' by W.R. Meadows.
- .2 Exterior Wall and Ceiling Vapour Retarder:
 - .1 Polyethylene film: to CAN/CGSB-51.34, 6 mil thick.
 - .2 Joint Sealing tape: to CCMC #11862-R, 75 mm / 3" wide 'Construction.
 - .1 Acceptable Product: Sheathing Tape 8808' by 3M, or approved alternate.
 - .3 Aluminum foil tape: 5 mil nominal dead soft aluminum foil backing combined with a transparent acrylic adhesive.
 - .1 Acceptable material: 'Aluminum Foil Tape', by 3M or approved alternate.
- .3 For rigid insulation, refer to Section 07 21 13 Board Insulation.
- .4 For batt insulation, refer to Section 07 21 16 Blanket Insulation.
- .5 For air barrier, refer to Section 072700 Air Barriers.
- .6 For rigid insulation in modified bituminous roofing, refer to Section 07 52 00 Modified Bituminous Membrane Roofing.

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2.2 ACCESSORIES

- .1 Sealant: Refer to Section 07 92 00 Joint Sealants.
- .2 Staples: minimum 6 mm leg.
- .3 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vapour retarder installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

- .1 Ensure services are installed and inspected prior to installation of retarder.
- .2 Install sheet vapour retarder on warm side of exterior assemblies prior to installation of gypsum board to form continuous retarder.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.3 UNDER SLAB VAPOUR BARRIER

- .1 Install sheet vapour barrier over insulation granular subbase to entire interior concrete floor slab, unless otherwise indicated.
- .2 Cut sheet vapour barrier to form complete coverage. Lap sheet vapour over footings and onto vertical wall surface and seal joint with tape.
- .3 Overlap all both lateral and butt joints 150 mm / 6" and seal with Joint Sealing Tape. Ensure tape area is free from dust, dirt and moisture prior to placing tape.
- .4 Prior to placing concrete slab, repair all damaged areas to manufactures recommendations.
- .5 Do not permit concrete floor finishers to puncture sheet vapour barrier.

3.4 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.5 PERIMETER SEALS

- .1 Seal perimeter of sheet vapour barrier as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 LAP JOINT SEALS

- .1 Seal lap joints of sheet vapour barrier as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm / 6" and press into sealant bead.
 - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.7 ELECTRICAL BOXES

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 Install moulded box vapour barrier.
 - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Construction Documents Committee:
 - .1 CCDC 2-94, Stipulated Price Contract.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
 - .2 CAN/CGSB-19.24M-M90, Multi-Component, Chemical Curing Sealing Compound.
 - .3 CGSB 19-GP-14M-84, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .3 Sealant and Waterproofer's Institute Sealant and Caulking Guide Specification.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Mock-Up:
 - .1 Construct mock-up in accordance with Section 01 45 00 Quality Control.
 - .2 Construct typical exterior wall panel, incorporating window and frame and sill, insulation, building corner condition, junction with roof system and; illustrating materials interface and seals.
 - .3 Locate where directed by Consultant.
 - .4 Mock-up may remain as part of finished work for Consultant approval.
 - .5 Allow 48 hours for inspection of mock-up by Consultant before proceeding with air/vapour barrier Work.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Avoid spillage: immediately notify Consultant if spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.

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1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.6 COORDINATION

.1 Ensure continuity of the water resistive air barrier throughout the scope of this section.

1.7 AMBIENT CONDITIONS

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.8 SEQUENCING

- .1 Sequence work in accordance with Section 01 32 16 Construction Progress Schedules Bar (GANTT) Charts.
- .2 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.9 WARRANTY

- .1 Provide manufacturer's standard 12-year assembly warranty under provisions of Section 01 78 00 Closeout Submittals and in accordance with General Conditions (GC) CCDC 2 GC 12.3.
- .2 Warranty: include coverage of installed sealant and sheet materials which:
 - .1 Fail to achieve air tight and watertight seal.
 - .2 Exhibit loss of adhesion or cohesion.
 - .3 Do not cure.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

- .1 Self-Adhered Air Barrier Membrane:
 - .1 Primary water resistive air barrier membrane and window flashing, self-adhering reinforced modified polyolefin tri-laminate sheet air barrier membrane for wall construction, specifically designed to be water resistant and vapour permeable with adhesive backing protected with

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release film to the following physical properties:

- .1 Air leakage: <0.02L/s/m² @ 75Pa <0.004 CFM/ft² @ 1.57 lbs/ft² when tested in accordance with ASTM E 2178.
- .2 Water Vapour Permeance: 1658 ng/Pa.m².s (29 perms) to ASTM E96, Method B Desiccant Method.
- .3 Tested to ASTM E 2357 for Air Leakage of Air Barrier Assemblies.
- .4 Resistance to Water Penetration: Pass ICC-ES AC 38.
- .5 Water Penetration Resistance around Nails: Pass when tested to AAMA 711-05 & ASTM D 1970 modified.
- .6 Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84: Flame Spread Rating of 0 and Smoke Development Classification of 105.
- .7 Basis Weight: 120 g/m², when tested in accordance with TAPPI Test Method T-410.
- .8 Tensile Strength: 182N MD and 129N CD per ASTM D828.
- .9 Average Dry Breaking Force: 565N MD, and 405N CD per ASTM D 5034.
- .10 Cyclic and Elongation: Pass at 100 cycles, -29 degree C. per ICC-ES AC 48.
- .11 Acceptable Product: 'Blueskin VPTM 160' as manufactured by Henry Bakor, or approved alternate.
- .2 Transition Membrane:
 - .1 Transition Sheet Membrane (For use with spray polyurethane insulation, refer to Section 07 21 29 Sprayed Insulation Polyurethane Foam):
 - .2 Plain: 1.0 mm/0.04" thick, 457 mm/18" wide modified bitumen membrane, reinforced.
- .3 Acceptable Product: 'Blueskin SA', by Bakor or 'Sopraseal 60', by Soprema, or approved alternate.
- .4 Membrane Flashings:
 - .1 Rubberized reinforced asphalt compound, self-adhered membrane, 1.0 mm thick, width to suit application.
 - .1 Acceptable Product: "Blueskin TWF" by Bakor, or approved alternate.

2.2 SEALANTS

.1 Sealants in accordance with Section 07 92 00 - Joint Sealants.

2.3 ACCESSORIES

- .1 Adhesive Primer: To manufacturer's written recommendations.
- .2 Membrane flashings:
 - .1 Rubberized reinforced asphalt compound, self-adhered membrane, 1.0mm thick, width to suite application.
 - .1 Acceptable Product: "Blueskin TWF" by Bakor, or approved alternate.
- .3 Termination Sealant: a moisture cure, medium modulus polymer modified sealing compound to ASTM C920 Type S, Grade NS, Class 25.
 - .1 Acceptable Products: 'HE925 BES Sealant' manufactured by Henry Bakor, or approved alternate.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, and continuous and comply with air barrier manufacturer's requirements.
- .3 Report unsatisfactory conditions to Consultant in writing.
- .4 Do not start work until deficiencies have been corrected.
 - .1 Beginning of Work implies acceptance of conditions.

3.3 PREPARATION

- .1 Remove loose or foreign matter, which might impair adhesion of materials.
- .2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.
- .6 Install Through-Wall Flashing Membrane over all foundations and shelf angles to receive exterior masonry and to other areas as indicated. Lap flashing membrane 300 mm vertically onto wall surface and over entire horizontal surface. Trim back all exposed to view membrane upon completion of exterior cladding.
- .7 Install flashings as per Section 04 05 00 Common Work Results for Masonry.

3.4 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions.
 - Secure Air Barrier where indicated with adhesive or tape. Caulk with acoustic sealant to ensure complete seal. Position lap seal over firm bearing.
- .2 Install Air Barrier, between flashings at roof membrane and adjacent parapet and seal materials with acoustic sealant. Caulk to ensure complete seal. Position lap seal over firm bearing, as indicated.

- .3 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- .4 Parapet and Roof Junction: Lap Air Barrier 150 mm/6" with firm bearing to adjacent membranes. Seal Air Barrier to roof membrane with continuous bead of acoustic sealant Seal all joints in parapet and roof junction with tape. Provide continuous airtight seal.

3.5 INSTALLATION OF SELF-ADHERED AIR BARRIER MEMBRANE

- .1 Adhesive Primer for Primary Water Resistive Air Barrier Membrane:
 - .1 Conditions not typically requiring adhesive-primers: Application above 5°C to clean and dry substrate. Ensure substrate and membrane temperatures are above 5°C.
 - .2 Conditions requiring use of adhesive-primers:
 - .1 Metal, gypsum sheathing, concrete, concrete unit masonry, and other masonry substrates.
 - .2 Should appropriate adhesion not be obtained due to conditions beyond the control of the installer, the adhesion may be aided by continuous application of adhesive-primer to the substrate and laps. Ensure all primed surfaces are covered in same day.

.2 Inside and Outside Corners:

- .1 Seal inside and outside corners of sheathing boards with a strip of self-adhering vapour permeable membrane extending a minimum of 75 mm/3" on either side of corner.
- .2 For inside corners, pre-treat the corner with a continuous 13 mm/½" bead of termination sealant.
- .3 Adhesive prime surfaces where indicated to achieve surface adhesion as per manufacturers' instructions.
- .4 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm/2" minimum overlap at all side laps and 75 mm/3" minimum overlap at all end laps of membrane.
- .5 Roll all laps and membrane with a counter top roller to ensure seal.

.3 Transition Areas:

.1 Tie-in to structural beams, columns, floor slabs, and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhered air barrier transition membrane in accordance with Section 07 27 00 - Air/Vapour Barriers.

.4 Windows, Doors and Rough Openings:

- .1 Place transition membrane in accordance with Section 07 27 00 Air/Vapour Barriers across window sills. Pre-treat inside corners with a bead of termination sealant. Install window sill pan membrane and end dam terminations, seal cuts and terminations with termination sealant per window manufacturer's instructions and ASTM E 2112.
- .2 Wrap head and jamb of rough openings with transition membrane as detailed.
- .3 Extend specified self-adhered air barrier membrane into rough window openings sufficient to provide a connection to interior vapour retarder.
 - .1 Prime surfaces where indicated to achieve surface adhesion as per manufacturers' instructions.
 - .2 Align and position transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm/2" overlap at all side laps and 75 mm/3" overlap at all end laps of membrane
 - .3 Roll all laps and membrane with a counter top roller to ensure seal.

- .5 Through-Wall Flashing Membrane:
 - .1 Apply through-wall flashing membrane along the base of masonry veneer walls and over lintels as detailed.
 - .2 Prime surfaces and allow to dry, press membrane firmly into place, overlap minimum 50 mm /2" at all side and end laps. Promptly roll all laps and membrane to ensure the seal.
 - .3 Form continuous flashing membrane and extend up back-up wall minimum of 200 mm /8".
 - .4 Seal the top edge of the membrane where it meets substrate using termination sealant. Trowelapply a feathered edge to seal termination to shed water.
 - .5 Install through-wall flashing membrane and extend 13 mm /½" from outside edge of veneer. Provide "end dam" flashing as detailed.

.6 Sheet Air Barrier Installation:

- .1 Apply self-adhering sheet air barrier membrane complete and continuous to substrate in an overlapping shingle fashion in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
- .2 Prime surfaces where indicated to achieve surface adhesion as per manufacturers' instructions and allow to dry.
- .3 Align and position self-adhering membrane to substrate, remove top panel of protective release film and press firmly into place.
- .4 Ensure alignment, hold membrane in place to avoid wrinkles and sequentially remove remaining panels of protective film and press firmly into place.
- .5 Ensure minimum 75 mm /3" overlap at all end and 50 mm /3" side laps of subsequent membrane applications.
- .6 Apply pressure to all membrane surfaces, laps, and flashings using an appropriate roller to provide best possible surface adhesion.
- .7 At the end of each day's work seal the top edge of the membrane where it meets the substrate with termination sealant. Trowel to a feathered edge to seal termination and shed water.

.7 Application of Termination Sealant:

.1 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the sheet air barrier membrane and around perimeter edge of membrane terminations at window and door frames with termination sealant.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.7 PROTECTION OF WORK

- .1 Protect finished work in accordance with Section 01 61 00 Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Permit damp substrates to dry. Do not expose the backside of the substrate to moisture or rain.

- .4 Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed air barrier installations.
- Water resistive air barrier membranes are not designed for permanent exposure. Cover as soon as .5 possible. Do not exceed 150 day exposure to the elements.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-37.4-M89, Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing.
 - .2 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
 - .3 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .4 CAN/CGSB-51.34-M86, Vapour Barrier Polyethylene Sheet, for Use in Building Construction.
- .2 Canadian Roofing Contractors' Association (CRCA):
 - .1 CRCA Roofing Specification Manual 1997.
- .3 CSA International:
 - .1 CSA A123.1/A123.5-05(R2015), Asphalt Shingles Made From Organic Felt and Surfaced With Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
 - .2 CAN/CSA-A123.2-03(R2013), Asphalt-Coated Roofing Sheets.
 - .3 CSA A123.3-05(R2015), Asphalt Saturated Organic Roofing Felt.
 - .4 CAN3-A123.51-M85(R2011), Asphalt Shingle Application on Roof Slopes 1:3 and Steeper.
 - .5 CAN3-A123.52-M85(R2011), Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3.
 - .6 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt shingles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit proof of manufacturer's CCMC listing and listing number.
 - .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .3 Submit product data sheets for asphalt shingles. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Installation instructions.
 - .4 Limitations.
 - .5 Colour and finish.
- .4 Samples:
 - .1 Submit duplicate samples of full size specified shingles.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Remove only in quantities required for same day use.
 - .3 Store and protect asphalt shingles from nicks, scratches, and blemishes.
 - .4 Replace defective or damaged materials with new.

1.4 EXTRA STOCK MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 Closeout Submittals.
- .2 All unused shingles remain property of Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Asphalt shingles: to CSA A123.1/A123.5 and as follows:
 - .1 Match existing.
 - .2 Type: 30-year warranty.
 - .3 Weight/Square: 124 kg/10m².
 - .4 Colour: as later selected by Consultant from manufacturers' full range of colours.
 - .5 Texture: Tradition Classic.
 - .6 Acceptable Product: 'Tradition-Classic' by BP EMCO Building Products Corp., or equivalent by IKO, Owens Corning, or approved alternate.
- .2 Eave protection: cold-applied, self-adhering membrane, to ASTM D3767 and ASTM E96 over entire roof.
 - .1 Acceptable material: 'Grace Ice & Water Shield' by Grace Construction Products, or equivalent or equivalent by asphalt shingle manufacturer, or approved alternate.
- .3 Prefinished metal drip edge: profile as indicated, 0.607mm/24 gauge.
- .4 Ridge vent: by same manufacture as asphalt shingles, type as recommended by manufacturer to obtain specified warranty, finish and colour to match shingles.
- .5 Asphaltic Cement:
 - .1 Plastic cement: to CAN/CGSB-37.5.
 - .2 Lap cement: to CAN/CGSB-37.4.
- .6 Nails: to CSA B111, of galvanized steel, sufficient length to penetrate 19 mm into deck.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt shingles installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate prior to commencing with Work of this section, in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 REMOVAL OF EXISTING ROOFING

- .1 Remove existing roofing, flashings and underlay, and expose sheathing or shingle lath of roof.
- .2 Withdraw existing shingle and flashing nails, set those which break off. Leave surfaces free from dirt and loose material.
- .3 Remove portion of sheathing affected by fungal or insect attack as directed by Consultant.
- .4 Replace cut out portions of sheathing or lath with sheathing of equal sectional dimensions, and specified grade. Seat each end on rafter, with 25 mm bearing, and secure to rafter.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 .

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by asphalt shingles installation.

PART 1 - GENERAL

1.1 REFERENCES

- .1 The Aluminum Association, Inc. (AA):
 - .1 AA DAF45-03, Designation System for Aluminum Finishes.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriter Lavatories of Canada (ULC):
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S134-92, Fire Test for Exterior Wall Assemblies
 - .3 ULC-S135-04, Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter), Includes Amendment 1.

1.2 DESIGN REQUIREMENTS

.1 Design composite metal cladding panels to allow for thermal movement of component materials caused by variation in ambient temperature range of 80 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for cladding system materials, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Indicate dimensions and thickness of panels, fastening and anchoring methods, detail, and location of joints and gaskets, thermal movement provision, wall openings, head, jamb, and sill details, materials and finish, compliance with design criteria and requirements of related work.
- .4 Samples:
 - .1 Submit duplicate 75 mm x 125 mm samples for each type of assembly including but not limited to wall and soffit systems, representative of materials, finishes, and colours.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 Quality Control.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Manufacturer: company specializing in producing composite wall panels with 5 years of experience with sufficient capacity to produce and deliver required units without causing delay in work.

- .2 Installer: person specializing in composite wall panel installations with 5 years of experience and approved by manufacturer.
- .3 Mock-ups: construct mock-ups in accordance with Section 01 45 00 Quality Control and to requirements supplemented as follows:
 - .1 Provide mock-up for evaluation of surface finishes and workmanship.
 - .2 Notify Consultant a minimum of five (5) working days prior to mock-up construction.
 - .3 Provide initial production units for job-site assembly with other materials for review.
 - .4 Coordinate type and location of mock-ups with project requirements.
 - .5 Accepted units will be used as standard for acceptance of production units.
 - .6 Remove and replace units which are not accepted.
 - .7 Do not proceed with remaining work until workmanship, colour, and finish are reviewed by Consultant.
 - .8 Refinish mock-up area as required to produce acceptable work.
 - .9 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
 - .1 Approved mock-up may remain as part of finished work to Consultant approval.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.
- .2 Deliver, store and protect material in accordance with panel manufacturer's recommendations.
- Deliver Materials to site in Manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. Stack materials on pallets or platforms, covered with suitable ventilated covering. Do not store panels where accumulation of water may occur or in contact with other materials that might cause staining, denting or other damage.
 - .2 Store and protect composite panel materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .5 Handling: Open crate within 72 hours of material delivery. Remove extra top panel and inspect contents by lifting each panel vertically to prevent chafing of the decorative face. Protect materials during handling to prevent damage.
- Do not expose panels with strippable film to direct sunlight or extreme heat. Protective strippable peel-off film must be removed immediately after panel is installed.
- .7 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

1.6 PROJECT CONDITIONS

.1 Do not install composite wall materials under environmental conditions where it is likely to be immersed in water or where the temperature is likely to exceed 50 degrees C for extended periods of time.

1.7 WARRANTY

- .1 Manufacturer's Warranty: Furnish panel manufacturer's standard limited warranty document executed by an authorized company official. Manufacturer's warranty is in addition to and not a limitation of other rights Owner may have under the Contract Documents.
- .2 Panel Lamination Warranty: Provide manufacturer's standard five (5) year warranty commencing on Date of Substantial Completion to maintain the mechanical qualities, water tightness and frost resistance, providing the panels are correctly installed on a ventilated construction according to the installation procedures of the manufacturer.
- .3 Finish Warranty: Twenty (20) years.
- .4 Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owners may have under Contract Documents.

1.8 PERFORMANCE REQUIREMENTS

- .1 Design and install cladding system to allow for thermal movement of local climate with minimum 80 degrees C ambient or panel temperature fluctuations, without causing undue stress on fasteners or panel or other detrimental effects.
- .2 Design to accommodate, by means of control joints, movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to in fills or racking of joints.
- .3 Design members and suspension system to withstand gravity load, live loads, including negative loads, as calculated in accordance with the Ontario building code.
- .4 Provide structural panel supports to provide minimum L/300 deflection stiffness as required by panel manufacturer. Panels themselves shall not reflect more than L/180 maximum at serviceability limit states.
- .5 Provide for positive drainage of incidental moisture entering panels to exterior face of wall.

1.9 DESCRIPTION METAL COMPOSITE MATERIAL CLADDING SYSTEM

- .1 Provide Metal Composite Material panels formed into "pans" with "Rain Screen System".
- .2 Panel's exposed finishes: in accordance with AAMA 2605-98; exposed anodized aluminum according to AAMA 611-98.
- .3 Panel bond integrity: in accordance with minimum peel strength of 34.5 lb-in/lb when tested according to ASTM D1781.

- .4 Panel composite assembly: conform to ASTM E84, Flame Spread, Class A.
- .5 Design wall system to withstand a positive and negative wind load pressure acting inward and outward normal to the plane of the wall to meet the requirements of the latest Ontario Building Code, in accordance with ASTM E71, Strength Test for Panels for Building Construction.
- .6 Make adequate provisions in the wall system for thermal expansion and contraction of the component parts and fastening of the system to prevent harmful damage caused by buckling, opening of joints, expansion and contraction due to accumulation of dead loads and various live loads.
- .7 Water Leakage: No water infiltration into the panel system under static pressure when tested in accordance with ASTM E331 at a differential of 10% of inward acting design load, 6.24 psf (.299kPa) minimum, after 15 minutes.
- .8 Permanent bowing of panels will not be accepted.

PART 2 - PRODUCTS

2.1 COMPOSITE METAL WALL PANELS

- .1 Composite Aluminum Panels Composition:
 - .1 Face skin: 0.5 mm / 0.020" (minimum) prefinished smooth aluminum, as per acceptable products specified, to match colour selection.
 - .2 Core: 2.67 mm / 0.105" thermoset phenolic resin or thermoplastic compound core, thickness as required to suit total panel thickness, as per acceptable products specified.
 - .3 Back skin: 0.25 mm / 0.010" or 0.5 mm (0.020") primed smooth aluminum as per acceptable products specified.
 - .4 Overall panel thickness: 4mm
 - .5 Panel size: as indicated on the drawings.
 - .6 Acceptable Products:
 - .1 Alpolic by Mitsubishi Chemical FP America, Chesapeake, VA
 - .2 Alucobond by Alcan Composites, USA, Benton, KY
 - .3 Envelope 2000 by Citadel Architectural Products, Inc., Indianapolis, IN
 - .4 Reynobond by ALCOA Architectural Products, Eastman, GA
 - .7 Panel Tolerances:
 - .8 Thickness: +/- 1/32" / 0.8 mm
 - .9 Length & Width: +0, -1.6 mm / 1/16"
 - .10 Squareness: 0.4 mm / 1/64" per lineal foot
 - .11 Colour: Not more than two (2) colours as later selected by Consultant from panel manufacturer's complete colour range.
 - .12 Attachment System: Rain Screen System with extruded aluminum components.
 - .13 Exposed sealants: as recommended by manufacturer, colour to match panel.

2.2 FRAMING SYSTEM

.1 Sub-girt System: structural quality steel with Z275 zinc coating to ASTM A653/A653M, capable of accepting exterior sheet, with structural attachment to building frame, minimum base metal thickness and spacing as required for a complete system to withstand required wind loading/uplift.

- .2 Attachment System: Rain Screen system with concealed clips and fasteners.
- .3 Framing System:
 - .1 Horizontal Clip System: Use one of the two following methods:
 - .1 Method 1: 38 mm / 1-1/2" wide, die cut aluminum extruded clip, adjustable to plumb structure, minimum 1.2 mm (18 gauge) thick galvanized zinc-coated steel to ASTM A653. System to provide compliance to ASHRAE 90.1 and thermally broken façade requirements of the building code.
 - .1 Adaptable horizontal framing members.
 - .2 Clip Depth:
 - .1 100 mm / 4", 125 mm / 5",150 mm / 6",
 - .3 Acceptable Product: EA RVRS T-Clip and Girt, Model T100, by Engineered Assemblies; info@engineeredassemblies.com, telephone (905) 816-2218 or approved alternate.
 - .2 Method 2: Adjustable Steel Sub-Girts (Z-Bars)
 - .1 Continuous Angles: Continuous length angle x 75 mm / 3" substrate leg depth (but 19 mm / 3/4" less than insulation thickness) with 6 mm / 1/4" downturn lip inside insulation, minimum 1.2 mm / 18 gauge thick, galvanized zinc-coated steel to ASTM A653 with Grade A coating Z275, adjustable to plumb structure.
 - .2 Spacing: as required by manufacturer and shop drawing engineer.
 - .3 Provide thermal tape on building substrate side of clip angle leg and on horizontal side of leg to accept continuous horizontal z-girt as per details.
 - .4 Continuous Angles: Continuous length angle x 75 mm / 3" cladding side x depth to suit wall depth (but 19 mm / 3/4" less than insulation thickness) as detailed.
 - .5 Continuous Vertical hat Bar: minimum 1.2 mm / 18 gauge thick, galvanized zinc-coated steel to ASTM A653 with Grade A coating Z275.
 - .2 Locations and spacing for framing system members as determined by shop drawing structural engineer, to align with modular panel fasteners spaced based on manufacturer's panel load data.
 - .3 Substructure to account for control joints of building to ensure a girt is not connected across the control joint.
 - .4 Install panels across one set of vertical girts to ensure that expansion and contraction of the substrate is controlled within framing members.

2.3 ACCESSORIES

- .1 Fasteners and extrusions as required for panel system's design by panel system manufacturer.
- .2 Flashings: refer to Section 0 762 00 Sheet Metal Flashing and Trim.
- .3 Insulation: Refer to Section 07 21 13 Board Insulation and 07 21 29 Sprayed Insulation -Polyurethane Foam
- .4 Air/Vapour Barrier Transition Membranes: Refer to Section 07 27 00 Air Barriers.
- .5 Gypsum Sheathing: Refer to Section 09 21 16 Gypsum Board Assembles.
- .6 Adhesive: in accordance with manufacturers written recommendations.
- .7 Thermal Tape: low to medium pressure gasket from neoprene rubber and cork blend with a highstrength acrylic adhesive on one side, protected by siliconized liner, with anti-skid properties, 38 mm / 1 1/2" wide x length to suit.
- .8 Scupper: same material as composite panels. Size and profile as indicated on drawings.

- .9 Exposed sealants (only where applicable): as recommended by manufacturer in accordance with Section 07 92 00 Joint Sealants and in accordance with panel manufacturer's installation instructions, colour to match panels.
 - .1 Acceptable product: As recommended by panel manufacturer.
- .10 Stiffener Tubes: Aluminum, gauge, and profile to panel manufacturer's standard fabrication and installation instructions.
- .11 Separation Tape: Provide separation tape to prevent galvanic corrosion between the aluminum panel clips and metal girts.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal composite material building panel installation in accordance with manufacturer's written instructions.
 - .1 Beginning of Work implies acceptance of conditions.
 - .2 Maximum deviation from vertical and horizontal alignment of substrate shall be no more than 6.35 mm in 6100 mm / 1/4" in 20'-0".
 - .3 Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where materials outlined in this Section are indicated to fit walls and other construction.

3.3 PREPARATION - GENERAL PREPARATION

- .1 Prepare substrate surfaces using the methods recommended by the manufacturer.
- .2 Field measure and verify dimensions as required.
- .3 Protect adjacent areas or surfaces from damage as a result of the Work of this Section.
- .4 Thermal Tape: install thermal tape between metal subgirt clips and metal framing members as required to prevent cold bridging from exterior to interior building surfaces.
- .5 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surfaces with isolation coating.
- .6 Comply with manufacturer's product data including product technical bulletins, product catalogue installation instruction, and product carton instructions.
- .7 Ensure surfaces to receive panels are even, smooth, sound, clean, and free from defects detrimental to panel installation.
- .8 Prepare substrate surfaces using the methods recommended by the manufacturer.

- .9 Metal furring and Sub-girt System: Erect metal furring and sub-girt system plumb, aligned and securely attached building framing.
- .10 Protect adjacent areas or surfaces from damage as a result of the work of this section.
- .11 Protect metal surfaces in contact with concrete, masonry, mortar, plaster or other cementitious surfaces with isolation coating.

3.4 INSTALLATION OF METAL COMPOSITE MATERIAL WALL PANELS

- .1 Erect panels level and true to intended plane.
- .2 Install panels in accordance with panel manufacturer's written instructions.
- .3 Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.
- .4 Do not install component parts that are observed to be defective, including warped, bowed, dented, scraped and broken members.
- Do not cut, trim, weld or scrape component parts during erection in a manner that would damage the finish, decrease strength or result in a visual imperfection or a failure in performance.
- .6 Separate dissimilar metals; use appropriate gaskets and fasteners to minimize corrosive or electrolytic action between metals.
- .7 Remove strippable coating from panels as they are erected.
- .8 Anchor panels securely in place in accordance with manufacturer's / fabricator's approved engineered shop drawings to allow for necessary thermal movement and structural support.
- .9 Allow for free vertical and horizontal thermal movement due to expansion and contraction to prevent buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement. Account for ambient temperature at the time of the respective operation during fabrication, assembly and erection.
- .10 Maximum deviation from vertical and horizontal alignment of erected panel system: 6.35mm in 6100 mm / 1/4" in 20'-0".
- .11 Maximum deviation in panel flatness: 0.6% of assembled units.
- .12 Panel bowing will not be accepted.
- .13 Conform to panel manufacturer's installation instructions for attachment systems.
- .14 Weather seal all joints where noted on drawings and specifications using methods and materials as recommended by the panel manufacturer's / fabricator's installation instructions.
- .15 Provide 13 mm / 1/2" reveals between panels with splines.
- .16 Provide spline, with weep holes, between bottom of panels and top of drip edge flashing. Weep hole locations on splines to match weep hole locations of panels directly above.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
- .2 Progress Cleaning: Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.
- .3 Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- .4 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .5 Leave work areas clean, free from grease, finger marks and stains.
- .6 Replace all damaged panels. Touch-up paint is not acceptable.
- .7 Remove temporary coverings and protection to adjacent work areas.
- .8 Clean installed products in accordance with manufacturer's instructions prior to project completion.

3.6 PROTECTION

.1 Protect installed products and components form damage during construction.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CGSB 37-GP-9Ma, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
 - .2 CGSB 37-GP-56M-80b(A1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
 - .3 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .2 Canadian Roofing Contractors Association (CRCA):
 - .1 CRCA Roofing Specifications Manual-1997.
- .3 Canadian Standards Association (CSA International):
 - .1 CSA A123.21-10, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems
 - .2 CSA-A123.3-05(2010), Asphalt Saturated Organic Roofing Felt.
 - .3 CAN/CSA A123.4-04 (R2008), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
 - .4 CSA A231.1-06/A231.2-06 (R2010), Precast Concrete Paving Slabs/Precast Concrete Pavers.
 - .5 CSA O121-08, Douglas Fir Plywood.
 - .6 CSA O151-09, Canadian Softwood Plywood.
- .4 Factory Mutual (FM Global):
 - .1 FM Approvals Roofing Products.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .6 National Fire Protection Association:
 - .1 NFPA (FIRE) 276, Standard Method of Fire Test for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-Desk Roofing Components, 2011 Edition.
- .7 Underwriters Laboratories' of Canada (ULC):
 - .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC S107-10, Methods of Fire Tests of Roof Coverings.
 - .3 CAN/ULC S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
 - .4 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .5 CAN/ULC S702-09-AM1, Standard for Thermal Insulation Mineral Fibre for Buildings.
 - .6 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.
 - .7 CAN/ULC-S706-09, Standard for Wood Fibre Thermal Insulation for Buildings.
 - .8 CAN/ULC S126-14, Standard Method of Test for Fire Spread under Roof-Deck Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meeting one week prior to beginning roofing Work, with roofing contractor's representative and Consultant in accordance with Section 01 32 16 Construction Progress Schedules Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

- .1 Provide electronic copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size. finish and limitations.
- .2 Provide electronic copies of WHMIS MSDS in accordance with Section 01 35 29 Health and Safety Requirements, 01 35 43- Environmental Procedures, and indicate VOC content for:
 - .1 Primers.
 - .2 Asphalt.
 - .3 Sealers.
 - .4 Filter fabric.

.3 Provide shop drawings:

- .1 Indicate flashing, control joints, tapered insulation details.
- .2 Provide layout for tapered insulation.
- .4 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .6 Manufacturer's field report: in accordance with Section 01 45 00 Quality Control.
- .7 Reports: indicate procedures followed and ambient temperatures and wind velocity during application.

1.4 QUALITY ASSURANCE

- .1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems with 5 years documented experience approved by manufacturer.
- .2 Conform to CRCA Roofing Specifications and roofing membrane manufacturer's instructions.
- .3 Only qualified, certified installers employed by a company with the appropriate equipment may execute roofing work.

.4 Mock-ups:

- .1 Construct mock-up in accordance with Section 01 45 00 Quality Control.
- .2 Construct mock-up 10 m² minimum size showing typical lap joint, one inside corner.
- .3 Accepted mock-up may form part of complete work.
- .4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with roofing work.
- .5 Manufacturer's Field Services: as part of Manufacturer's Services described in PART 3 FIELD QUALITY CONTROL, schedule site visits with manufacturer's representative, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work and mock-up is complete, but before installation begins.
 - .2 As required by membrane manufacture to obtain roof warranty, but as a minimum twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
 - .2 Provide and maintain dry, off-ground weatherproof storage.
 - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
 - .4 Remove only in quantities required for same day use.
 - .5 Place plywood runways over completed Work to enable movement of material and other traffic.
 - .6 Store sealants at +5°C minimum.
 - .7 Store materials unless otherwise indicated in accordance with manufacturer's written instructions.
 - .8 Store insulation protected from daylight and weather and deleterious materials.
 - .9 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
 - .10 Fold up metal banding, flatten and place in designated area for recycling.

1.6 SITE CONDITIONS

- .1 Ambient Conditions
 - .1 Do not install roofing when temperature remains below -18°C for torch application, or -5°C to manufacturers' recommendations for mop application.
 - .2 Minimum temperature for solvent-based adhesive is -5°C.
 - .3 Or as specified by the manufacturer.
- .2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.7 MANUFACTURER'S FIELD SERVICES

- .1 Arrange for initial job start-up site attendance, periodic site attendance of membrane manufacturer's technical representative during installation work, together with written report.
- .2 The Contractor must at all times enable and facilitate access to the work site by said representative.
- .3 Notify Consultant of date and time of inspection, a minimum of 24 hours prior to inspection. Provide one copy of manufacturer's report to the Consultant within 48 hours of inspection being carried out.

1.8 WARRANTY

- .1 For the Work of this Section 07 52 00 Modified Bituminous Membrane Roofing, twelve (12) months warranty period is extended to twenty-four (24) months.
- At no cost to Owner, Contractor shall remedy any defects in Work, including Work of this and other Sections, due to faults in materials or workmanship provided under this Section of Specifications appearing within a period of two (2) years from date of Substantial Performance. CRCA Standard Form of Guarantee is not acceptable.
- .3 Provide manufacturer's twenty (20) year extended system warranty covering all costs for materials and workmanship including watertightness.
- .4 Roofing/Waterproofing contractor must include with his tender, proof from the manufacturer that they can supply specified manufacturers material and workmanship warranty. Failure to submit may result in tender disqualification.

1.9 ADDITIONAL REQUIREMENTS

- .1 Prior to fastening roof sheathing and or other roof system components, inspect underside of deck for conduit locations, fire-proofing material and other potential hazards.
 - .1 If mechanical fastening is not specified, utilize specified insulation adhesive in these areas. Where adhesive is not specified, utilize adhesive as recommended by the manufacturer of the material being adhered.
- .2 Remove all debris and sweep clean existing substrate.
- .3 Supply and install roof drain inserts, roof drain sleeves, collars, pitch pans, gas line support, concrete pavers and miscellaneous items in accordance with Contract Documents.
- .4 Supply and install all pre-finished sheet metal flashings in accordance with Contract Documents. Colour and profile samples to match existing.
- .5 Supply and install joint sealants in accordance with Section 079200 Joint Sealants.
- .6 Utilize only single source supplier of membrane and related primary materials.
- .7 Ensure proper tie-ins as indicated.
- .8 Dispose of all debris/ waste in approved containers and transfer to approved municipal and/or provincial disposal site(s).

- .9 Install walkways at all roof access and ladder locations.
- .10 Provide tapered insulation as noted according to Contract Documents.

1.10 DESCRIPTION OF ROOF MEMBRANE SYSTEM

- .1 Provide the following roof membrane systems (types) (from top down):
 - .1 Roof Construction (Cold applied, 2 ply modified bitumen):
 - .1 Composite-reinforced cap sheet membrane, adhesive applied.
 - .2 Composite-reinforced base sheet, adhesive applied.
 - .3 6 mm / 1/4" asphaltic overlay board, adhesive applied.
 - .4 Tapered polyisocyanurate insulation backslopes, crickets, and drain sumps, adhesive applied.
 - .5 3-layers 52 mm / 2" thick polyisocyanurate insulation, each adhesive applied.
 - .6 Self-adhered vapour retarder
 - .7 13 mm / 1/2" exterior grade gypsum board.
 - .8 Structural steel decking.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- .1 Compatibility between components of roofing system is an essential requirement of the contract for the purpose of obtaining a manufacturer's system warranty.
 - .1 Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.
 - .2 Products specified within this specification section by Soprema, unless otherwise noted are to be used for this project. Equivalent systems, single sourced from the following manufacturers are also acceptable for use:
 - .1 Firestone.
 - .2 GAF.
 - .3 Henry Bakor.
 - .4 Johns Manville.
 - .5 IKO.
 - .6 Siplast.
 - .7 Tremco.
 - .8 Or approved alternate.
- .2 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 VAPOUR BARRIER/RETARDER

- .1 Vapour Barrier / Vapour Retarder definition: the terms vapour barrier and vapour retarder are to be considered as one in the same throughout these documents.
- .2 Self-adhesive Modified Bitumen Vapour Barrier: composed of SBS modified bitumen and a trilaminated facer.
 - .1 Acceptable product: 'Sopravapor' by Soprema, or approved alternate.

2.3 POLYISOCYANURATE INSULATION

- .1 Polyisocyanurate Insulation:
 - .1 Conform to CAN/ULC-S704. CFC and HCFC free, 1220 mm x 2440 mm / 4'-0" x 8'-0" maximum board size, thickness as indicated on drawings and Summary of Work. Closed cell polyisocyanurate foam with integrally formed and coated inorganic glass fibre mat facers. Material selected must be supported by membrane manufacturer's warranty. Accepted products:
 - .1 "SopraISO Plus" by Soprema.
 - .2 "IKOTherm III" by IKO Industries.
 - .3 "ACFoam III" by Atlas Roofing Corporation.
 - .4 Or approved alternate.
- .2 Tapered Polyisocyanurate Insulation:
 - .1 Conform to CAN/ULC-S704. 1220 mm x 1220 mm / 4'-0" x 4'-0" maximum board size. Tapered as per drawings and details. Uniform slope and all panels/corners/hips to be factory cut and labelled for ease of installation. Material to be same type and from same manufacturer as base insulation or approved for use by membrane manufacturer. Acceptable products:
 - .1 Soprema.
 - .2 Accu-Plane Enterprises Inc.
 - .3 Beacon Roofing Supply Inc.
 - .4 Everest Supply Inc.
 - .5 Posi-Slope Enterprises Inc.
 - .6 Or approved alternate.

2.4 INSULATION ADHESIVE - COLD APPLIED

- .1 Insulation Adhesive: Cold applied insulation adhesive to FM Approvals 4470 for securing overlay board and insulation:
 - .1 Accepted products:
 - .1 For temperatures below 5°C: a low-rise two-part urethane adhesive, "Duotack" by Soprema.
 - .2 For temperatures above 5°C: a solvent-based polyurethane bitumen adhesive, "Coltack" by Soprema.

2.5 SELF-ADHERED MEMBRANE PRIMER

- .1 Self-Adhered Membrane Primer:
 - .1 Synthetic/Asphalt/Solvent formulated primer to enhance adhesion of self-adhered membranes to substrates. Use summer or winter grade as required. Accepted products:
 - .1 "Elastocol Stick" by Soprema.

2.6 ROOF MEMBRANE ADHESIVE – COLD APPLIED

- .1 Modified Bitumen Membrane Adhesive:
 - .1 SBS Modified bitumen adhesive, low solvent to reach optimum adhesion within 24 to 48 hours, 250% ultimate elongation, minimum lap strength 3.5 KN/m, acceptable product:
 - .1 'Colply Brush' grade by Soprema for field membranes.

- .2 'Colply Trowel' grade by Soprema for flashings.
- .3 Or approved alternate.

2.7 OVERLAY BOARD (PROTECTION BOARD)

- .1 Overlay Board (Protection Board): Multi-ply, semi-rigid asphaltic roofing substrate board composed of a mineral fortified asphaltic core formed between two asphaltic saturated fibreglass liners. 6.4 mm / 1/4" minimum thickness, size to best suit application.
 - .1 Puncture resistance: 500 N to ASTM E154.
 - .2 Water Absorption: 0.25% to ASTM D994
 - .3 Compressive strength: ≥ 3565 kPa / 517 psi to ASTM C472
 - .4 Acceptable product: "Sopraboard" by Soprema.

2.8 MEMBRANE – COLD APPLIED BASE SHEET / COLD APPLIED CAP SHEET

- .1 Base sheet: to CAN/CGSB-37.56M, 2.5 mm / 0.098" thick bitumen adhered waterproof sheet membrane composed of composite reinforcement (non-woven polyester and glass grid) and SBS modified bitumen, both faces sanded, with distinctive lines on top surface to facilitate roll alignment:
 - .1 Strain energy, MD/XD: 7.8 kN/m / 7.2 kN/m.
 - .2 Breaking strength, MD/XD: 15 kN/m / 13.5 kN/m.
 - .3 Ultimate elongation MD/XD: 60% / 65%.
 - .4 Tear resistance: 125 N.
 - .5 Static puncture resistance: 560 N.
 - .6 Dimensional stability MD/XD: 0.2% / 0%.
 - .7 Plastic flow: ≥ 110°C.
 - .8 Cold bending at -30°C: No cracking.
 - .9 Lap joint strength: Pass > 4 kN/m.
 - .10 Acceptable Products:
 - .1 "Colply BASE-410" by Soprema.
- .2 Cap Sheet and Walkway Membrane: to CAN/CGSB-37.56M, 4.0 mm / 0.157" thick bitumen adhered waterproof sheet membrane composed of composite reinforcement (non-woven polyester and glass grid) and SBS modified bitumen. Bottom face sanded, top face covered with ceramic granules:
 - .1 Strain energy, MD/XD: 7.8 kN/m / 7.2 kN/m.
 - .2 Breaking strength, MD/XD: 15 kN/m / 13.5 kN/m.
 - .3 Ultimate elongation MD/XD: 60% / 65%.
 - .4 Tear resistance: 125 N.
 - .5 Static puncture resistance: 560 N.
 - .6 Dimensional stability MD/XD: 0.2% / 0%.
 - .7 Plastic flow: ≥ 110°C.
 - .8 Cold bending at -30°C: No cracking.
 - .9 Lap joint strength: Pass > 4 kN/m.
 - .10 Acceptable Products:
 - .1 "Colply Traffic Cap 460" by Soprema or approved equivalent.
 - .2 "Colply Traffic Cap FR 461 for ULC Class A.

2.9 CAP SHEET COLOUR

.1 Cap sheet colour: White.

2.10 SEALERS

- .1 Sealing Product: Bitumen/polyurethane waterproofing mono-component resin and polyester reinforcement.
 - .1 Acceptable Product: 'Alsan Flashing' and 'Alsan Reinforcement' by Soprema, or approved alternate'.
 - .2 Sealants: refer to Section 07900 Joint Sealants.

2.11 WALKWAYS

.1 Walkway: Walkways to consist of one additional cold applied cap sheet membrane. Colour to be Grey.

2.12 CARPENTRY

.1 Refer to Section 06 10 00 - Rough Carpentry

2.13 ACCESSORIES

- .1 Aluminum Sleeves and Collars:
 - .1 16 ga. / 0.051" pre-spun aluminum as required. Acceptable manufacturers:
 - .1 National Roofing Supply.
 - .2 Lexcor Canada.
 - .3 Thaler Metal Industries.
 - .4 Altra Metal Specialties Inc.
- .2 B-Vent Flashing:
 - .1 Prefabricated from heavy gauge aluminum or stainless steel, complete with wide base flange. Accepted products:
 - .1 "MEF-4A" by Thaler Metal Industries Ltd.
 - .2 "Flash-Tite" by Lexcor.
 - .3 "ME-TC" by National Roofing Supply.
 - .4 "BVF" by Altra Metal Specialties Inc.
- .3 Soil Pipe Flashings:
 - .1 Prefabricated from heavy gauge spun aluminum, complete with wide base flange, telescoping cap and pre-insulated. Minimum 305 mm (12") above roof surface. Accepted products:
 - .1 "PVP-1 series" by National Roofing Supply; complete with cap.
 - .2 "SJ-26 series" by Thaler Metal Industries
 - .3 "Flash-Tite SC-S Series" by Lexcor
 - .4 "AVS-1" by Altra Metal Specialties.

- .4 Gooseneck Type Conduit Flashing:
 - .1 Prefabricated from heavy gauge aluminum or stainless steel, complete with wide base flange. Accepted products:
 - .1 MEF-2A series by Thaler Metal Industries Ltd.
 - .2 Flash-Tite series by Lexcor.
 - .3 ME-GN series by National Roofing Supply.
 - .4 "MEFA" by Altra Metal Specialties Inc.
- .5 Roof Drains:
 - .1 Refer to Division 23.
- .6 Scuppers:
 - .1 0.80 mm / 22 ga. pre-finished metal with 127 mm / 5" flanges and soldered seams.
- .7 Deck Closures:
 - .1 3 mm / 1/8" galvanized metal plate, size to suit opening and as detailed.
- .8 Pipe Supports for roof mounted gas pipes, pipes, electrical conduit, ducts and other mechanical piping:
 - .1 Refer to Division 23.

PART 3 - EXECUTION

3.1 QUALITY OF WORK

- .1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual, CRCA Roofing Specification Manual, and Ontario Roofing Association Manual.
- .2 Do priming in accordance with manufacturers written recommendations.
- .3 Provide interface between walls and roof assemblies with durable rigid sheet metal as required to provide connection point for continuity of air barrier.
- .4 Provide assembly, component and material connections in consideration of appropriate design loads.
- .5 Maintain equipment in good working order to ensure control of roofing operations and protection of work.

3.2 GENERAL

- .1 Apply roofing in accordance with drawings, specifications and requirements of authorities having jurisdiction and the Canadian Roofing Contractors' Association Roofing Manual.
- .2 Use manufacturer's printed recommendations and specifications as minimum requirements for materials, methods and quality of work not otherwise specified herein.
- .3 Make adjustments to specified roofing procedures caused by weather and site conditions to Consultant approval.
- .4 Ensure watertight junctions of roof drains, vents and other items passing through the roof.

- .5 Install plywood and lumber nailer plates to deck, walls and parapets where required and as indicated.
- .6 Install vapour retarder and all field membrane beginning at low point and at right angles to the slope or from roof drain.
- .7 At manufacturer's recommended rate, prime all existing surfaces that are to receive roof membrane.
- .8 Install tapered insulation in accordance with manufactured instructions and reviewed shop drawings.
- .9 Soften and shim edges of tapered insulation as required to provide smooth transition from one level to the next.
- .10 Ensure all edges of insulation and cover boards, are structurally supported. Stagger joints of insulation boards both horizontally and vertically. Stagger end joints. Butt joints with no gaps or broken boards. Cut and fit neatly at all projections.
- .11 Apply adhesives in accordance with manufacturer's instructions and recommendations.
- .12 Use only manufacturer approved torches a per manufacturer's recommendations.

3.3 EXAMINATION OF ROOF DECKS

- .1 Verification of Conditions: inspect deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.
- .2 Evaluation and Assessment: Prior to fastening deck sheathing and/or other roof system components, inspect underside of the deck for conduit locations, fire-proofing material and other potential hazards.
- .3 If fastening is specified, assume full responsibility to avoid damaging existing conduits within the interior space. Utilize all available means to ensure the continued uninterrupted function of electrical/electronic items, including visual reviews and available electronic detection devices.
- .4 Ensure decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
- .5 Ensure curbs have been built.
- .6 Ensure roof drains have been installed at proper elevations relative to finished roof surface.
- .7 Assume full responsibility for damages occurring as a result of fastening through the deck and make good all such damages at no additional cost to the Owner.
- .8 Do not install roofing materials during rain or snowfall.

3.4 PROTECTION OF IN-PLACE CONDITIONS

- .1 Cover walls, walks, and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.
- .3 Clean off drips and smears of bituminous material immediately.

- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Protect roof from traffic and damage.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .7 Seal and ballast exposed edges.

3.5 PREPARATION OF STEEL DECK

- .1 Install sound absorbing insulation in flutes of acoustical steel roof deck in accordance with deck manufacturer's instructions and Section 05 31 00 Steel Decking.
- .2 When installing vapour retardant directly on the steel deck, place a thin sheet of metal under the end lap of the vapour barrier.

3.6 PRIMING DECK

.1 Apply deck primer to deck roofing substrate at the rate recommended by manufacturer.

3.7 VAPOUR RETARDER TO STEEL

- .1 Prime surfaces to receive vapour retarder membrane. Apply membrane only once primer coat is dry.
- .2 Over exposed substrate and without adhering, unroll modified bitumen membrane to relax and for alignment.
- Once relaxed and aligned, reroll membrane from both ends. Peel back one end of the silicone release sheet and adhere this part of the membrane to the substrate. Peel back the remaining release sheet at a 45° angle to avoid wrinkles in the membrane.
- .4 If the membrane is not properly aligned, do not try to adjust. Instead, cut the roll and start again, making sure that it is properly aligned and that it overlaps the end of the misaligned piece by 150 mm / 6".
- .5 Overlap each preceding sheet by 75 mm / 3" lengthwise following the reference line and by 150 mm / 6" at each end. Stagger end laps by at least 300 mm / 12".
- .6 Use a 34 kg roller to press down along each membrane strip, including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped below the laps, but rather push the roller to the edge of the joint to squeeze them out.

3.8 INSULATION INSTALLATION

- .1 Insulation Application General:
 - .1 Install roof insulation boards, cut and trimmed to provide plain butt joints at perimeters, parapets, curbs, etc.

- .2 Lay insulation boards in parallel courses, butted together tightly in firm contact with one another, without gaps, complete with staggered end joints.
- .3 Place boards in parallel rows with ends staggered, and in firm contact with one another.
- .4 Cut end pieces to suit.
- .5 Install second layer with joints placed offset and perpendicular from underlying layer.

.2 Insulation – Cold Adhesive Application:

- .1 Mop tapered insulation to vapour retarder and upper layers of insulation to bottom layer with cold applied adhesive as specified and as per adhesive manufacturer's instructions.
- .2 Install three layers of insulation to vapour retarder with adhesive in conformance with manufacturer's written recommendations.
- .3 Install insulation panels by butting edges snugly and without warping. Stagger all joints between layers
- .4 Install only as much insulation as can be covered in the same day.
- .5 Around the drains lower insulation by 25 mm / 1" to create a sump 1200 mm x 1200 mm / 4' X 4' in area. Bevel edge of 75 mm / 3" insulation on a 45° angle.

3.9 OVERLAY BOARD

- .1 General Application Method:
 - .1 Stagger all vertical joints between boards and insulation.
 - .2 Connect panels in perfect connection, without any differences in level and completely adhered all surfaces.
 - .3 Apply only as many boards as can be covered in the same day.
- .2 Cold Applied Adhesive Application: Over completed layer(s) of insulation, and with board joints offset from insulation joints, install overlay board in cold applied adhesive as specified and as per adhesive manufacturer's instructions. Walk-in to ensure 100% of surface is adhered.

3.10 BASE SHEET

- .1 Installation of Cold Applied Adhesive Base Sheet:
 - .1 Beginning at the drain and perpendicular to the slope, install the membrane base sheet in a full bed of adhesive applied at the rate of 6 to 8 litres per 10 square metres of roofing area using a notched 5 mm / 3/16" neoprene squeegee.
 - .2 Apply base sheet in parallel strips. Lap side joints 100 mm / 4" and end joints 150 mm / 6". Stagger end joints a minimum of 300 mm / 12".
 - .3 After placement in the adhesive, roll the surface of the installed membrane with a 27 kg steel roller to smooth the membrane to ensure complete and uniform embedment.
 - .4 Always seal the lap joints of the base sheet at the end of the workday. Perform the work without interruption to avoid tears and the formation of fishmouths, air pockets and wrinkles.
 - .5 Cut off corners at end laps to be covered by the next roll.
 - .6 Provide a smooth application free of wrinkles, fishmouths, air pockets or tears.
 - .7 Terminate the base sheet 40 mm / 1-1/2" above top of the cant or at the perimeter.

3.11 CAP SHEET

- .1 Installation of Cold Adhesive Applied Cap Sheet:
 - .1 Beginning at the drains and perpendicular to the slope, install the cap sheet in a full bed of cold applied adhesive applied at the rate of 6 to 8 litres per 10 square metres using a notched 5 mm / 3/16" neoprene squeegee. Use coldply adhesive on granulated overlaps with a notched 5 mm / 3/16" trowel.
 - .2 Lap side joints 100 mm / 4", and end joints 150 mm / 6". Stagger end joints and joints between membranes plies by a minimum of 300 mm / 12". Base and cap sheet membranes must be staggered by at least 300 mm / 12".
 - .3 Immediately after placement of sheet in adhesive, brush the surface to ensure complete and uniform embedment.
 - .4 Cut off corners at end laps to be covered by the next roll.
 - .5 Provide a smooth application, free of wrinkles, fishmouths, air pockets or tears.
 - .6 Terminate the cap sheet at the top of the cant or at the perimeter.
 - .7 During installation, take care to avoid excessive bitumen bleed-out at joints.

3.12 FLASHINGS

- .1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.
- .2 Apply base and cap sheet onto substrate in 1 m / 3'-3" x 3'-3" wide strips using same method as base and cap sheet applications.
- .3 Lap flashing base sheet to membrane base sheet minimum 150 mm / 6" and seal by using same method as base and cap sheet applications.
- .4 Lap flashing cap sheet to membrane cap sheet 250 mm / 10" minimum using same method as base and cap sheet applications.
- .5 Provide 75 mm / 3" minimum side lap and seal.
- .6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
- .7 Do work in accordance with manufacturer's recommendations and Section 07 62 00 Sheet Metal Flashing and Trim.

3.13 ROOF PENETRATIONS

- .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.
- .2 Ensure substrate is clear of loose granules and all foreign substances that can impair adhesion.
- .3 Place prefabricated curbs in the desired location and mark outside edge for reference. Place curbs at least 25 mm / 1" away from the penetration.
- .4 Wire brush area around penetration to remove loose materials and contaminants.
- .5 Seal base of penetration with specified sealant to prevent the mastic from flowing through openings.

- JLR No. 27672-000.1
 - .6 Apply a bead of sealant to the substrate where curbs will be placed.
 - .7 Apply a bead of sealant to locking joint of the curb.
 - .8 Set the curbs in place and apply equal pressure to assure positive contact with roof membrane. Strike away excess sealant.
 - .9 Dispense a small amount of mastic to ensure proper mix, and fill inside prefabricated curb until full.

3.14 WALKWAYS

- .1 Install walkway membrane in accordance with manufacturer's instructions and as indicated.
 - .1 Apply an additional layer of cap sheet membrane fully adhered in the areas in location to receive walkway mat.
 - .2 Apply primer to cap sheet membrane and cold apply walkway membrane ensuring selvage edge is not removed.
 - .3 Install walkway with gaps of at least 13 mm / 1/2" between panels to allow for expansion.

3.15 DRAINS

- .1 Prior to proceeding with drain installation, ensure all rain water leaders are properly secured. Inspect underside of deck as required.
- .2 Neatly cut down top of existing drain bowl to below top of new insulation as required to ensure new drain insert sits at the lowest point possible.
- .3 Make opening water and vapour tight at vapour retarder. Apply spray foam insulation to fill voids between existing drain bowl and new insulation. Fill voids within existing drain bowl with mineral wool batt insulation.
- .4 Install drains and seals in accordance with the manufacturer's printed instructions.
- .5 Flash with 2-ply bitumen membrane. Extend first ply 152 mm / 6", second ply 305 mm / 12" beyond flange.
- .6 Stop membrane flashing 25 mm / 1" from strainer ensuring drainage openings at base of strainer are kept clear.
- .7 Ensure strainer dome is in place and secure.

3.16 PIPE SUPPORTS

- .1 Install pipe supports where indicated.
- .2 Place one additional cold applied cap sheet membrane below pipe supports supporting heavy loads, colour different from field membrane as later selected by Consultant from manufacturer's standard colour range.
- .3 Centre support below conduits pipes and ducts squarely over pipe stand.

- .4 Adjust supports level and plumb as required to ensure uniform load with other supports.
- .5 Place pipe and ducts on support without dropping or causing undue impact.

3.17 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 QUALITY ASSURANCE.

3.18 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
- .2 Remove bituminous markings from finished surfaces.
- .3 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .4 Repair or replace defaced or disfigured finishes caused by work of this section.
- .5 Perform daily clean up to collect all wrappings, empty containers, and other debris from the project site.
- .6 Upon completion, all debris must be disposed of in a legally acceptable manner.
- .7 Prior to the final inspection, perform pre-inspection to review all work and to verify completion of all flashings and sealant applications.
- .8 Leave roof clean of debris, spills, etc.

3.19 MAINTENANCE MATERIAL

- .1 Granules:
 - .1 As supplied by membrane manufacturer, colour to match membrane granule, provide to Owner one full pail of granules at end of project.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM A 506-12, Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.
 - .2 ASTM B 370-14, Specification for Copper Sheet and Strip for Building Construction.
 - .3 ASTM A 653/A 653M-15, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM D 2369-10(2015)e1, Test Method for Volatile Content of Coatings.
 - .5 ASTM D 2832-92(2011), Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .6 ASTM D 5116-10, Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
- .2 CSA International:
 - .1 CSA B111-1974(R2005), Wire Nails, Spikes and Staples.
- .3 The Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual current edition.
 - .1 MPI #76, Primer, Alkyd, Quick Dry, for Metal.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for roof hatches and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit electronic copies of WHMIS MSDS in accordance with Section 01 35 29 Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Submit drawings:
 - .1 Indicate size and description of components, materials, attachment devices, description of frame and finish, and construction details.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Submit operation and maintenance data for hardware complete with pertinent details, spare parts lists and warnings against harmful maintenance materials and practices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect roof hatches from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Roof hatch manufacturer hereby warrants that the roof hatch will remain in a watertight condition and will not leak as a result of faulty materials and remain free from material or workmanship defects for five (5) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- .1 Design Requirements:
 - .1 Roof hatches to withstand snow load of 40 lbs. per square foot without damage to unit or permanent deformation to seals.

2.2 MATERIALS

- .1 Steel sheet: regular quality alloy steel to ASTM A 506.
- .2 Galvanized steel sheet: commercial quality to ASTM A 653, Z275designation zinc coating.
- .3 Gaskets: extruded resilient neoprene, with full recovery after 50% compression.
- .4 Fasteners: screws to manufacturer's standard.
- .5 Sealants: Refer to Section 07 92 00 Joint Sealing.
- .6 Primers and paints: in accordance with manufacturer's recommendations for surface conditions.
 - .1 Primer paint for steel: to MPI #76.
- .7 Isolation coating: alkali resistant bituminous paint or epoxy solution.

- .8 Finish painting: refer to:
 - .1 Section 09 91 13 Exterior Painting.
 - .2 Section 09 91 23 Interior Painting.

2.3 ROOF HATCH

- .1 Roof Hatch Size: 762 mm x 914 mm ladder access / 2'-6" x 3'-0"
- .2 Deck Opening Size: Correspond to hatch size.
- .3 Curb and door(s) Construction:
 - .1 1.89 mm / 14 ga. primer coated galvanized steel c/w factory finished with grey primer.
 - .2 3.0 mm / 11 ga. mill finished aluminum.
 - .3 1.89 mm / 14 ga. Type 304 stainless steel.
 - .4 24oz copper, neatly welded and ground at corners.
- .4 Door insulation: 25.4 mm / 1" fiber insulation with a minimum density of 4 lbs. (1.8 kg).
- .5 Door liner of 22 ga. primer coated galvanized steel.
- .6 Curb:
 - .1 Height: 305 mm / 12".
 - .2 Insulation: 25.4 mm / 1" polyisocyanurate insulation plus 13 mm / 1/2" rigid insulation secured to the curb exterior.
 - .3 Flange: 89 mm / 3-1/2"wide, pre-punched flanges.
- .7 Accessories:
 - .1 Hardware: heavy duty pintle hinges, torsion bar operated doors / heli coil operated doors, latching mechanisms, interior (and exterior) padlock hasps and neoprene draft seal, automatic hold-open arm complete with a foam rubber grip handle.
 - .1 Hardware finish: cadmium plated.
- .8 Options: Provide the following options:
 - .1 Safety Bar Handle: 35 mm / 1-1/4" diameter safety bar coated with PVC, mounted on hatch curb without impeding operation of the door.
- .9 Manufacturer: Lexsuco Corporation, Lexcor, Bilco, or approved alternate.

2.4 FLOOR ACCESS DOOR HATCH

- .1 Floor Hatch Size: 762 mm x 914 mm ladder access / 2'-6" x 3'-0".
- .2 Deck Opening Size: correspond to hatch size.
- .3 Accessories:
 - .1 Hardware: heavy duty hinges, stainless steel slam lock with fixed interior handle, gas strut lifting mechanism with automatic hold-open with grip handle release.
 - .1 Finishes: stainless steel.
- .4 Options: provide the following options:
 - .1 Safety posts and chains.

.5 Manufacturer: Bilco or approved alternate.

2.5 FABRICATION

- .1 Fabricate components free of twists, bends, or visual distortion and insulated. Weld corners and joints.
- .2 Assemble roof hatch components as indicated.
- .3 Ensure continuity of weather-tight seal.
- .4 Design flashings to collect and lead off accumulated condensation.
- .5 Zinc plate hardware and attachments and shop prime ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roof hatch installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Erect components plumb, level and in proper alignment.
- .2 Ensure continuity of building envelope air barrier and vapour retarder systems.
- .3 Adjust and seal assembly with provision for expansion and contraction of components.
- .4 Secure prefabricated curb assembly to structure.
- .5 Coat aluminum and copper in contact with dissimilar materials, with isolation coating.
- .6 Secure and seal frame to curb.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by roof hatch installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)L:
 - .2 ULC-S115-11, Fire Tests of Fire stop Systems.

1.2 **DEFINITIONS**

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit electronic copies of WHMIS MSDS Material Safety Data Sheets.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show locations, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: person specializing in fire stopping installations with 5 years of experience.
- .2 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations, with contractor's representative accordance with Section 01 32 16 Construction Progress Schedule Bar (GANTT) Charts to:
 - .1 Verify Project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN- ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stops system rating: to correspond with tested assemblies, or acceptable calculation procedures to provide fire resistance ratings as indicated.

- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with OBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.
- .11 Sealants:
 - .1 Sealants / Silicone: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction, colour as later selected by Consultant from manufacturer's complete colour range.
 - .2 Sealants / Water-based Acrylic Dispersion (Paintable):to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction, colour as later selected by Consultant from manufacturer's complete colour range.
- .12 Fire Stop Insulation: Mineral wool insulation as per sealant manufacturer written recommendations for intended use.
- .13 Fire Stop Mortar: Non-combustible, fibre reinforced, foamed cement mortar, ULC labelled.
 - .1 Acceptable material: 'A/D Fire barrier Mortar', by A/D Fire Protection Systems Inc, or equivalent by Hilti or approved alternate.
- .14 Sheet Metal Fire stopping in accordance with OBC 3.1.11.7(2).
 - .1 Sheet Metal Fire stopping: min 0.38 mm / 28 gauge sheet metal size and shape to suit opening. Provide continuous supports to all joints.
- .15 Gypsum Board: Refer to Section 09 21 99 Partitions and Section 09 21 16 Gypsum Board Assemblies.
- .16 Identification Labels: Purpose made by manufacturer for permanent attachment to fire stop substrate area. Clearly identify manufacturer, product name, maximum hour rating, ULC rating number, installation date, approved installer name and company c/w phone and fax number, and location number.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping / smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Fire Stop Sealant:
 - .1 Provide silicone fire stop sealant in concealed locations as determined in writing by Consultant.
 - .2 Provide water-based paintable acrylic fire stop sealant at all exposed to view locations.
 - .3 Provide fire stop sealant over fire stop insulation.
 - .4 Tool or trowel exposed sealant surfaces to a smooth, neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.
- As the Work progresses, permanently mark all penetration seals with identification plate in visible locations next to seal. Review all exposed to view locations with Consultant prior to installing identification plates.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Consultant.
- .2 Install floor fire stopping before interior partition erections.

- .3 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal including but not limited to:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.
 - .9 Rigid ducts greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
 - .10 At other locations as indicated on drawings.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C834-14, Standard Specification for Latex Sealants.
 - .2 ASTM C 919-12, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 General Services Administration (GSA) Federal Specifications (FS):
 - .1 FS-SS-S-200-E (2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland cement Concrete Pavement.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Manufacturer's product to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .3 Submit electronic copies of WHMIS MSDS in accordance with Section 01 35 29 Health and Safety Requirements.
- .3 Manufacturer's Instructions:
 - .1 Submit instructions to include installation instructions for each product used.

1.3 QUALITY ASSURANCE

- .1 Mock-ups:
 - .1 Construct mock-up in accordance with Section 01 45 00 Quality Control.
 - .2 Construct mock-up to show location, size, shape and depth of joint(s) complete with back up material, primer, caulking and sealant.

- .3 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed by Consultant.
- .5 Allow forty eight (48) hours for inspection of mock-up by Consultant before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work if deemed acceptable by Consultant.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Proceed with installation of joint sealants only when:
 - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
 - .2 Joint substrates are dry.
 - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
 - .1 Proceed with installation of joint sealants only where joint widths do not exceed those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

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1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.
- .2 Arrange for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants. Ventilate area of work as required with use of approved portable supply and exhaust fans.

1.8 WARRANTY

.1 Provide a written warrantee signed and issued in the name of the Owner, stating that caulking work of this section is guaranteed against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion and staining adjacent surfaces, for a period of two (2) years from date of Consultant's Certificate of Substantial Performance.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

- .1 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .2 Where sealants are qualified with primers use only primers as recommended by sealant manufacturer for type of surface and conditions being primed.
- .3 Joint Filler and Back-Up: Circular cross section unless shown as slab or sheet, minimum 25% wider than joint, semi-rigid: closed cell polyethylene or polyurethane product, rubber tubing or nonmigrating plasticized vinyl having a shore "A" hardness of 20 and tensile strength of 130-200 kPa, compatible with sealant and as recommended by sealant manufacturer.
 - .1 Acceptable material: 'Ethafoam', by Dow Chemical of Canada Ltd, or product of Hercules Inc., Delaware USA.
- .4 Bond Breaker: As recommended for use by sealant manufacturer.
- .5 Vent Tubes: Rigid clear extruded plastic, min. 6 mm ID and 9 mm OD.
- .6 Preformed compressible and non-compressible back-up materials:
 - .1 Polyethylene, urethane, neoprene or vinyl foam:
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or butyl rubber:
 - .1 Round solid rod, Shore A hardness 70.
 - .3 High density foam:
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond breaker tape:
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

.7 Sealant Colours: Colours of exposed sealants as later selected by Consultant from manufacturer's standard colour range.

2.2 SEALANT MATERIAL/DESIGNATIONS

- .1 Exterior Use:
 - .1 All areas unless specified otherwise: One Part moisture curing polyurethane, Self-leveling to CAN/CGSB-19.13, class MC-2-25-B-N:
 - .1 Acceptable Product: "Dymonic' by Tremco Ltd, or approved alternate.
 - .2 Prefinished Metal to Prefinished Metal: one part blend of synthetic rubber and resin, self leveling to CAN/CGSB 7.1:
 - .1 Acceptable Product: "Gutter Seal" by Tremco or approved alternate.
 - .3 Glass to glass, glass to metal and metal to metal curtain wall joints: medium modulus, moisture curing, one part silicone sealant. Meeting the specified requirements of specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-L:
 - .1 Acceptable Product: 'Spectrem 2' by Tremco Ltd or approved alternate.
 - .4 Sealants in contact with air/ vapour barrier membranes: refer to Section 07 27 00 Air-Vapour Barriers.

.2 Interior Use:

- .1 Lap Joints in Plastic Sheet Vapour Barrier and around mechanical piping and conduit in concealed to view spaces in partitions identified with an STC rating: Non-skinning, non-hardening, non-oxidizing, non-bleeding synthetic rubber sealant sealing and bedding compound for acoustical purposes and concealed joints conforming to CAN/CGSB 19-GP-21M87:
 - .1 Acceptable Product: "Acoustical Sealant", by Tremco, or approved alternate.
- .2 Joints around holes or voids made by through penetrations including but limited to mechanical piping and conduit in exposed to view spaces in partitions identified with an STC rating: easy gunning, non-staining, paintable acrylic polymer conforming to ASTM C834:
 - .1 Acceptable Product: "Tremflex 834", by Tremco, or approved alternate.
- .3 Interior General Application (all areas unless specified otherwise): to CAN/CGSB-19.14M:
 - .1 Acceptable Product: "Tremflex 834" by Tremco or approved alternate.
- .4 Wet Areas and Washroom Fixtures: Mildew resistant, one component neutral cure silicone sealant to CGSB-19GP22M:
 - .1 Acceptable Product: "Tremsil 200" by Tremco or approved alternate.
- .5 Interior non-moving joint applications to be painted: One component, paintable acrylic latex sealant to CGSB-19-GP-17M:
 - .1 "Tremflex 834" by Tremco or approved alternate.
- .6 Interior Fire Stop application:
 - .1 All locations unless otherwise noted:
 - .1 Acceptable Product: to CAN4-S115M "Tremstop Acrylic (GG)" by Tremco or approved alternate.
 - .2 For ULC rated systems: Refer to Section 07840 Fire Stopping and Smoke Seals.

2.3 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
- .2 Primer: in accordance with sealant manufacturer's written recommendations.

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PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACK-UP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant:
 - .1 Apply sealant in accordance with manufacturer's written instructions.

- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Clean adjacent surfaces immediately.
 - .3 Remove excess and droppings, using recommended cleaners as work progresses.
 - .4 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

3.9 SCHEDULE

- .1 Apply sealant at the following exterior locations:
 - .1 Between dissimilar materials in locations except where specifically indicated otherwise.
 - .2 Control joints in masonry elements.
 - .3 Below thresholds (double bead).
 - .4 At perimeter of door, screen and louver frames.
 - .5 At penetrations through exterior building elements.
 - .6 Where indicated.
- .2 Apply sealant at the following interior locations:
 - .1 Between dissimilar materials in exposed locations except where specifically indicated otherwise.
 - .2 Perimeter of exterior door, louver and screen frames.
 - .3 Between interior door frames and wall.
 - .4 Control joints in masonry elements, and joints between bearing and non-bearing masonry walls.
 - .5 Building expansion joints, except where expansion joint covers are required.
 - .6 At ceramic tile control joints.

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- .7 Perimeter of firehose cabinets, access panels, and control panels.
- .8 Between vanities / countertops / u/s of window stools and walls.
- .9 Between interior door frame and flooring.
- .10 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of sound ratings are maintained in partitions identified with STC ratings.
- .11 Where shown.
- .3 At interior locations use acrylic emulsion sealant except:
 - .1 At floor control joints use self leveling polyurethane.
 - .2 At vanities / countertops and at ceramic wall tile control joints use silicone sealant.
 - .3 Where expected joint movement exceeds movement capacity of acrylic emulsion sealant, use sealant specified for exterior use, as directed by Consultant

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A 653/A 653M-15, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B 29-14, Standard Specification for Refined Lead.
 - .3 ASTM B 749-14, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International):
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA):
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2016 Edition, Standard for Fire Doors and Other Opening Protectives.
 - .2 NFPA 252-(2012), Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
 - .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
 - .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 for ratings specified or indicated.
 - .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104, and listed by nationally recognized agency having factory inspection services.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Provide product data: in accordance with Section 01 33 00 Submittal Procedures.
- .3 Provide shop drawings: in accordance with Section 01 33 00 Submittal Procedures.
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware, fire rating and finishes.
 - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing finishes.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
 - .4 Submit test and engineering data, and installation instructions.
 - .5 Verify actual opening sizes and field conditions by field measurement before fabrication. Shop drawings to reflect measurements and conditions provided, and product shall be manufactured accordingly. Coordinate field measurements with fabrication and construction schedules to avoid delays.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials off floor, in well ventilated room, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry area.
 - .2 Store and protect metal doors and frames from dents, nicks, scratches, and blemishes, well-ventilated area.
 - .3 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Honeycomb Construction:
 - .1 Structural full, 32 mm, cell size resin impregnated fibrous 'honeycomb'.

- .2 Stiffened: face sheets welded, honeycomb, uninsulated and insulated core.
 - .1 Insulation: polyurethane, rigid extruded, closed cell board and heat resistant. Density; 16 to 32 kg/m³, thermal values; RSI 1.0 (R 6.0) minimum, Type 1, in accordance with ASTM C578 Fibreglass: to CAN/ULC-S702, semi-rigid, density 24 kg/m³.
- .3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC-S104, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene and Polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 99 - Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Door bottom seal: Refer to Section 08 71 00 Door Hardware and door hardware schedule.
- .5 Metallic paste filler: to manufacturer's standard.
- .6 Fire labels: metal, riveted and clearly visible.
- .7 Sealant: Refer to Section 07 92 00 Joint Sealing.
- .8 Glazing: Refer to Section 08 80 50 Glazing.
 - .1 Make provisions for glazing as indicated and provide necessary glazing stops.

- .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
- .2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm / 16 ga. welded thermally broken type construction.
- .4 Interior frames:
 - .1 1.6 mm / 16 ga. Welded type construction, unless otherwise indicated.
 - .2 1.6mm / 16 ga. knock down frames will only be permitted where welded frames cannot be installed (i.e.; existing openings where frames cannot be practicably installed). Obtain written approval from Consultant prior to shipment and use of knock-down frames.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare frame for door silencers, three (3) for single door, two (2) at head for double door.
- .8 Manufacturer's nameplates on frames and screens are not permitted.
- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Insulate entire interior of exterior frame components with polyurethane foam insulation.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide two (2) anchors for rebate opening heights up to 1520 mm / 5'-0" and one (1) additional anchor for each additional 760 mm / 2'-6" of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm / 6" from top and bottom of each jamb and intermediate at 660 mm / 26" on centre maximum.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 FRAMES: KNOCKED-DOWN TYPE

- .1 Where knock down frames are permitted:
 - .1 Ship knocked-down type frames unassembled.
 - .2 Provide frames with mechanical joints which inter-lock securely and provide functionally satisfactory performance when assembled and installed in accordance with CSDMA Recommended Installation Guide for Steel Doors and Frames.
 - .3 Securely attach floor anchors to inside of each jamb profile.
 - .4 Accurately form interlocking joints of frames to maintain tight alignment where field assembled. Provide continuous weld to joints on site and grind smooth. Touch up galvanized primer finish where coating has been removed or damaged during field work.

2.11 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: insulated hollow steel construction, size as indicated x 45 mm thick, unless otherwise indicated.
- .3 Interior doors: honeycomb hollow steel construction, size as indicated x 45 mm thick, unless otherwise indicated.
- .4 Fabricate doors with longitudinal edges welded. Grind welded seam joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketting and hardware in accordance with ASTM E 330.
- .6 Size doors to provide even margins between doors and jambs and doors and finished floor and thresholds as follows:
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm
 - .3 Underside of door to finished floor, non-combustible sill, and thresholds: 13 mm.
- .7 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

- .8 Factory prepare holes 12.7 mm / 1/2" diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .9 Reinforce doors where required, for surface mounted hardware. Provide inverted, recessed, spot welded channels to top and bottom of interior and exterior doors and finish with flush PVC top and bottom caps.
- .10 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .11 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC-S104 NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .12 Manufacturer's nameplates on doors are not permitted.

2.12 HOLLOW STEEL CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm / 16 ga. sheet steel.
- .2 Form face sheets for interior doors from 1.2 / 18 ga. sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm / 6" on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with polystyrene core
- .5 Fill voids between stiffeners of interior doors with honeycomb core.

2.13 THERMALLY BROKEN DOORS AND FRAMES

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation to entire frame interior.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1220 mm / 4'-0" wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material in accordance with Section 07 92 00
 Joint Sealants.
- .6 Maintain continuity of air / vapour barrier. Provide continuous air / vapour barrier seal between thermal break of thermally broken frame and air / vapour barrier of exterior wall system with air / vapour barrier transition membrane. Refer to Section 07 27 00 Air / Vapour Barriers.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 Door Hardware.
- .2 Adjust operable parts for correct function.
- .3 Install louvres.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Architectural Manufacturers Association (AAMA):
 - .1 AAMA 609/610-09, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
- .3 Environmental Choice Program (ECP):
 - .1 CCD-045-95, Sealants and Caulking Compounds.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for doors and frames and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

- .1 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:
 - .1 Interior trim and exterior junctions with adjacent construction.
 - .2 Junctions between combination units.
 - .3 Elevations of units.
 - .4 Core thicknesses of components.
 - .5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement and accessories.
 - .6 Location of caulking.
 - .7 Each type of door system including location.
 - .8 Arrangement of reinforcing for hardware and joints.
 - .9 Arrangement of hardware and required clearances.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Use coatings that are easy to remove and residue free.
- .2 Leave protective covering in place until final cleaning of building.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect aluminum doors and frames from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Design frames and doors in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of -35 to 35 degrees
 C.
 - .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E 330 under wind load of 1.2 kPa submit certificate of tests performed.
 - .3 Movement within system.
 - .4 Movement between system and perimeter framing components or substrate.
 - .5 Fenestration performance grades:
 - .1 In accordance with the CSA A440SI Canadian Supplement, Clause (1)(b) appropriate for the conditions and geographic location in which the doors will be installed.
 - .2 Conform to performance grades selected under CSA A440SI Canadian Supplement, Sentence (2) when tested in accordance with the standard referenced in Clause (1)(a).
- .2 Include continuous air / vapour barrier and vapour retarder through door system. Primarily in line with [inside] pane of glass and heel bead of glazing compound.

2.2 MATERIALS

- .1 Aluminum extrusions: to Aluminum Association alloy AA 6063-T6 anodizing quality.
- .2 Sheet aluminum: 1.5 mm/ 1/16" minimum thick.
- .3 Fasteners: stainless steel, finished to match adjacent material.
- .4 Glazing materials: Refer to Section 08 80 50 Glazing.
- .5 Sealants: colour as later selected by Consultant in accordance with Section 07 92 00 Joint Sealants.

2.3 ALUMINUM DOORS

- .1 Interior Aluminum Entrance Door:
 - .1 Construct doors of porthole extrusions with minimum wall thickness of 2.3 mm / 0.090" minimum.
 - .2 Door depth: 45 mm / 1 3/4".

- .3 Door stiles nominal 127 mm / 5" wide plus or minus 6 mm / 1/4".
- .4 Top rail nominal 89 mm / 3 1/2" wide plus or minus 6 mm.
- .5 Bottom rail nominal 165 mm / 6 1/2" wide plus or minus 6 mm / 1/4".
- .6 Mid rail nominal 152 mm / 6" wide plus or minus [6] mm / 1/4".
- .7 Reinforce mechanically joined corners of doors to produce sturdy door unit.
- .8 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
- .9 Hardware: Refer to Section 08 71 00 Door Hardware.
- .10 Acceptable product: '500 Wide Stile', by Kawneer, or equivalent by Alumicor Canada Limited, or Oldcastle Building Envelope, or Windspec Inc., or approved alternate.
- .2 Exterior Thermally Broken Aluminum Entrance Doors:
 - .1 Construct doors of porthole extrusions with minimum wall thickness of 3.0 mm / 0.125".
 - .2 Door depth: 57 mm / 2 1/4".
 - .3 Door stiles nominal 108 mm / 4 1/4" wide plus or minus 6 mm / 1/4".
 - .4 Top rail nominal 108 mm / 4 1/4" wide plus or minus 6 mm.
 - .5 Bottom rail nominal 165 mm / 6 1/2" wide plus or minus 6 mm / 1/4".
 - .6 Mid rail nominal 209 mm / 8-1/4" wide plus or minus 6 mm / 1/4".
 - .7 Reinforce mechanically joined corners of doors to produce sturdy door unit.
 - .8 Acceptable product: 'AA 425 wide stile', by Kawneer, or equivalent by Alumicor Canada limited, or Oldcastle BuildingEnvelope, or Windspec Inc., or approved alternate.

2.4 ALUMINUM FRAMES

- .1 Frame Members:
 - .1 Exterior: Refer to 08 44 13 Glazed Aluminum Curtain Walls.
 - .2 Interior: 45 mm x 115 mm / 1 3/4" x 4 1/2" nominal size, for flush glazing.
- .2 Sidelite Base: width to match frame, height to match bottom rail of adjacent door.
- .3 Acceptable Product:
 - .1 Interior Frame: '450', by Kawneer, or equivalent by Alumicor Canada limited, or Oldcastle BuildingEnvelope, or Windspec Inc., or approved alternate.

2.5 ALUMINUM FINISHES

- .1 All door and frame finish unless otherwise noted:
 - .1 Exterior Doors and Frames: Refer to 08 44 13 Glazed Aluminum Curtain Walls.
 - .2 Interior Doors and Frames: #17 clear, designation AA M12C22A31 by Kawneer, or equivalent by Alumicor Canada Limited, or Oldcastle Building Envelope, or Windspec Inc., or approved alternate.
- .2 Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.

2.6 STEEL FINISHES

.1 Finish steel clips and reinforcing steel with steel primer to CGSB 1.40.

2.7 FABRICATION

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames to profiles and maximum face sizes as indicated.
- .3 Provide structural steel reinforcement as required.
- .4 Fit joints tightly and secure mechanically.
- .5 Conceal fastenings.
- .6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 00 - Door Hardware.
- .7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum doors and frames installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate. Examine work of other trades over which aluminum framing will be applied, for conformity to drawings. Report all discrepancies to Consultant prior to commencing with work for aluminum doors and framing systems.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
- .3 Anchor securely.
- .4 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .5 Adjust door components to ensure smooth operation.
- .6 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.
- .7 Glaze aluminum doors and frames in accordance with Section 08 80 50 Glazing.

.8 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Perform cleaning of aluminum components in accordance with AAMA 609.1 Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
 - .3 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
 - .4 Clean aluminum with damp rag and approved non-abrasive cleaner.
 - .5 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.
 - .6 Clean glass and glazing materials with approved non-abrasive cleaner.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by aluminum door and frame installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.
- .2 CAN/CSA O132.2 Series-90(R1998), Wood Flush Doors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 Submittal Procedures.
 - .2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom panel construction and cutouts.

1.3 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection:
 - .1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
 - .2 Store doors indoors, in well ventilated room, off floor, in accordance with manufacturer's recommendations.
 - .3 Store doors away from direct sunlight.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of corrugated cardboard, polystyrene, and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .4 Divert unused adhesive material from landfill to official hazardous material collections site.
- .5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 WOOD FLUSH DOORS

- .1 Solid core: Bonded laminated strand lumber core to CAN/CSA3-188.1M78, Type II Grade E for fire rated doors, provide core in accordance with fire test requirements,
 - .1 Construction:
 - .1 Size: size as indicated x 45 mm / 1 3/4" thick, unless otherwise indicated.
 - .2 Structural composite lumber (SCL) core: 609 kg/m³ (38 PCF) stile and rail frame bonded to stiles, 5-ply construction.
 - .3 Solid wood core:
 - .1 Glued block core with wood edge band.
 - .2 Framed block glued core.
 - .3 Stile and rail core: 13 mm / 1/2" hardwood bonded on 25 mm / 1" structural composite lumber.
 - .4 5-ply construction.
 - .2 Finish as identified in Door Schedule:
 - .1 Hardwood Face (HWF): transparent grade face panels to requirements of AWMAC Premium Grade, rotary cut maple veneer, finished both sides to avoid warping. Refer to Section 09 91 23, Interior Painting.
 - .2 Hardboard Face (HBF): Paint Grade Face Panels to requirements of AWMAC Custom Grade, Hardboard Veneer, finished by Section 09 91 23 Interior Painting.
 - .3 Laminated Plastic Finish (P-Lam): bonded to composite cross-band.
 - .3 Edge bands: laminated to core with adhesive:
 - .1 Stiles: width as indicated including hardwood edge, 19 mm / 3/4" thick, matching door face, where stain and varnished finish is required.
 - .2 Rails: as indicated.
 - .4 Cross-banding: approximately 1.5 mm / 1/16" thick hardwood veneer laminated to each face of core at doors requiring plastic laminate facing.
 - .5 Factory seal top and bottom edges with two coats of urethane sealer, prior to shipping.
 - .6 Factory prepare doors for finish hardware.
 - .7 Provide transom panels matching doors above which they are located. Provide rabetted joints where doors meet transoms.
 - .8 Mineral core fire doors shall have pilot holes of 3 mm / 1/8" diameter for installation of hinges and, screws shall be turned into pilot holes by use of manual or "Yankee" screwdriver.
 - .9 Adhesive: Type I (waterproof) for interior and exterior doors.
 - .10 Fire Resistant Rating: ULC Label as indicated in door schedule.
 - .11 Acceptable product:
 - .1 All doors unless otherwise noted: '5-LSL-ME' by Lambton Doors
 - .2 Equivalent products by Dormond Industries, or Cambridge Doors and Windows, or Baillargeon, or Door-lam, or Mohawk.

2.2 GLAZING

.1 Glass: refer to Section 08 80 50 – Glazing.

2.3 WOOD LOUVERS

.1 Refer to Division 23 for supply of louvers.

2.4 FABRICATION

- .1 Vertical edge strips to match face veneer.
- .2 Prepare doors for louvres and glazing. Provide hardwood maple to match face veneer, glazing stops with mitred corners.
- .3 Bevel vertical edges of single acting doors 3 mm in 50 mm / 1/8" in 2" on lock side and 1.5 mm in 50 mm / 1/16" in 2" on hinge side.
- .4 Radius vertical edges of double acting doors to 60 mm / 2 1/4" radius.
- .5 Finish laminated plastic smooth and flush with stile edges of door and bevel at approxmately 20 degrees.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.
- .2 Install labelled fire rated doors to NFPA 80.
- .3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.
- .4 Adjust hardware for correct function.
- .5 Install glazing in accordance with Section 08 80 50 Glazing.
- .6 Install louvres and stops.
- .7 Secure transom and side panels by means of concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
- .2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .3 Remove traces of primer, caulking; clean doors and frames.
- .4 Clean glass and glazing materials with approved non-abrasive cleaner.
- .5 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Page 1

PART 1 - GENERAL

1.1 **DELIVERY, STORAGE AND HANDLING**

- Deliver, store and handle materials in accordance with Section 01 61 00 Common Product .1 Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 NON-RATED ACCESS DOORS FOR WALLS AND CEILINGS

- .1 Source Limitations: Obtain each type of access door and frame for the entire project from a single source and from a single manufacturer.
- .2 Size: to suit access requirements.
 - .1 For body entry: 600 x 600 mm minimum.
 - .2 For hand entry: 300 x 300 mm minimum.
- .3 Construction: rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.
- .4 Gasketing: Fabricate access doors with neoprene gasket around perimeter of door frame.
- .5 Anchors: concealed, to suit application.
- .6 Finish: as follows:
 - .1 All areas unless otherwise indicated: Galvanized, bonderized steel with white powder coat primer.
 - .2 To all washrooms, kitchens, custodial wet areas and other wet areas as indicated: No. 304 stainless steel with No. 4 satin brushed finish.
- .7 Flush Access Doors with Exposed Flanges:
 - .1 Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - .2 Door: 1.6 mm / 16 gauge cold rolled steel with edge support for structural rigidity.
 - .3 Frame: Standard, 16 gauge cold rolled sheet steel with concealed fasteners.
 - .4 Hinge: Flush continuous piano type.
 - .5 Latching / Locking: Factory installed 6 mm / 1/4" Allen key, self-latching.

2.2 FIRE-RATED ACCESS DOORS FOR WALLS AND CEILINGS

- Fire-Rated Access Doors and Frames: Provide access door and frame assemblies tested for fire-.1 test-response characteristics in accordance with NFPA 80 to the following test methods and that are listed and labeled by UL or Intertek - Warnock Hersey and to the authorities having jurisdiction:
 - .1 NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - .2 NFPA 288 for fire-rated access door assemblies installed horizontally.

- .2 Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide fire rated access door and panel assemblies with panel door, frame, hinge, and latch from manufacturer listed in Underwriter's Laboratories (UL), "Building Materials Directory" or Intertek Warnock Hersey for rating shown.
 - .1 Provide 90 minute UL label at 2-hour rated partitions.
 - .2 Provide 3 hour Warnock Hersey label at horizontal applications, up to 24 inch wide x 36 inch high.
 - .3 Provide 2 hour Warnock Hersey label at horizontal applications greater than 24 inch wide x 36 inch high.
- .3 Size: to suit access requirements.
 - .1 For body entry: 610 x 610 mm / 24" x 24" minimum.
 - .2 For hand entry: 305 x 305 mm / 12" x 12" minimum.
- .4 Construction: rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.
- .5 Anchors: concealed, to suit application.
- .6 Finish:
 - .1 All areas unless otherwise indicated: Galvanized, bonderized steel with white powder coat primer.
 - .2 To all washrooms, kitchens, custodial wet areas and other wet areas as indicated: No. 304 stainless steel with No. 4 satin brushed finish.
- .7 Maximum Size and Rating for:
 - .1 Horizontal Application: 610 mm wide x 914 mm high / 24" x 36".
 - .2 Maximum Size and Rating for Vertical Applications: 1219 mm x 1219 mm / 48" x 48".
- .8 Fire-Rated, Insulated Flush Access Doors with Exposed Flanges / Frame:
 - .1 Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fibre insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - .2 Door: 0.9 mm / 20 gauge galvanized (satin coated) steel door with 2-1/4 inch (57 mm) depth sandwich type assembly.
 - .3 Frame Material: 1.6 mm / 16 gauge cold rolled steel of 64 mm / 2-1/2" depth with 25.4 mm / 1" flange at perimeter with concealed fasteners.
 - .4 Hinges: Flush continuous piano hinge.
 - .5 Latching / Locking Devices: Standard, hex head cam latch, regular 6 mm / 1/4" Allen head.
 - .6 Automatic Closure Devices: Spring operated automatic closure devices for each door, number of springs to suit door size.
 - .7 Interior Latch Release all doors over 305 mm x 305 mm / 12" x 12": Mechanisms to allow panels to open from inside.
 - .8 Insulation: 51 mm / 2" thick fire rated mineral wool.

2.3 EXCLUSIONS

.1 Lay-in Tile Ceilings: use unobtrusive identification locators.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Installation: locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.
 - .1 Install gypsum board surfaces: in accordance with Section 09 21 16 Gypsum Board Assemblies.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by access door installation.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Contractor's Representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.
- .2 Ensure key personnel attend.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gymnasium fold-up curtain and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate type of gymnasium fold-up curtain, arrangement of hardware, required clearances, and electrical characteristics including voltage, size of motors, auxiliary controls and wiring diagrams.
 - .2 Indicate assembly details and dimensions of fabrication, required clearances [and electrical connections].
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Submit duplicate 305 x 305 mm / 12" x 12" sample of curtain fabric.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gymnasium fold-up curtain from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for gymnasium fold-up curtain, and hardware for incorporation into manual.

1.5 WARRANTY

.1 Submit a written document stating that gymnasium curtain is warranted against crackling, tearing, joint failures and rupture of suspension system for a period of FIVE (5) YEARS from the date of Substantial Performance.

PART 2 - PRODUCTS

2.1 CURTAIN

- .1 Formed of one (1) panel of vertical heat sealed strips in sufficient quantity and length to cover entire opening complete with matching seams of same vinyl characteristics, eyelets riveted to vinyl spaced not more than 630 mm / 25" apart along the entire height and 3050 mm / 10'-0" apart along entire width of curtain to allow routing of lifting cable.
- .2 Colour: as later selected by Consultant from manufacturer's standard colour range.
- .3 Fabricate curtain in two sections as follows:
 - .1 Lower Part: from polyester reinforced vinyl with a flame spread of 75 or less as per S109 laboratory tests.
 - .2 Upper Part: netted and joined to lower section of net with 150 mm / 6" strip of identical vinyl to provide a path for the lifting cable.
- .4 Provide 38 mm / 1½" diameter steel pipe inserted in hem at bottom of curtain to keep curtain stretched and aligned over entire length.
- .5 Curtain Weight: 644 gr/sq.m. (19 oz/sq.yd).

2.2 RAISING MECHANISM

- .1 Motor drive unit: 1 1/2 HP, 208 V, 3 Phase, 60 Hz complete with a magnetic contactor capable of reversing the movement of the curtain at any point, emergency brake and travel limit switches for both up and down positions.
- .2 Raising mechanisms:
 - .1 Provide 32 mm / 1¼" diameter transmission shafts equipped complete with 50 mm / 2" wide flange drums with machined grooves to allow a single and uniform winding.
 - .2 Provide 5 mm diameter aircraft type lifting cables that wind on drums fixed to motor drive unit located in centre of opening.
 - .3 Allow three (3) complete turns of cable to remain on the drums when curtain is in lowered position and one (1) empty groove on drums when curtain is in raised position.
 - .4 Suspend motor drive unit from structure with 13 mm / ½" diameter threaded rods.

- .5 Single shaft motor drive units for total length of gymnasium will not be accepted.
- .6 Steel cables winding on drums attached to a single shaft will not be accepted.

.3 Pulleys:

- .1 Pulley diameter: minimum 30 times cable diameter.
- .2 Attach pulleys to structure, spaced not more than 3050 mm / 10'-0" along the entire width of opening.
- .3 Hold lifting pulleys and curtain in place with 75 mm X 50 mm X 6 mm / 3" x 3" x 1/4" minimum steel angles attached to structure with 13 mm diameter threaded rods. Do not weld steel angles to structure.
- .4 Provide safety switches to monitor roller chain tension for loose chain or breakage.
- .5 Provide key operated spring-loaded type switch for operating control.
- .6 Belts for driving transmission shafts will not be accepted.

2.3 ACCESSORIES

- .1 Valance:
 - .1 Conceal curtain stacking of at top with valance of same vinyl and colour material as curtain.
 - .2 Valance height: 1475 mm / 4'-10" high.
 - .3 Suspend valances from steel angles attached to building structure. Hang valance from angles with 38 mm / 1¼" diameter steel pipe inserted in curtain top hem and attach with "U" clamp holding system.
 - .4 Wooden parts in the holding system will not be accepted.
- .2 Hydraulic safety brake
 - .1 Provide hydraulic emergency stopping device to prevent curtain free fall, or provide system to limit the descending speed to less than normal operation speed.
 - .2 Connect emergency stopping device directly to motor drive unit gear box.
 - .3 Mechanical systems designed to hold curtain in place in case of a failure of the gear box will not be acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Install gymnasium fold-up curtain in accordance with manufacturer's printed instructions.
- .3 Install electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for [gymnasium fold-up curtain] operation.
- .4 Install electric wiring from power supply located near gymnasium fold up curtain.

- .5 Install master-keyed cylinder specified in Section 08 71 00 Door Hardware.
- .6 Adjust fold up curtain operating components to ensure smooth opening and closing.

3.2 CLEANING

- .1 Perform cleaning of aluminum components in accordance with: AAMA 609.
- .2 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Clean aluminum and stainless steel with damp rag and approved non-abrasive cleaner in accordance with manufacturer's instructions.
 - .2 Remove traces of primer, caulking; clean doors and frames.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by overhead coiling door and grille installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA CW-10-04, Care and Handling of Architectural Aluminum from Shop to Site.
 - .2 AAMA CW-11-85, Design Wind Loads and Boundary Layer Wind Tunnel Testing.
 - .3 AAMA T1R-A1-04, Sound Control for Fenestration Products.
 - .4 AAMA 501-05, Methods of Test for Exterior Walls.
 - .5 AAMA 611-98, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
 - .6 AAMA 612-02, Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.
 - .7 AAMA 2603-02, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - .8 AAMA 2604-05, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

.3 ASTM International

- .1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Allov-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B 209-14, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM B 221-14, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .4 ASTM E 283-04(2012), Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .5 ASTM E 330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .6 ASTM E 331-00(2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .7 ASTM E 413-10. Classification for Rating Sound Insulation.
- .8 ASTM E 1105-15, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.108-M89, Bituminous Solvent Type Paint.
 - .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.5 CSA International

- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members.
- .3 CSA S157-05/S157.1-05(R2015), Strength Design in Aluminum/Commentary on CSA-S157-05, Strength Design in Aluminum.
- .4 CSA W59.2-M1991(R2013), Welded Aluminum Construction.

- .5 CSA A440-11, North American Fenestration Standards/Specification for Windows, Doors and Skylights.
- .6 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440,NAFS # North American Fenestration Standard/Specification for windows, doors, and skylights, Includes Update No. 1 (2013).
- .6 Society for Protective Coatings (SSPC)
 - .1 SSPC Paint 20-02(R2014), Zinc Rich Coating, Type I Inorganic and Type II Organic.
 - .2 SSPC Paint 25-11, BCS, Zinc Oxide, Alkyd, Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: coordinate work of this Section with installation of air / vapour barrier placement, and flashing placement.
- .2 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with Contractor's Representative in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for curtain wall components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazed aluminum curtain wall for incorporation into manual.

1.5 QUALITY ASSURANCE

JLR No. 27672-000.1

- .1 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 Quality Control.
 - .2 Supply 10 m / 100 sq.ft. x full height mock-up including intermediate mullion, corner mullion, sill muntin, vision glass light, and insulated infill panel glass.
 - .1 Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
 - .3 Locate mock-up where Consultant.
 - .4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with work.
 - .5 When accepted, mock-up will demonstrate minimum standard of quality and materials for work of this Section.
 - .6 Mock-up may remain as part of finished work to Consultant approval.
- .2 Manufacturer's Field Services: as part of Manufacturer's Services described in PART 3 FIELD QUALITY CONTROL, schedule site visits with manufacturer's representative, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work and mock-up is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Handle work of this Section in accordance with AAMA CW-10.
 - .2 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Store and protect aluminum glazed curtain wall components from nicks, scratches, and blemishes.
 - .4 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
 - .5 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

1.7 AMBIENT CONDITIONS

- .1 Install sealants when ambient temperature is above 5°C minimum.
- .2 Maintain this minimum temperature during and for forty-eight (48) hours minimum after installation of sealants.

1.8 MANUFACTURER'S FIELD SERVICES

- .1 Arrange for initial job start-up site attendance, periodic site attendance of membrane manufacturer's technical representative during installation work, together with written report.
- .2 The Contractor must at all times enable and facilitate access to the work site by said representative.
- .3 Notify Consultant of date and time of inspection, a minimum of 48 hours prior to inspection. Provide one copy of manufacturer's report to the Consultant within 48 hours of inspection being carried out.

1.9 WARRANTY

.1 Contractor hereby warrants that glazed aluminum curtain wall will function as specified in accordance with CCDC 2, but for sixty (60) months.

PART 2 - PRODUCTS

2.1 SYSTEMS

- .1 Description:
 - .1 Vertical glazed aluminum curtain wall system includes thermally broken tubular aluminum sections with self-supporting framing, shop fabricated, factory prefinished, vision glass, insulated metal panel spandrel infill; related flashings, anchorage and attachment devices.
 - .2 Assembled system to permit re-glazing of individual glass (and infill panel) units from exterior without requiring removal of structural mullion sections.

.2 Performance Requirements:

- .1 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with OBC.
- .2 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable codes.
- .3 Fenestration performance grades for curtain wall system:
 - .1 In accordance with the CSA A440SI Canadian Supplement, Clause (1)(b) appropriate for the conditions and geographic location in which the doors will be installed.
 - .2 Conform to performance grades selected under CSA A440SI Canadian Supplement, Sentence (2) when tested in accordance with the standard referenced in Clause (1)(a).
- .4 Deflection of Framing Members: At design wind pressure, as follows:
 - .1 Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite, or an amount that restricts edge deflection of individual glazing lites to 19 mm / 3/4", whichever is less. Limit deflection of clear span of framing members to L/175 for spans less than or equal 5.0 m / 16'-6" and L/240 for spans greater than 5.0 m / 16'-6".
 - .2 Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 3 mm / 1/8", whichever is smaller.
- .5 Ensure system allows for expansion and contraction within system components when temperature range is 95 degrees C over 12 hour period without causing detrimental effect to system components.
- .6 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

- .7 Maintain continuous air/vapour barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
 - .1 Position thermal insulation on exterior surface of air/vapour barrier and vapour retarder.
- .8 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

2.2 MATERIALS

- .1 Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 2.0 mm / 5/64" wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
- .2 Aluminum sheet alloy: to requirements of ASTM B209.
- .3 Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
- .4 Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- .5 Pressure Plate: Aluminum fastened to the mullion with stainless steel screws.
- Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- .7 Sealant: Refer to Section 07 92 00 Sealants.
- .8 Thermal Barrier: Thermal barrier consists of 25 mm / 1" separation between the interior and exterior metal members in a typical condition, while maintaining a continuous watertight seal. Thermal barrier assembly tested in accordance with thermal cycling requirements of ASTM E2692 and show no sign of degradation following the test.
- .9 Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.
- .10 Bituminous Paint: CAN/CGSB 1.108, Type 1 or 2, without thinner as recommended by manufacturer.
- .11 Glazing: Refer to Section 08 80 50 Glazing.

2.3 COMPONENTS

.1 Description: Thermally broken with interior tubular section insulated from exterior pressure plate; matching stops and pressure plate of sufficient size and strength to provide adequate bite on glass and infill panels; drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

- .2 Vertical members: overall size including cap, 63.5 x 152.4 mm / 2 1/2" x 6" nominal dimension.
- .3 Horizontal members: overall size including cap, 63.5 x 152.4 mm / 2 1/2" x 6" nominal dimension.
- .4 Fasteners: 300 Series stainless steel or 400 series stainless steel cadmium plated of sufficient size and quantity to perform work.
- .5 Weathering and Glazing Gaskets: extruded, black, closed cell or dense elastomer of durometer appropriate to function.
- .6 Thermally Broken Door Adaptors: provide thermal pressure plate door adaptors to accommodate insulated aluminum doors.
- .7 Structural Silicone Glazing Spacer Gaskets: provide glazing spacer gaskets compatible with structure silicone sealant.
- .8 Gasket and Glazing Tape: EPDM gasket with integral glazing tape, 'Vision Strip' by Tremco, or approved alternate.
- .9 Captured Mullion profile:
 - .1 Acceptable material: 1600UT System 1 by Kawneer, or ThermaWall 2600 by Alumicor, or equivalent by Alumicor Canada limited, or Oldcastle BuildingEnvelope, or Windspec Inc., or approved alternate.
- .10 Structural Silicone Glazing with Capless Vertical Glass Joints:
 - .1 Acceptable material: 1600 System 2 by Kawneer, or ThermaWall 2500 SSG System by Alumicor, or equivalent by Oldcastle BuildingEnvelope, or Windspec Inc., or approved alternate.

.11 Cap Profile:

- .1 Horizontal mullions: 63.5 wide x 19 mm / 2 1/2" x 3/4" deep nominal dimension unless otherwise indicated.
- .2 Vertical mullion: 6 3.5 x 19 mm / 2 1/2" x 3/4" deep nominal dimension.
- .3 Decorative cap and plate: Horizontal pressure plate and cap to extend across the full glass. Finish back of the pressure plate with anodized aluminum to match curtain wall framing.

.12 Infill panels:

- .1 Interior spandrel panel: 1.5 mm / 1/16" thick, aluminum panel laminated to 19 mm / 3/4" thick plywood, finish to match framing system.
- .2 Internal back pan: galvanized metal, 0.8 mm / 22 gauge, x full depth, sealed air / vapour tight corners, and flanges designed to fit into glazing pocket to form an integral part of the curtain wall air / vapour barrier system.
- .3 Insulation: Semi-rigid stone wool insulation board. Fill pan with mineral wool insulation. Allow for 22 mm / 7/8" space between back pan and inside mullion face in locations to receive anodized aluminum panel.
 - .1 Acceptable Product: CurtainRock 40 by Roxul Inc., or approved alternate.
- .4 Exterior Spandrel Panel: Refer to Section 08 85 00 Glazing.
- .5 Adjacent Wall Covers: 0.50 mm / 1/64" thick aluminum, full contact pressure bonded to wall surfaces, ensuring flat surface, finish to match curtain wall mullion sections.
- .6 Flashings: 0.50 mm / 1/64" thick aluminum, to match curtain wall mullion sections where exposed, secured with concealed fastening method.

- .13 Flashings: Refer to Section 07 62 00 Sheet Metal Flashing and Trim.
- .14 Sills: Refer to Section 07 62 00 Sheet Metal Flashing and Trim.
- .15 Air / Vapour Barrier: Refer to Section 07 28 00 Air/Vapour Barrier

2.4 FABRICATION

- .1 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- .2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof
- .3 Prepare components to receive anchor devices. Install anchors.
- .4 Arrange fasteners and attachments to ensure concealment from view.
- .5 Prepare system components to receive exterior doors, and hardware specified in Section 08 11 16 -Aluminum Doors and frames.
- .6 Visible manufacturer's identification labels not permitted.
- .7 Fabricate curtain wall system complete with glazing to withstand the lateral design loads as per OBC requirements.
- .8 Finishes:
 - .1 Finish coatings: unless otherwise indicated finish all exposed surfaces of interior and exterior aluminum sections with anodic oxide treatment in accordance with Aluminum Association specification #14 clear, designation AA M12C22A41 by Kawneer, or equivalent by Alumicor, or Oldcastle BuildingEnvelope, or Windspec Inc., or approved alternate.
 - .1 Curtain wall caps: #14 clear, designation AA M12C22A41.
 - .2 Shop and touch-up primer for steel components: SSPC 25 Paint red oxide.
 - .3 Touch-up primer for galvanized steel surfaces: SSPC 20 Paint zinc rich.
 - .4 Concealed steel items: galvanized in accordance with CSA G164M to 600 gm/m2. Primed with iron oxide paint.
 - .5 Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

2.5 SOURCE QUALITY CONTROL

- .1 Manufacturer qualifications: company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience.
- .2 Installer qualifications: company specializing in performing the work of this section with minimum five (5) years documented experience approved by manufacturer.
- .3 Perform welding Work in accordance with CSA W59.2.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Verify dimensions, tolerances, and method of attachment with other work.
 - .3 Verify wall openings and adjoining air / vapour barrier and vapour retarder materials are ready to receive work of this Section.
 - .4 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

- .1 Install curtain wall system in accordance with manufacturer's instructions.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Use alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Use thermal isolation where components penetrate or disrupt building insulation.
- .6 Install sill flashings.
- .7 Coordinate attachment and seal of perimeter air / vapour barrier and vapour retarder materials.
- .8 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier in accordance with curtain wall and insulation manufacturer's written instructions.
- .9 Install thermally broken pressure plate door adaptors to accommodate insulated aluminum doors.
- .10 Install glass and infill panels in accordance with Section 08 80 50 Glazing.
- .11 Install perimeter sealant to method required to achieve performance criteria and installation criteria in accordance with Section 07 92 00 Joint Sealants.

3.3 SITE TOLERANCES

- .1 Maximum variation from plumb: 1.5 mm/m / 1/16" non-cumulative or 12 mm/30 m / 1/2":100', whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm / 1/32".
- .3 Maximum sealant space between curtain wall and adjacent construction: 13 mm / 1/2".

3.4 FIELD QUALITY CONTROL

- .1 Inspection by independent testing agency, engaged and coordinated by the Contractor, will monitor quality of installation and glazing.
 - .1 Test system to: AAMA 501 and ASTM 1105 15
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer of curtain wall verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products, and submit written reports in acceptable format to verify compliance of Work with Contract within 3 days of review.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Ensure manufacturer's representative of curtain wall and of glass is present before and during critical periods of installation and testing.
 - .4 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning has been carried out.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Remove protective material from prefinished aluminum surfaces.
 - .3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
 - .4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
 - .5 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCES

- .1 Aluminum Association (AA):
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 CSA Group:
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS North American Fenestration Standard for Windows, Doors, and Skylights.
 - .2 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/1.S.2/A440, NAFS North American Fenestration Standard for Windows, Doors, and Skylights.
 - .3 CAN/CSA-A440.4-07(R2012), Window, Door, and Skylight Installation.
 - .4 CAN/CSA-A440.2/A440.3-14, Fenestration energy performance/User guide to CSA A440.2, Fenestration energy performance.
- .3 Screen Manufacturers Association (SMA):
 - .1 SMA 1201R-2002 Specification for Insect Screens for Windows, Sliding Doors and Swinging Doors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [windows] and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim junction between combination units elevations of unit, anchorage details, description of related components and exposed finishes, fasteners, and caulking. Indicate location of manufacturer's nameplates.
- .4 Test and Evaluation Reports:
 - .1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.
 - .2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:
 - .1 The product manufacturer.
 - .2 The type of product.
 - .3 The model number/series number.
 - .4 The primary product designation.
 - .5 The secondary product designation.
 - .1 Positive design pressure.
 - .2 Negative design pressure.
 - .3 Water penetration resistance test pressure.
 - .4 Canadian air infiltration and exfiltration levels.
 - .6 The test completion date.

- .3 The report will also contain the following information:
 - .1 Test dates.
 - .2 Report preparation dates.
 - .3 Test information retention period.
 - .4 Location of testing facilities.
 - .5 Full description of test samples, including:
 - .1 Anodized finish, weathering characteristics.
 - .2 Condensation resistance.
 - .3 Forced entry resistance.
 - .4 Mullion deflection combination and composite windows.
 - .6 Complete description of amendments, as applicable.
 - .7 Conclusion.
 - .8 Drawings signed by the testing laboratory, if provided.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for [windows] for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect windows from [nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Fenestration performance grades for windows:
 - .1 In accordance with the CSA A440SI Canadian Supplement, Clause (1)(b) appropriate for the conditions and geographic location in which the doors will be installed.
 - .2 Conform to performance grades selected under CSA A440SI Canadian Supplement, Sentence (2) when tested in accordance with the standard referenced in Clause (1)(a).

2.2 MATERIALS

- .1 Materials: to CSA-A440/A440.1 supplemented as follows:
- .2 All windows by same manufacturer.
- .3 Main frame: aluminum thermally broken.
- .4 Aluminum Support Angles: Design and fabricate aluminum support angles at sill jambs and head in accordance with OBC and manufacturers requirements.
- .5 Glass: in accordance with Section 08 80 50 Glazing.
- .6 Screens: to CAN/CGSB-79.1 and as follows:
 - .1 Type: heavy duty.
 - .2 Style: aluminum frame and glass fibre mesh (mesh colour black) to CSA-A440/A440.1.
 - .3 Insect screening mesh: count 18 x 16.
 - .4 Fasteners: tamper proof.
 - .5 Screen frames: aluminum colour to match window frames.
 - .6 Mount screen frames for placement of screen for interior replacement.
- .7 Flashings: Refer to Section 07 62 00 Sheet Metal Flashing and Trim.
- .8 Sills: Refer to Section 07 62 00 Sheet Metal Flashing and Trim.
- .9 Aluminum facings: brake formed, 1.5 mm / $^{1}/_{16}$ " thick, clear anodized aluminum panel laminated to 19 mm / $^{3}/_{10}$ " thick plywood.
- .10 Isolation coating: alkali resistant bituminous paint.
- .11 Sealants: Refer to Section 07 92 00 Joint Sealants.

2.3 WINDOW TYPE AND CLASSIFICATION

- .1 Types:
 - .1 Combination In-Swing Hopper/ Fixed Window Unit: combination awning/fixed window unit designed and fabricated to 'rainscreen principals', 127 mm / 5" wide, complete with thermal break, heavy duty aluminum insect screen with tamper resistant screws, pivot shoe roto-operators, claw locks, four-bar stainless steel friction arms 'aluminum rainscreen drain hole hood riveted to aluminum frame, colour to match frame. Provide awning windows (top hinged) where indicated.
 - .1 Acceptable product: 'Kawneer 526' Thermal Windows (Casement) by Kawneer, or equivalent by Alumicor Canada limited, or Oldcastle BuildingEnvelope, or Windspec Inc., or approved alternate.
 - .2 Fixed Window Unit: fixed window unit, 127 mm / 5" wide, c/w thermal break.
 - .3 Acceptable product: 'Kawneer 518' fixed framing, or 'Series 970' by Alumicor, or equivalent Oldcastle Building Envelope, or Windspec Inc., or approved alternate.

2.4 FABRICATION

- .1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm / ¹/₁₆" for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm / 1/8" for units with a diagonal measurement over 1830 mm / 6"-0".
- .3 Face dimensions detailed are maximum permissible sizes.
- .4 Brace frames to maintain squareness and rigidity during shipment and installation.
- .5 Finish steel clips and reinforcement with shop coat primer to MPI #79.

2.5 ALUMINUM FINISHES

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Finish coatings: finish all exposed surfaces of interior and exterior aluminum sections with anodic oxide treatment in accordance with Aluminum Association specification AA-M12c22A31, "No. 17 Clear" by Kawneer, or equivalent by Alumicor Canada limited, or Oldcastle Building Envelope, or Windspec Inc., or approved alternate.

2.6 GLAZING

.1 Glaze windows: Refer to Section 08 80 50 – Glazing.

2.7 HARDWARE

- .1 Hardware: stainless steel sash locks and aluminum handles to provide security and permit easy operation of units.
- .2 Locks: provide operating sash with spring loading locking device, to provide automatic locking in closed position.
- .3 Include special keyed opening device for windows normally locked.
- .4 Equip window openers with 100 mm / 4" restrictors / limiters.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate to verify dimensions, tolerances, and method of attachment with other work.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Window installation:
 - .1 Install in accordance with CSA-A440/A440.1.
 - .2 Arrange components to prevent abrupt variation in colour.
 - .3 Do not exceed 3 mm $/ \frac{1}{8}$ " in 3.0 m / 10' variation from plumb and level.
- .2 Aluminum Support Angles:
 - .1 Design and fabricate aluminum angles in accordance with OBC and manufacturers requirements. Provide slotted clip angle connection where deflection is anticipated.
- .3 Sill installation: Refer to Section 07 62 00 Sheet Metal Flashing and Trim.
- .4 Aluminum Closure Panel and Column Cover Installation:
 - .1 Install aluminum closure panel and column covers, level in length, straight in alignment with plumb upstands and faces. Use one (1) piece lengths where practicable.
 - .2 Where joints in closure panels and column covers are necessary, provide hairline joints with concealed watertight anchors.
 - .3 Secure closure panels and column covers in place with anchoring devices located spaced 610 mm / 24" o/c maximum between.
- .5 Caulking:
 - .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
 - .2 Apply sealant in accordance with Section 07 92 00 Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Consultant.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by window installation.

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PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA):
 - .1 ANSI/BHMA A156.9-2010, Cabinet Hardware.
 - .2 ANSI/BHMA A156.11-2014, Cabinet Locks.
 - .3 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
 - .4 ANSI/BHMA A156.18-2012, Materials and Finishes.
 - .5 ANSI/BHMA A156.20-2012, Strap and Tee Hinges and Hasps.

1.2 **ACTION AND INFORMATIONAL SUBMITTALS**

Submit in accordance with Section 01 33 00 - Submittal Procedures. .1

.2 **Product Data:**

.1 Submit manufacturer's instructions, printed product literature and data sheets for cabinet hardware and include product characteristics, performance criteria, physical size, finish and limitations.

Samples: .3

- .1 Submit samples in accordance with Section 01 33 00 Submittal Procedures.
- .2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
- .3 After approval, samples may be returned if requested for incorporation in the Work.

Hardware List: .4

- .1 Submit contract hardware list.
- .2 Indicate specified hardware, including make, model, material, function, finish and other pertinent information.
- Test Reports: certified test reports showing compliance with specified performance characteristics .5 and physical properties.
- Manufacturer's Instructions: submit manufacturer's installation instructions. .6

1.3 **CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for cabinet hardware for incorporation into manual.

1.4 **QUALITY ASSURANCE**

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store cabinet hardware in locked, clean, dry area, off ground, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cabinet hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping strippable coating.
 - .4 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan Waste Reduction Workplan related to section Work.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

- .1 Cabinet hardware listed within provides a 'standard of acceptance' for the specified item. Equivalent products by Richelieu, Häfele, Hettich, or approved alternate are acceptable for use on this project.
 - .1 Use one manufacturer's product for all similar items.

2.2 CABINET HARDWARE

- .1 Cabinet hardware: to CAN/CGSB-69.25, as listed below:
 - .1 Hinges: soft close hinge, 120° swing.
 - .1 Acceptable product: '71T Series' hinge with 'Blumotion 973A, by Richelieu or approved equivalent. Model type to suit cabinet.
 - .2 Drawer and Door Pulls:
 - .1 Stainless Steel Edge Pull: brushed nickel Contemporary Metal Pull, vertical installation on doors and horizontal on drawers.
 - .1 Acceptable product: 'No. 687160195', by Richelieu or approved equivalent.
 - .3 Drawer Slides:
 - .1 'Type 1': For all drawers unless otherwise noted, easy close, medium duty, 45 Kg / 100 lb. capacity, zinc finish, length to suit drawer for full extension.
 - .1 Acceptable product: 'Accuride 3832EC2G Full Extension Slide', by Richelieu or approved equivalent.
- .2 Cabinet and Drawer Unit, Locks: to CAN/CGSB-69.27, as listed below:
 - .1 Door or drawer locks:
 - .1 Acceptable product:
 - .1 Universal Cam Lock Body: Adjustable from 22 mm / 7/8" to 35 mm / 1 3/8". '235.09.000', by Häfele Canada Inc. or approved equivalent. Material: steel.
 - .2 Cylinder Rosette: '210.04.062', by Häfele Canada Inc. or approved equivalent. Material: nickel-polished finish.

- .3 Lock Core: '210.04.606', by Häfele Canada Inc. or approved equivalent. Snap-in lock core, material zinc die cast, Lock face, nickel polished finish.
- .2 Cylinders: key into keying system. Master key each department complete with grand master key, as later selected by Consultant.

.3 Shelf Supports:

- .1 Acceptable product:
 - .1 Display Metal Support Type 1:'No. 282.11.707', by Häfele or approved equivalent, 5 mm / 1/4" diameter, angular with riveted pin, material steel, nickel plated finish.
 - .2 Metal Support Socket: 'No. 2292180', by Richelieu or approved equivalent, 7.5 mm / 5/16" diameter, nickel finish.
 - .3 Display Metal Support Type 2: 'No. 2291180', by Richelieu or approved equivalent, 5 mm / 5/16" diameter. nickel finish.
 - .4 Metal Pilaster: 'No. 2552G', by Richelieu or approved equivalent, 16mm / 5/8" wide x total length. zinc finish.
 - .5 Pilaster Shelf Clip: 'No. CP2392G', by Richelieu or approved equivalent, heavy-duty, zinc finish.

.4 Coat Hook:

- .1 Washrooms
 - .1 Acceptable product: 'No. B-76717', by Bobrick or approved equivalent.
- .2 Showers
 - .1 Acceptable product: 'No. CBH 61', by Canadian Builders Hardware or approved equivalent. Finish: aluminum.
- .5 Door and Drawer Bumpers:
 - .1 Acceptable product: 'No. MP30311', by Richelieu or approved equivalent, clear nylon, 3 mm / 1/8" height x 9 mm / 3/8" diameter, peel and stick bumpers.
- .6 Closet Rod and Flange:
 - .1 Acceptable product:
 - .1 Closed Flange: 'No. 8332-140', by Richelieu or approved equivalent, 25.4 mm diameter / 1" closed flange, colour: chrome.
 - .2 Central Support for Round Tubing: 'No. 37030140', by Richelieu or approved equivalent, for 26.7 mm diameter, 1-1/16" round tubing, colour: chrome.
 - .3 Shelf and Rod Support: 'No. 915030', by Richelieu or approved equivalent, 267 mm / 10-1/2" high x 275 mm / 11" long, metal, colour white.
 - .4 Closet Rod: 'No. 122.112-140', by Richelieu or approved equivalent, 25.4 mm diameter / 1", 3660 mm / 12'-0" length metal, cut to suit, rod colour: chrome.
- .7 Key Cabinet: Refer to Section 087100 Door Hardware and Door Hardware Schedule.

2.3 FASTENINGS

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Cabinet locks to be as directed. Submit keying schedule for approval.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply three (3) master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Install key cabinet where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Install hardware to standard hardware location dimensions in accordance with manufacturer's recommendations and to project design requirements.
- .3 Make all shelves in cabinets adjustable, unless otherwise indicated.
- .4 Install locks on all cabinet doors and drawers where indicated.
- .5 Install drawer slides to all drawers, number as required to suit application.
- .6 Install drawer and drawer bumpers to all doors and drawers.

3.2 ADJUSTING

- .1 Adjust cabinet hardware for optimum, smooth operating condition.
- .2 Lubricate hardware and other moving parts.
- .3 Adjust cabinet door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
 - .3 Lock key cabinet and turn over key to Consultant.
- .2 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by cabinet and miscellaneous hardware installation.

3.6 SCHEDULE

- .1 All cabinet drawers, unless otherwise noted:
 - .1 1 set full extension drawer slides: 'Type 1'.
 - .2 Lock, where indicated.
 - .3 1 pull per drawer.
 - .4 Drawer bumpers.
- .2 Cabinet swing doors:
 - .1 1 pull per door
 - .2 Lock, where indicated.
 - .3 1 set of hinges, number as recommended by manufacturer to suit condition.
 - .4 Door bumpers.
- .3 Shelf supports:
 - .1 4 recessed metal standards per unit.
 - .2 4 pilaster shelf clips per shelf.

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- .4 Closet rod and flange:
 - .1 1 rod at each closet as detailed.
 - .2 Closed-end flanges, one at each end.
 - .3 Central Support for round tubing, 914 mm / 36" o/c maximum.

END OF SECTION

PART 1- GENERAL

1.1 RELATED SECTIONS

- .1 08 11 00, Metal Doors and Frames.
- .2 08 11 16, Aluminum Doors and Frames.
- .3 Division 26, Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI) /Builders Hardware Manufacturers Association (BHMA).
 - .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.3-2001, Exit Devices.
 - .3 ANSI/BHMA A156.4-2000, Door Controls Closers.
 - .4 ANSI/BHMA A156.6-2005, Architectural Door Trim.
 - .5 ANSI/BHMA A156.10-1999, Power Operated Pedestrian Doors.
 - .6 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
 - .7 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA).
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Shop Drawings, Product Data, Samples, Mock-ups.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .4 After approval samples will be returned for incorporation in Work.
- .4 Hardware List:
 - .1 Submit detailed type written contract hardware list indicating; door number, complete location description, active door hand, door size, door and frame material and fire rating.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- 5 Key Schedule: Submit detailed keying schedule and system diagram in accordance with DHI publication. Include schematic keying diagram and index each key to unique designations.

- .6 Wiring Diagrams: Provide two dimensional colour coded detailed wiring diagrams as listed below for electrified door hardware and building safety and security systems required to achieve required mode of operation.
 - .1 Portal
 - .2 Point-to-point wiring
- .7 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .8 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.
- .2 Letter of warranty for exit devices, door closers and auto openers.

1.5 MAINTENANCE MATERIALS SUBMITTALS

.1 Tools: Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.6 QUALITY ASSURANCE

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 All opening sizes to be site measured by contractor and information provided to sub-trades.

1.7 DELIVERY, STORAGE AND HANDLING

- Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping or strippable coating.
 - .4 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Butts and hinges:

Butt hinges, supply 1 ½ pair per door leaf for doors up to 90" in height. Supply an additional hinge for each additional 30" of height or fraction thereof. Doors 45mm in thickness, up to 915mm (36") in width, supply 114mm (4.5") high hinges – 915mm to 1220mm (36" to 48"), supply 127mm (5") high hinges.

Listed product: Ives 5BB1HW, 5BB1.

Acceptable alternate: Hager BB1199, BB1168, BB1279, Stanley FBB199, FBB168, FBB179.

.2 Continuous hinges:

.1 Shall be full mortise, heavy duty, no inset, minimum thirty-two bearings, staggered screw holes. Listed product: Select Hinge SL11, SL11HD, SL24HD. No alternates accepted.

.3 Locksets and latchsets:

.1 Grade 1, heavy duty cylindrical locks with ½" throw. Lever design to be RHO as noted. All locks to be installed with wrought boxes for strikes.

Listed product: Schlage ND series.

No alternates accepted.

.2 Grade 1, mortise type, function as noted with 19mm (3/4") latch throw. Deadbolt functions shall be 25.4mm (1") projection with self-aligning through bolted trim and to accept specified cylinder. Lever to be 06 design with B rose. All locks to be installed with wrought boxes for strikes.

Listed product: Schlage L9000 and LV9000 series.

No alternates accepted.

.3 Grade 1, mortise type, function as noted with 1" stainless steel throw deadbolt. Listed product: Listed product: Schlage L400 series.

No alternates accepted.

.4 Exit devices:

.1 Exit devices, shall be push bar type with break-away lever 06 trim.

Listed product: Von Duprin 98 series.

No alternates accepted.

.5 Door Closers and Accessories:

.1 Cast iron cylinder body, handed, double heat treated steel pinion, adjustable back check, forged steel are, SRI primer on exterior doors and full size plastic molded cover.

Listed product: LCN 4040XP.

No alternates accepted.

.6 Auto openers: CLIENT TO CONFIRM PNEUMATIC OPERATORS REQUIRED

.1 Pneumatic surface mounted automatic operator with heavy duty closer with adjustable backcheck and slow opening. Control box containing valves, electrical timing circuits and and compressor. Adhesive handicap wheelchair logo mounted to door.

Listed product: LCN 4800 series No alternates accepted

.2 Actuators and escutcheons to be 152.4mm (6") diameter with embossed blue handicap logo and stainless steel heavy duty escutcheon.

Listed product: LCN

Acceptable alternate: Camden Door Controls, WIKK.

.7 Door pulls:

.1 Offset tubular, 25.4mm (1") diameter, 304.8mm (12") c.c., 16ga (.065") wall thickness and security cap mounting on single mounted pulls. Exterior door pulls to be supplied in 316SS/630.

Listed product: Standard Metal 3012-2 Acceptable alternate: CBH: 7009-1

.8 Kickplates, Mop plates, Armor plates, push plates:

.1 Solid metal plate, 1.27mm (.050") thick stainless steel material, all edges beveled, double sided tape mounting.

Listed product: Standard Metal K10A

Acceptable alternate: CBH 903 and GSH 80A

.9 Threshold:

.1 Solid extruded aluminum, sized as noted to rough opening width and to match depth. All exterior doors to be thermal break threshold.

Listed product: Pemko

Acceptable alternate: Hager, KN Crowder, NGP

.10 Weatherstripping:

.1 Heavy duty extruded aluminum, 6.35mm (1/4") thickness x with angled nylon brush insert, supplied with countersunk #10 hole secured with flat head machine screws. Provides continuous seal when parallel arm door closers, overhead stops and exit device strikes are mounted through 1/4" extrusion. Listed product: Pemko

.11 Door Sweep:

Extruded anodized aluminum extrusion retainer with silicone seal, punched with slotted holes for adjustment. Mounted on bottom pull side and overlaps threshold.

Listed product: KN Crowder

.12 Power supplies:

.1 UL class 2 listed, 120VAC to the fused input and regulated and filtered 24VDCor as required and UL and supplied in keyed power supply cabinet. Provide relays as required.

2.3 FINISHES

.1 BHMA Code Description

626 Satin Chromium plated 630 Satin Stainless Steel

316SS/630 316 Grade Stainless Steel, Brushed finish

689 Aluminum painted

2.4 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door with back plate, supply fastening devices, and install so pull can be secured through backplate from reverse side and pull/backplate mounted to door.
- .5 Use fasteners compatible with material through which they pass.

2.5 KEYING

- 1 Cylinders to be keyed into existing Master key system as directed by Owner's representative. Prepare and submit detailed keying schedule in conjunction with Architect and Owner's representative.
 - .1 Exterior doors to be Medeco cylinders supplied by owner. Interchangeable core? Installed by?
 - .2 Interior doors to be Primus XP cylinders keyed into existing School Board system? CONFIRM
 - .3 Supply keys in triplicate for every lock in this Contract.
 - .4 Supply 3 master keys per group.
 - .5 Supply 1 extractor key.
 - .6 Supply 3 construction keys.
 - .7 Stamp keying code numbers on keys.
 - .8 Cylinders to be construction keyed during construction period.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply complete instructions and templates for preparation of doors and frames to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- 5 Only tradesman competent in the installation of Finishing Hardware shall be used for this purpose. Minimum of ten (10) years of experience in the installation of commercial applications.
- .6 Do not install surface mounted items until finishes have been completed on the substrate. Protect all install hardware during painting.

- .7 Only licensed and qualified tradesman competent in the installation of electronic and electric hardware connections shall be permitted for this project.
 - .1 Provide written commission report for each opening with electronic hardware connections.
- .8 Door closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- .9 Contractor to supply and install backing for mounting of auto openers.
- .10 Kickplates to be installed .0313 (1/32") maximum from the bottom edge of bottom of door with the exception of doors with threshold stops.
- .11 Thresholds to extend from masonry opening to masonry opening and coped around frame and frame face and be installed level and plumb in full bed of sealant. All edges to be caulked. Door sweep to make contact with threshold for maximum seal.
- .12 Weatherstrip to be installed prior to hardware for continuous and uninterrupted seal. Install parallel arm of door closer on top of w/strip. Install exit device strike on top of w/strip where specified for continuous seal. Exit device may require special templating. Miter meeting corners of w/strip and meeting corners of door sweeps and astragals for continuous seal.
- .13 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 (Cleaning).
 - .1 Leave Work area clean at end of each day.
 - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 (Cleaning).

3.4 DEMONSTRATION

- .1 Maintenance Staff Briefing
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.

- .3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.
- .2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by door hardware installation.

3.6 INSPECTION

.1 Hardware Supplier to make periodic site inspections during installation of hardware to ensure all hardware supplied is being installed in accordance with specifications. Submit detailed written report of inspections noting any errors or omissions.

3.7 SCHEDULE

- .1 The following Finish Hardware list is to be used to meet Client standards for this project. Products deviating from products listed shall be replaced with proper hardware at the door hardware supplier's expense. Substitutions not approved prior to closing date will not be accepted.
- .2 Hardware schedule as follows:

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JLF	No. 27	7672-000.1		2018/03/14
			HEADING #1	
ITE	M #1	1 SGL DOOR D001 3'-0" x 7'-0" x 1-3/4" TYPE D02/F01	STAIR #1 FROM MECH ROOM 002 HMD/PSF 45 MIN.FR.	RHR
3 1 1 1 1 1	EA EA EA EA	HINGE EXIT DEVICE TEMP CYLINDER PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP GASKETING	5BB1 4.5" x 4" NRP 98L-NL-F x 996L-NL-R/V-06 20-021 BY OWNER 4040XP EDA K10A 8" x 34.5" x TAPE S121 NGP5050 x 17FT	652 626 626 626 689 630 626 CLR
			HEADING #2	
ITE	M #2	1 SGL DOOR 003 3'-0" x 7'-0" x 1-3/4" TYPE D01/F01	MECH ROOM 002 FROM MECH ROOM 003 HMD/PSF	RHR
3 1 1 1 3	EA	HINGE LATCHSET DOOR CLOSER KICKPLATE DOOR SILENCER	5BB1 4.5" x 4" NRP ND10S RHO 13-048 x 10-025 4040XP EDA K10A 8" x 34.5" x TAPE SR64	652 626 689 630 GRY
			HEADING #3	
ITE	M #3	1 SGL DOOR D004 3'-0" x 7'-0" x 1-3/4" TYPE D02/F01	MECH ROOM 002 FROM ELEC ROOM 004 HMD/PSF	RHR
3 1 1 1 3	EA EA EA EA	HINGE LATCHSET DOOR CLOSER KICKPLATE DOOR SILENCER	5BB1 4.5" x 4" NRP ND10S RHO 13-048 x 10-025 4040XP EDA K10A 8" x 34.5" x TAPE SR64	652 626 689 630 GRY
			HEADING #4	
ITE	M #4	1 SGL DOOR D005 3'-0" x 7'-0" x 1-3/4" TYPE D02/F01	VESTIBULE 006 FROM ELEC ROOM 005 HMD/PSF	RHR
3 1 1 1 1	EA EA EA	LATCHSET	5BB1 4.5" x 4" NRP ND10S RHO 13-048 x 10-025 4040XP EDA K10A 8" x 34.5" x TAPE S121	652 626 689 630 626

S121

SR64

626

GRY

1

3

EA WALL STOP

EA DOOR SILENCER

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			HEADING #5	
ITEN	/ 1 #5	1 SGL DOOR D007 3'-0" x 7'-0" x 1-3/4" TYPE D01/F01	VESTIBULE 006 TO STORAGE HMD/PSF	RH
3 1 1 1 1 1 3	EA EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 4.5" x 4" ND80PD RHO x 10-025 PRIMUS? 4040XP REG K10A 8" x 34.5" x TAPE S121 SR64	652 626 626 689 630 626 GRY
			HEADING #6	
ITEN	/I #6	1 SGL DOOR D008 3'-0" x 7'-0" x 1-3/4" TYPE D02/F01	STAIR #2 FROM VESTIBULE 006 HMD/PSF 45 MIN.FR.	LHR
3 1 1 1 1 1	EA EA EA EA EA		5BB1 4.5" x 4" NRP 98L-NL-F x 996L-NL-R/V-06 20-021 PRIMUS? 4040XP S CUSH 110 DEGREE K10A 8" x 34.5" x TAPE NGP5050 x 17FT	652 626 626 626 689 630 CLR
			HEADING #7	
ITEM	Л #7	1 PR DOORS D101A 2/3'-2" x 7'-0" x 2" TYPE D04/ F??	EXTERIOR FROM MAIN ENTRANCE 101 ALD/ALF INSULCLAD	LHR/ <i>RHRA</i>
2 2 1 1 1 1 1 1 1	EA EA EA EA EA EA EA	,		CL 689 SP28 626 626 626 626 626 626
1	EA	CARD READER ` ´	20-001 BY OWNER BY OTHERS	626
1 2 1 1	EA EA EA EA	RELAY DOOR PULL DOOR CLOSER AUTO OPENER CONTROL BOX	CX-33 SM3012-2 x #4MTG 4040XP TJ x 4040XP-18G 4822 x 4822-18G ES7982 (SHARED WITH D101A & D101B)	316SS/630 689 689

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1 E 1 E 2 E	=T ≣A ≣A ≣A	TUBING ACTUATOR ACTUATOR ESCUTCHEON O/H STOP TB THRESHOLD W/STRIPPING DOOR SWEEP	925 8310-852 x WR 8310-852 8310-876 104S x 110 DEGREE BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER	630 630 630 630

⁻SPECIAL CYLINDER DOGGING ONLY AVAILABLE WITH QEL OPTION – WALL SWITCH CAN ALSO DOG EXIT DEVICES WHEN REQUIRED – ADVISE PREFERENCE.

- -ADVISE IF DOOR WILL BE ON TIMER?
- -ADVISE IF REMOTE RELEASE REQUIRED?

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

MODE OF OPERATION:

EXIT DEVICES TO BE DOGGED THROUGH **KEY SWITCH AND OR ACCESS SYSTEM** DURING OPEN HOURS. LX FEATURE ALLOWS ACTIVATION OF OUTSIDE ACTUATOR WHEN EXIT DEVICE IS ELECTRICALLY DOGGED.

OUTSIDE ACTUATOR CONTROLLED THROUGH ACCESS SYSTEM. INSIDE ACTUATOR ACTIVE AT ALL TIME.

ITEN	Л #8	1 PR DOORS D101B 2/3'-2" x 7'-0" x 1-3/4" TYPE D04	VESTIBULE FROM CORRIDOR ALD/ALF	LHR/ <i>RHRA</i>
2 2 2 1 1	EA EA EA EA	CONT. HINGE DUMMY PUSH BAR DOOR PULL DOOR CLOSER AUTO OPENER	SL11HD x 83" 350 x 38"DR SM3012-2 x #4MTG 4040XP TJ DEL x 4040XP-18G 4822 x 4820-18G	CL 626 630 689 <i>689</i>
50 2 2 2	FT EA EA	CONTROL BOX TUBING ACTUATOR ESCUTCHEON O/H STOP	ES7982 (SHARED WITH D101A & D101B) 925 8310-852 8310-876 104S x 110 DEGREE	630 630 630

⁻ADVISE IF KR CYLINDER AND KEY SWITCH TO BE KEYED INTO EXTERIOR OR INTERIOR KEY SYSTEM

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			HEADING #9	
ITEM	1 #9	1 SGL DOOR D102 3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	GYM 105 TO KITCHEN 102 HMD/PSF	RH
3 1	EA EA	HINGE DEADLOCK	5BB1HW 5" x 4.5" L463P INSTALL 48" CYLINDER/THUMBTURN C/L	652 626
1 1	EA EA	PERM CYLINDER DOOR PULL	PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF	626 630
1	EA	PULL PLATE	CUT FOR INSIDE THUMBTURN H416 (GYM SIDE) CUT PLATE FOR GYM SIDE CYLINDER INSTALL @ 45" C/L AFF	630
1 1 1 1 3	EA EA EA EA	DOOR CLOSER KICKPLATE MOP PLATE O/H STOP DOOR SILENCER	4040XP H TJ x 4040XP-18G K10A 8" x 36.5" x TAPE K10A 4" x 37" x TAPE 104S SR64	689 630 630 630 GRY
			HEADING #10	
ITEM	1 #11	3'-0" x 7'-0" x 1-3/4" TYPE D01/F01	VESTIBULE 103B FROM STORAGE 103A COMM CENTRE 140 FROM STORAGE 140C HMD/PSF	LHR LHR
6 2 2 2 2 6	EA EA EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE DOOR SILENCER	ATERIAL (NOT SHOWN ON DR/FR SCHEDULE) 5BB1 4.5" x 4" NRP ND96PD RHO x 10-025 PRIMUS? 4040XP H TJ x 4040XP-18TJ K10A 8" x 34.5" x TAPE SR64	652 626 626 689 630 GRY
			HEADING #11	
	/I #12 /I #13	1 SGL DOOR D104A 1 SGL DOOR D110A 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	GYM 105 TO WOMEN'S CHANGE ROOM 104 GYM 105 TO CHANGE ROOM 110 HMD/PSF	LH RH
6 2	EA EA	HINGE DEADLOCK	5BB1HW 5" x 4.5" L463P INSTALL @ 48" CYLINDER/THUMBTURN C/L	652 626
2 2	EA EA	PERM CYLINDER DOOR PULL	PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF	626 630
2	EA	PUSH PLATE	CUT FOR INSIDE THUMBTURN K10A 6" x 20" x TAPE INSTALL @ 45" C/L AFF CUT FOR GYM SIDE CYLINDER	630
2 2 2	EA EA	DOOR CLOSER KICKPLATE MOP PLATE	4040XP REG DEL K10A 8" x 36.5" x TAPE K10A 4" x 37" x TAPE	689 630 630

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2		WALL STOP	\$121	630
6	EA	DOOR SILENCER	SR64	GRY
AU	го орг	ENER?		
			HEADING #12	
ITE	M #15	1 SGL DOOR D104B 1 SGL DOOR D110B 3'-2" x 6'-0" x 1-3/4" TYPE D01/F01	CHANGE ROOM 104 TO SHOWER CHANGE ROOM 110 TO SHOWER ALD/ALF	LH RH
		DOOR AND FRAME TYPE		
2 2 2 2 6	EA EA	CONT. HINGE PRIVACY W/INDICATOR CYLINDER WALL STOP DOOR SILENCER	SL11 x 72" LV9496 x OCCUPIED INDICATOR PRIMUS? S121 SR64	CL 626 626 630 GRY
		IUMBTURN MAY BE AN ISS		diti
			HEADING #13	
		1 SGL DOOR D105A 1 SGL DOOR D105B 3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	CORRIDOR FROM GYM 105 CORRIDOR FROM GYM 105 HMD/PSF	LHR RHR
6 2 2 2 2 2 2 2 6 AD	EA EA EA EA EA	HINGE EXIT DEVICE TEMP CYLINDER PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1HW 5" x 4.5" NRP 98L x 996L-R/V-06 X 38"DR 20-021 PRIMUS? 4040XP H-EDA DEL K10A 8" x 36.5" x TAPE S121 SR64 UIRED	652 626 626 626 689 630 630 GRY
			HEADING #14	
ITE	M #18	1 PR DOORS D105C 2/3'-2" x 7'-0" x 2" TYPE D04/ F??	EXTERIOR FROM GYM 105 ALD/ALF	LHR/ <i>RHRA</i>
		FRAME TYPE	OL 141UD v. 00"	<u> </u>
2 1 1 2 2	EA EA	CONT. HINGE REMOV MULLION TEMP CYLINDER (MULLION) PERM CYLINDER (MULLION) EXIT DEVICE DOOR PULL		CL SP28 626 626 626 316SS/630
2 2	EA EA	DOOR CLOSER O/H STOP TB THRESHOLD W/STRIPPING DOOR SWEEP	4040XP TJ x 4040XP-18G 104S x 110 DEGREE BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER	689 630
AD	VISE IF	KH CYLINDER 10 BE KEYL	ED INTO EXTERIOR OR INTERIOR KEY SYS	I EIVI

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			HEADING #15	
ITEN	l #19	1 SGL DOOR D105D 3'-2" x 7'-0" x 2" TYPE D04/ F??	EXTERIOR FROM GYM 105 ALD/ALF	LHR
1 1 1	EA EA EA	EXIT DEVICE DOOR CLOSER	SL11HD x 83" 98EO x 38"DR 4040XP TJ x 4040XP-18G 104S x 95 DEGREE BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER	CL 626 689 630
			HEADING #16	
ITEN	1 #20	1 SGL DOOR D107 3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	GYM 105 TO STAGE AREA 106 HMD/PSF	RH
3 1	EA EA		5BB1HW 5" x 4.5" L463P INSTALL 48" CYLINDER/THUMBTURN C/L	652 626
1	EA EA		PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF	626 630
1	EA	PULL PLATE	CUT FOR INSIDE THUMBTURN H416 (GYM SIDE) CUT PLATE FOR GYM SIDE CYLINDER INSTALL @ 45" C/L AFF	630
1 1 1 3	EA EA EA	KICKPLATE	4040XP H REG DEL K10A 8" x 36.5" x TAPE S121 SR64	689 630 626 GRY

ADVISE IF LATCHING/LOCKSET PREFERRED TO DEADBOLT W/PUSH & PULL

ITE	M #21	1 PR DOORS D108 2/3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	GYM 105 TO STORAGE 108 HMD/PSF	LH/ <i>RHA</i>
6	EA	HINGE	5BB1HW 5" x 4.5"	652
2	EΑ	FLUSH BOLT	DC840	626
1	EΑ	DUST PROOF STRIKE	DP1	626
1	EA	DEADLOCK	L463P MOUNT @ 48" CYLINDER C/L AFF	626
1	EΑ	PERM CYLINDER	PRIMUS?	<i>626</i>
1	EA	DOOR PULL	SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF CUT FOR INSIDE THUMBTURN	630
1	EA	PULL PLATE	H416 (GYM SIDE) CUT PLATE FOR GYM SIDE CYLINDER INSTALL @ 45" C/L AFF	630
2	EA	DOOR CLOSER	4040XP H REG DEL x ST-1630 x 4040XP-18TJ	689

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		WOVE ATE	W	
2 2	EA EA	KICKPLATE O/H STOP	K10A 8 x 34± x TAPE 104S 110 DEGREE	630 630
1		COORDINATOR	COR7G	689
2	EA	DOOR SILENCERS ASTRAGAL (WELDED)	SR64 BY DOOR MANUFACTURER	GRY
COI	NFIRM	ACTIVE DOOR	MOUNTED ON INATIVE DOOR GYM SIDE	
			HEADING #18	
	M #00	1 001 D00D D100	OVM 105 TO 0TOBACE 100	111
	WI #22	1 SGL DOOR D109 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	GYM 105 TO STORAGE 109 HMD/PSF	LH
3	EA	HINGE	5BB1HW 5" x 4.5"	652
1	EA	DEADLOCK	L463P	626
1	EA	PERM CYLINDER	MOUNT @ 48" CYLINDER C/L AFF PRIMUS?	
1	EA	DOOR PULL	SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF CUT FOR INSIDE THUMBTURN	630
1	EA	PULL PLATE	H416 (GYM SIDE) CUT PLATE FOR GYM SIDE CYLINDER INSTALL @ 45" C/L AFF	630
1	EA	DOOR CLOSER	4040XP H REG DEL	689
1	EΑ	KICKPLATE	K10A 8 x 36.5 x TAPE	630
1 3	EA EA	WALL STOP DOOR SILENCERS	S121 SR64	626 GRY
			HEADING #19	
ITEI	M #23	1 PR DOORS D111A 2/3'-2" x 7'-0" x 2" TYPE D04/ F??	EXTERIOR FROM SOUTH ENTRANCE 112 ALD/ALF INSULCLAD	LHR/ RHRA
4	EA	CONT. HINGE	SL11HD x EPT PREP x 83"	CL
4	EA	POWER TRANSFER	EPT-10	689
1 1	EA EA	REMOV MULLION PERM CYLINDER (MULLION)	KR4954 x 299 STRIKE BY OWNER?	SP28 626
1	EΑ	EXIT DEVICE	QEL-98EO x 38"DR	626
1	EΑ	EXIT DEVICE	QEL-98NL-OP x 110NL-MD x 38"DR	626
1	EA	TEMP CYLINDER PERM CYLINDER	20-021 BY OWNER	626 626
		CARD READER	BY OTHERS	0_0
1 2	EA EA	POWER SUPPLY DOOR PULL	PS904 x 2RS SM3012-2 x #4MTG	316SS/630
2	EA	DOOR CLOSER	4040XP TJ x 4040XP-18G	689
1	EA	KEY SWITCH	653-1414 x L2	630
1	EA	TEMP CYLINDER (K/S)	QEL DOGGING ON/OFF 20-001-114	626
a.		PERM CYLINDER (K/S)	BY OWNER?	626
1 2	EA EA	RELAY O/H STOP TB THRESHOLD W/STRIPPING	CX-33 104S x 110 DEGREE BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER	630

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DOOR SWEEP

BY DOOR AND FRAME MANUFACTURER

ADVISE IF KR CYLINDER TO BE KEYED INTO EXTERIOR OR INTERIOR KEY SYSTEM CYLINDER DOGGING NOT AVAILABLE WITH QEL OPTION KEY SWITCH WILL DOG IF REQUIRED INTERCOM...REMOTE RELEASE?

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

HEADING #20

ITEM #24 1 PR DOORS D111B VESTIBULE FROM CORRIDOR L 2/3'-2" x 7'-0" x 1-3/4" ALD/ALF TYPE D04/F?? ALD/ALF		LHR/RHR		
4 4 2 2 6	EA EA EA EA	CONT. HINGE DUMMY PUSH BAR DOOR PULL DOOR CLOSER O/H STOP DOOR SILENCER	SL11HD x 83" 350 x 38"DR SM3012-2 x #4MTG 4040XP TJ DEL x 4040XP-18G 104S x 110 DEGREE SR64	CL 626 630 689 630 GRY
			HEADING #21	
ITE	VI #25	1 SGL DOOR D112A 3'-2" x 7'-0" x 2" TYPE D04/ F??	EXTERIOR FROM VESTIBULE 112 ALD/ALF INSULCLAD	RHR
1 1 1 1 1 1 1	EA EA	POWER TRANSFER EXIT DEVICE TEMP CYLINDER PERM CYLINDER CARD READER POWER SUPPLY	SL11HD x EPT PREP x 83" EPT-10 QEL-98NL-OP x 38"DR 20-021 BY OWNER BY OTHERS PS902 x 2RS SM3012-2 x #4MTG 4040XP TJ x 4040XP-18G 104S x 110 DEGREE BY DOOR AND FRAME MANUFACTURER	CL 689 626 626 626 316SS/630 689 630
TIM	ER?	W/STRIPPING DOOR SWEEP	BY DOOR AND FRAME MANUFACTURER BY DOOR AND FRAME MANUFACTURER	

INTERCOM?

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

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			HEADING #22	
ITE	VI #26	1 SGL DOOR D112B 3'-2" x 7'-0" x 1-3/4" TYPE D04/ F??	VESTIBULE 112 FROM CORRIDOR 122 ALD/ALF	RHR
1 1 1 1 1 1 3	EA EA EA	DOOR THICKNESS CONT. HINGE DUMMY PUSH BAR DOOR PULL DOOR CLOSER WALL STOP	SL11HD x 83" 350 x 38"DR SM3012-2 x #4MTG 4040XP TJ x 4040XP-18G S121 SR64	CL 626 630 689 626 GRY
			HEADING #23	
		1 SGL DOOR D113 3'-2" x 7'-0" x 1-3/4" TYPE D03/F01	DAYCARE 114 TO SLEEP AREA 113 HMD/PSF	LH
3 1 1 3 1 1	EA EA EA	HINGE LATCHSET WALL STOP DOOR SILENCER FINGER GUARD FINGER GUARD	5BB1 5" x 4.5" ND10S RHO x 10-025 S121 SR64 951 (PULL SIDE) 51A-90 (PUSH SIDE)	652 626 626 GRY <i>GRY</i> <i>GRY</i>
			HEADING #24	
	M #28 M #29	1 SGL DOOR D114 1 SGL DOOR D123 3'-2" x 7'-0" x 1-3/4" TYPE D03/F02	CORRIDOR 122 TO DAYCARE 114 CORRIDOR 122 TO DAYCARE 123 HMD/PSF	LH RH
2 2 2 2	EA EA EA	CONT. HINGE LOCKSET PERM CYLINDER ELECT STRIKE CARD READER POWER SUPPLY	SL11HD x 83" ND96PD RHO x L/STRIKE PRIMUS? 6211 FSE (CONFIRM VOLTAGE) BY OTHERS BY OTHERS	CL 626 626 626
2 2 2 6 2	EA EA EA EA	DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER FINGER GUARD	4040XP REG DEL K10A 12" x 36.5" x TAPE S121 SR64 51A-90 (PUSH SIDE)	689 630 626 GRY GRY

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			HEADING #25	
ITEM	#30	1 SGL DOOR D115 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	DAYCARE 114 FROM STORAGE 115 HMD/PSF	RHR
3 1 1 1 1 1 3	EA EA EA EA EA	LATCHSET DEADBOLT PERM CYLINDER DOOR CLOSER	5BB1 5" x 4.5" NRP ND10S RHO x 10-025 L463P INSTALL @ 48" CYLINDER/THUMBTURN C/L PRIMUS? 4040XP H EDA DEL S121 SR64	652 626 626 626 689 626 GRY
			HEADING #26	
ITEM ITEM	#32 #33 #34	1 SGL DOOR D116 1 SGL DOOR D128 1 SGL DOOR D145 1 SGL DOOR D146 1 SGL DOOR D148 3'-2" x 7'-0" x 1-3/4" TYPE D01/F02	CORRIDOR TO OFFICE 116 CORRIDOR TO OFFICE 128 COMM CENTRE 140 TO OFFICE 145 COMM CENTRE 140 TO OFFICE 146 COMM CENTRE 144 TO OFFICE 148 HMD/PSF	LH LH LH RH LH
15 5 5 5 5 15	EA EA EA EA	LOCKSET PERM CYLINDER KICKPLATE	5BB1 5" x 4.5" ND92PD RHO x 10-025 PRIMUS? K10A 8" x 36.5" x TAPE S121 SR64	652 626 626 630 626 GRY
			HEADING #27	
ITEM	#36	1 SGL DOOR D117 2'-6" x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR TO WC 117 HMD/PSF	RH
3 1 1 1 1 3	EA EA EA EA EA	HINGE PRIVACY KICKPLATE MOP PLATE WALL STOP DOOR SILENCER	5BB1 4.5" x 4" ND40S RHO x 10-025 K10A 8" x 28.5" x TAPE K10A 4" x 29" x TAPE S121 SR64	652 626 630 630 626 GRY

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			HEADING #28		
	VI #37 VI #38	1 SGL DOOR D118 1 SGL DOOR D119 2'-6" x 3'-6" x 1-3/4" TYPE D01/ <i>F</i> ?	DAYCARE 114 FROM WC 117 DAYCARE 114 FROM WC 117 HMD/PSF	LHR RHR	
CO	NFIRN	I FRAME TYPE			
2	EΑ	CONT. HINGE	SL11 x HT x 41"	CL	
2	EΑ	LATCHSET	ND10S RHO x 10-025 PASSAGE OR PRIVACY?	626	
4	EA	DOOR SILENCER	SR64	GRY	
2	EA	FINGER GUARD	51A-90 (PUSH SIDE)	GRY	

SPRING HINGES DO NOT CONTROL THE CLOSING AND LATCHING SPEED OF THE DOOR - CONFIRM REQUIREMENT.

NOTE: STANDARD C/L LEVER MOUNTING LOCATION IS 40-5/16" – MOUNTING HEIGHT WILL NEED TO BE CONFIRMED.

HEADING #29

	Л #39 Л #40	1 SGL DOOR D120A 1 SGL DOOR D120B 3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	DAYCARE 123 FROM KITCHEN 120 DAYCARE 114 FROM KITCHEN 120 HMD/PSF	RHR LHR		
2 2 2 2 2 6	EA EA EA EA EA	LATCHSET DOOR CLOSER KICKPLATE	SL11 x 83" ND10S RHO x 10-025 4040XP H TJ DEL x 4040XP-18G K10A 8" x 36.5" x TAPE 104S 110 DEGREE OPEN SR64	CL 626 689 630 630 GRY		
	HEADING #30					
ITEN	/I #41	1 SGL DOOR D120C	CORRIDOR FROM KITCHENETTE 120	RHR		
		3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	HMD/PSF			
3 1 1	EA EA EA	3'-2" x 7'-0" x 1-3/4" TYPE D02/F01		652 626 630		

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

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HEADING #31 KITCHEN 120 TO/FR LAUNDRY CLOSET ITEM #42 1 PR DOORS D120D HMD/PSF 2/2'-6" x 7'-0" x 1-3/4" TYPE D05/F01 DOOR NUMBER NOT SHOWN ON DRAWING SET TRACK C-415 x 5FT x 4 DR CL INCLUDES: TRACK C-104 HANGERS C-993 PIVOTS C-415 QUICK RELEASE HANGERS C-993 2 EA PULLS GSH360B x 8" x 1-3/4" DR 630 **HEADING #32 ITEM #43** 1 SGL DOOR D121 CORRIDOR TO EMPLOYEE AREA 121 RH3'-2" x 7'-0" x 1-3/4" HMD/PSF TYPE D01/F02 EA HINGE 5BB1 5" x 4.5" 652 3 EA LATCHSET ND10S RHO x 10-025 1 626 1 EΑ WALL STOP S121 626 3 EA DOOR SILENCER SR64 **GRY HEADING #33** CORRIDOR 103 FROM CORRIDOR 122 **ITEM #44** 1 PR DOORS D122 LHR/RHR 2/3'-2" x 7'-0" x 1-3/4" ALD/ALF TYPE D04/F02 2 EA CONT. HINGE SL24HD x 83" CL **CD**9849EO x LBL x 38"DR 1 EA EXIT DEVICE 626 1 EA EXIT DEVICE **CD**9849NL-0P x 110NL-MD x LBL x 38"DR 626 2 TEMP CYLINDER (CD) 20-001-114 x INVERTED CAM 626 EΑ 2 EΑ PERM CYLINDER (CD) PRIMUS? 626 **TEMP CYLINDER** 20-021 626 1 EΑ **PERM CYLINDER** PRIMUS? 626 EΑ 1 2 DOOR PULL SM3012-2 x #4MTG EΑ 630

4040XP TJ DEL x 4040XP-18G

104S x 110 DEGREE OPEN

689

630

LOCKED AT ALL TIMES UNLESS EXIT DEVICES DOGGED?

2

2

EΑ

EΑ

DOOR CLOSER

O/H STOP

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			HEADING #34	
ITEM	l #45	1 SGL DOOR D124 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	DAYCARE 123 FROM STORAGE 124 HMD/PSF	RHR
3 1 1 1 1 3	EA EA	LATCHSET DEADBOLT PERM CYLINDER DOOR CLOSER	5BB1 5" x 4.5" NRP ND10S RHO x 10-025 L463P INSTALL @ 48" CYLINDER/THUMBTURN C/L PRIMUS? 4040XP H-CUSH DEL SR64	652 626 626 626 689 GRY
			HEADING #35	
		1 SGL DOOR D125 3'-2" x 7'-0" x 1-3/4" TYPE D04/ F?	CORRIDOR 103 TO WAITING AREA 125 ALD/ALF	LH
		N DRWG "WAITING" AREA M FRAME TYPE		
1 1 1 1 1	EA EA	CONT. HINGE LOCKSET PERM CYLINDER DOOR CLOSER WALL STOP	SL11 x 83" L9456P 06B PRIMUS? 4040XP H REG DEL S121	CL 626 626 689 626

IF DEADBOLT REQUIRED WOULD NEED TO PROVIDE MORTISE LOCK. ACCESSIBLITY CODE REQUIRES ONE MOTION ONLY REQUIRED FOR EGRESS.

3'-2" x 7'-0" x 1-3/4" HMD/PSF TYPE D01/F01	
3 EA HINGE 5BB1 5" x 4.5" 1 EA LOCKSET ND92PD RHO x 10-025 1 EA PERM CYLINDER PRIMUS? 1 EA KICKPLATE K10A 8" x 36.5" x TAPE 1 EA WALL STOP S121 3 EA DOOR SILENCER SR64	652 626 626 630 626 GRY

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HEADING #37			
		INIC	#27

ITE	M #48 M #49 M #50	1 SGL DOOR D127 1 SGL DOOR D142 1 SGL DOOR D143 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR TO WC 127 CORRIDOR TO WC 142 CORRIDOR TO WC 143 HMD/PSF	RH LH LH
_				
9	EA	HINGE	5BB1 5" x 4.5"	652
3	EA	PRIVACY	ND40S RHO x 10-025	626
3	EA	KICKPLATE	K10A 8" x 36.5" x TAPE	630
3	EA	MOP PLATE	K10A 4" x 37" x TAPE	630
3	EA	WALL STOP	S121	626
3	EA	AUTO DR BOTTOM	420APKL x 38" x SHIM TO SUIT UNDERCUT	CL
3	EΑ	GASKETING	NGP5050 x 18FT	CLR

ADVISE IF DOOR CLOSERS REQUIRED

HEADING #38

ITE	M #51	1 PR DOORS D129 1/2'-0" 1/3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	EXTERIOR FROM STAIR #2 129 INS.HMD/PSF	LHR/RHRA
6	EA	HINGE	5BB1HW 5 x 4.5 NRP	630
1	EΑ	POWER TRANSFER	EPT-10	689
1	EΑ	EXIT DEVICE	9849EO x 24"DR	626
1	EΑ	EXIT DEVICE	QEL- 9849NL-0P x 110NL-MD x 38"DR	626
1	EΑ	TEMP CYLINDER	20-021	626
		PERM CYLINDER	BY OWNER	626
1	EΑ	DOOR PULL	VR910NL	630
		CARD READER	BY OTHERS	
		POWER SUPPLY	PS902 x 2RS	
2	EΑ	DOOR CLOSER	4040XP EDA x ST-2731 x ST1944	689
			MOUNT DOOR CLOSER PA SHOE ON TOP OF HEADER W/STRIP FOR CONTINUOUS SEAL	
2	EA	O/H STOP	904S x 110 DEGREE OPEN	630
1	EA	TB THRESHOLD	254 x5AFG x 70"	AL
			COPE AROUND FRAME & CAULK ALL EDGES	
1	EΑ	THRESHOLD STOP	184AT x 66"	
1	EA	W/STRIP (HEADER)	2891AS x 66" x CTSK SCREW HOLES	AL
		,	INSTALL HEADER W/STRIP PRIOR TO DOOR CLOSER	
•	_^	MAYOTOID (IAMB)	& O/H STOP FOR CONTINUOUS SEAL.	A 1
2		W/STRIP (JAMB)	290AS x 84"	AL
1	EΑ	DOOR SWEEP	W-38S x 24" LESS cUL LABEL	AL
1	EA		W-38S x 42" LESS cUL LABEL	AL
1	SEI	MEETING STILE ASTRAGE		AL
			MITER CORNERS AT MEETING EDGES BETWEEN	

DOOR SWEEPS AND ASTRAGAL FOR CONTINUOUS SEAL.

CONFIRM STAILWELL HEATED

VERTICAL ROD EXIT DEVICES ON EXT. DOORS NOT MOST SECURE APPLICATION
ADVISE DOOR PAINT COLOR (ASTRAGAL & DOOR SWEEP AVAILABLE IN CLR OR DRK BRZ FINISHES)

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

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			HEADING #39	
ITEN	M #52	1 SGL DOOR D130 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR TO JANITOR ROOM 130 HMD/PSF 0 HR/FR	RH
3 1 1 1 1 1 1	EA EA EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP AUTO DR BOTTOM KICKPLATE	5BB1 5" x 4.5" ND96PD RHO x 10-025 PRIMUS? 4040XP REG DEL K10A 8" x 36.5" x TAPE S121 420APKL x 38" x SHIM TO SUIT UNDERCUT NGP5050 x 18FT	652 626 626 689 630 626 AL CLR
			HEADING #40	
ITEN	M #53	1 SGL DOOR D131 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR TO UNIVERSAL WASHROOM 131 HMD/PSF 0 HR/FR	RH
3 1 1 1	EA EA EA EA	HINGE LOCKSET PERM CYLINDER ELECT STRIKE POWER SUPPLY	5BB1 5" x 4.5" ND96PD RHO x 10-025 x LESS STRIKE PRIMUS? 6211FS x (CONFIRM VOLTAGE) PS902	652 626 626 630
1 1 50	EA EA FT	AUTO OPENER CONTROL BOX TUBING	4811 x 4810-18 ES7981 925	689
2 2 1	EA EA EA	ACTUATOR ESCUTCHEON RELAY	8310-852 8310-876 CX-33	630 630
1 1 1 1	EA EA EA	ANNUNCIATOR ILLUMINATED BUTTON SIGN (BILINGUAL) DOOR CONTACT	CM-AF-500/GRN "OCCUPÉ" CM-54GR "POUSSEZ POUR VERROUILLER" CM-SFE1 CM-MDS	630 630
1 1 1 1	EA EA EA EA	MUSHROOM BUTTON ANNUNCIATOR W/SNDR DOME LIGHT W/SOUNDER ENGLISH SIGN FRENCH SIGN	CM-450R12 "POUSSEZ EN CAS D'URGENCE" CM-AF501SO "ASSISTANCE REQUISE" CM-AF141SOFE "ASSISTANCE REQUISE" CM-21A CM-20A	630 630 630
1	EA EA	"BILINGUAL" SIGN KICKPLATE	"APPUYEZ LE BOUTON POUR VERROUILLER LA PORTE" "APPUYER PLAQUE HANDICAPPE OU TOURNEZ LA POIGNÉE POUR OUVRIR LA PORTE" SUPPLY SIGNAGE AS PER O.B.C. K10A 12" x 36.5" x TAPE	630
1 1 3 2	EA EA EA	MOP PLATE WALL STOP DOOR SILENCER COAT HOOK	K10A 4" x 37" x TAPE K10A 4" x 37" x TAPE S121 SR64 GSH343B	630 626 GRY 630

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NOTE: EMERGENCY BUTTON TO RELEASE ELECTRIC STRIKE IN EMERGENCY CONDITION.

GSH343B

COAT HOOK

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			TIEADING #41	
ITE	VI #54	1 SGL DOOR D135 3'-0" <u>+</u> x 7'-0" <u>+</u> x 1-3/4" TYPE D02/F01	EXTERIOR FROM STAIR #1 135 INS.HMD/PSF SITE VERIFY EXISTING OPENING	LHR
3 1 1	EA EA EA	= -	5BB1HW 4.5" x 4" NRP 98EO x 36"DR 4040XP EDA x ST-2731 x ST1944 MOUNT DOOR CLOSER PA SHOE ON TOP OF HEADER W/STRIP FOR CONTINUOUS SEAL	630 626 689
1 1 1	EA EA EA		904S x 195 DEGREE OPEN K10A 8" x 34"± x TAPE 254x5AFG x 40" COPE AROUND FRAME & CAULK ALL EDGES	630 630 AL
1	EA EA	THRESHOLD STOP W/STRIP (HEADER)	184AT x 36"± 2891AS x 36"± x CTSK SCREW HOLES INSTALL HEADER W/STRIP PRIOR TO DOOR CLOSER & O/H STOP FOR CONTINUOUS SEAL.	AL AL
2	EA EA	W/STRIP (JAMB) DOOR SWEEP	290AS x 84"± W-38S x 36"± LESS cUL LABEL	AL AL
			HEADING #42	
ITE	VI #55	1 SGL DOOR D136 3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	CORRIDOR TO KITCHEN 136 HMD/PSF	LH
3 1	EA EA	HINGE DEADLOCK	5BB1 5" x 4.5" L463P INSTALL 48" CYLINDER/THUMBTURN C/L	652 626
1 1	EA EA	PERM CYLINDER DOOR PULL	PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF	626 630
1	EA	PULL PLATE	CUT FOR INSIDE THUMBTURN H416 (GYM SIDE) CUT PLATE FOR GYM SIDE CYLINDER INSTALL @ 45" C/L AFF	630
1 1 1 1 3	EA EA EA EA	KICKPLATE MOP PLATE WALL STOP	4040XP H REG DEL K10A 8" x 36.5" x TAPE K10A 4" x 37" x TAPE S121 SR64	689 630 630 630 GRY
			HEADING #43	
ITE	VI #56	1 SGL DOOR D137 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	KITCHENETTE 136 FROM MECH HMD/PSF 45 MIN.FR.	LHR
3 1 1 1 3	EA EA EA EA	LOCKSET PERM CYLINDER DOOR CLOSER	5BB1 5" x 4.5" NRP ND96PD RHO x 10-025 PRIMUS? 4040XP CUSH SR64	652 626 626 689 GRY

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ITEI	VI #57	1 SGL DOOR D138 2'-8"± x 7'-0"± x 1-3/4" TYPE D01/F01	STAIR TO IT ROOM 138 HMD/PSF SITE VERIFY EXISTING OPENING	LH
3	ΕA	HINGE	5BB1 4.5" x 4" NRP	652
1	EΑ	LOCKSET	ND96PD RHO x L/STRIKE	626
1	EΑ	PERM CYLINDER	PRIMUS?	626
1	EA	ELECTRIC STRIKE CARD READER POWER SUPPLY	6211 FSE (CONFIRM VOLTAGE) BY OTHERS BY OTHERS	630
1	EA	DOOR CLOSER	4040XP REG DEL	689
1	EA	KICKPLATE	K10A 8" x 30.5"± x TAPE	630
1	EA	WALL STOP	S121	626
3	EΑ	DOOR SILENCER	SR64	GRY

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

HEADING #45

ITEM #58 ITEM #59	1 SGL DOOR D139 1 SGL DOOR D152 3'-2"± x 7'-0" x 1-3/4" TYPE D02/F01	WEST ENTRANCE TO WEST STAIR 139 EAST ENTRANCE TO EAST STAIR 139 HMD/PSF 45 MIN/FR	LH RH
6 EA	HINGE	5BB1HW 5" x 4.5"	652
2 EA	LATCHSET	ND10S RHO x 10-025	626
2 EA	DOOR CLOSER	4040XP REG DEL	AL
2 EA	KICKPLATE	K10A 8" x 36.5"± x TAPE	630
2 EA	WALL STOP	S121	626
2 EA	GASKETING	NGP5050 x 18FT	CLR

NO REQUIREMENT TO CONTROL ACCESS TO SECOND FLOOR?

ITEM #6	60	1 PR DOORS D140A 2/3'-2" x 7'-0" x 1-3/4" TYPE D04/F06	CORRIDOR FROM COMMUNITY CENTRE 140 ALD/ALF	LHR/RHRA
2 E 2 E 2 E 2 E 2 E 2 E 2 E	A A A A A A A A	CONT. HINGE EXIT DEVICE TEMP CYLINDER (CD) PERM CYLINDER (CD) TEMP CYLINDER PERM CYLINDER DOOR CLOSER O/H STOP DOOR SILENCER	SL24HD x 83" CD9849L x 996L-R/V-06 x LBL x 38"DR 20-001-114 x INVERTED CAM PRIMUS? 20-021 PRIMUS? 4040XP H TJ DEL x 4040XP-18G 104S x 95 DEGREE OPEN SR64	CL 626 626 626 626 626 689 630 GRY
	., .	DOOM GILLINGEN	01104	diti

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ITEM #61		1 SGL DOOR D140B WEST ENTRANCE 141 FROM COMM CENTRE 140 3'-2" x 7'-0" x 1-3/4" HMD/PSF TYPE D02/F01		LHR
3	EA	HINGE	5BB1HW 5" x 4.5" NRP	652
1	ΕA	EXIT DEVICE	CD98L x 996L-R/V-06 x 38"DR	626
1	EA	TEMP CYLINDER (CD)	20-001-114 x INVERTED CAM	626
1	EΑ	PERM CYLINDER (CD)	PRIMUS?	626
1	EΑ	TEMP CYLINDER ` ´	20-021	626
1	EΑ	PERM CYLINDER	PRIMUS?	626
1	EΑ	DOOR CLOSER	4040XP H EDA DEL	AL
1	EΑ	KICKPLATE	K10A 8" x 36.5" x TAPE	630
1	EΑ	WALL STOP	S121	626
1	EA	GASKETING	NGP5050	CLR

HEADING #48

ITEN	/I #62	1 PR DOORS D141 2/3'-2" <u>+</u> x 7'-0" <u>+</u> x 1-3/4" TYPE D03/F01	EXTERIOR FROM WEST ENTRANCE VESTIB INS.HMD/PSF SITE VERIFY EXISTING OPENING	ULE 141 LHR/RHRA
6	EA	HINGE	5BB1HW 5 "x 4.5" NRP	630
1	ΕA	POWER TRANSFER	EPT-10	689
1	ΕA	REMOV. MULLION	KR4954	689
1			20-001-114	626
		PERM CYLINDER (MULLION)		626
1	EA	,	98EO x 38"DR	626
1	EA	EXIT DEVICE	QEL98NL-OP x 110NL-MD x 38"DR	626
1	EA	TEMP CYLINDER	20-021	626
		PERM CYLINDER	BY OWNER	626
		CARD READER	BY OTHERS	
1	EA	POWER SUPPLY	PS902 x 2RS	
2	EΑ	DOOR PULL	SM3012-2 x #4MTG	316SS/630
2	EA	DOOR CLOSER	4040XP EDA x ST-2731 x ST1944 MOUNT DOOR CLOSER PA SHOE ON TOP OF HEADER W/STRIP FOR CONTINUOUS SEAL	689
2	EA	O/H STOP	904S x 95 DEGREE OPEN	630
2	EA	KICKPLATE	K10A 8 x 34 <u>+</u> x TAPE	630
1	EA	TB THRESHOLD	254x5AFG x 80"± (CONFIRM JD) COPE AROUND FRAME & CAULK ALL EDGES	AL
1	EA	W/STRIP (HEADER)	2891AS x 76"± x CTSK SCREW HOLES INSTALL HEADER W/STRIP PRIOR TO DOOR CLOSER & O/H STOP FOR CONTINUOUS SEAL.	AL
2	EA	W/STRIP (JAMB)	290AS x 84" <u>+</u>	AL
2	EA	DOOR SWEEP	W-38S x 38"± LESS cUL LABEL	AL
1	EA	GASKETING (MULLION)	NGP5100S	GRY

ADVISE IF KR CYLINDER TO BE KEYED INTO EXTERIOR OR INTERIOR KEY SYSTEM

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

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JLR	No. 27	7672-000.1		2018/03/14
			HEADING #49	
ITE	M #63	1 SGL DOOR D144A 3'-2" x 7'-0" x 1-3/4" TYPE D03/F01	CORRIDOR TO COMMUNITY CENTRE 144 HMD/PSF	RH
3 1 1 1 1 1 3	EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE O/H STOP DOOR SILENCER	5BB1 5" x 4.5" ND94PD RHO x 10-025 PRIMUS? 4040XP H REG DEL x ST-1630 x 4040XP-18TJ K10A 8" x 36.5" x TAPE 104S 110 DEGREE SR64	652 626 626 689 630 630 GRY
			HEADING #50	
ITE	M #64	1 SGL DOOR D144B 3'-2"± x 7'-0"± x 1-3/4" TYPE D03/F01	CORRIDOR FROM COMMUNITY CENTRE 144 HMD/PSF SITE VERIFY EXISTING OPENING	RHR
3 1 1 1 1 1 1 1 3	EA EA EA EA	HINGE EXIT DEVICE TEMP CYLINDER (CD) PERM CYLINDER (CD) TEMP CYLINDER PERM CYLINDER DOOR CLOSER KICKPLATE DOOR SILENCER	5BB1 5" x 4.5" NRP CD98L x 996L-R/V-06 x 38"DR 20-001-114 x INVERTED CAM PRIMUS? 20-021 PRIMUS? 4040XP H CUSH DEL K10A 8" x 36.5" ± x TAPE SR64	652 626 626 626 626 626 689 630 GRY
			HEADING #51	
ITE	M #65	1 SGL DOOR D144C 3'-2" <u>+</u> x 7'-0" <u>+</u> x 1-3/4" TYPE D03/F01	CORRIDOR FROM COMMUNITY CENTRE 144 HMD/PSF SITE VERIFY EXISTING OPENING	LHR
3 1 1 1 1 1 1 1 1 3	EA EA EA EA EA	HINGE EXIT DEVICE TEMP CYLINDER (CD) PERM CYLINDER (CD) TEMP CYLINDER PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" NRP CD98L x 996L-R/V-06 x 38"DR 20-001-114 x INVERTED CAM PRIMUS? 20-021 PRIMUS? 4040XP H EDA DEL K10A 8" x 36.5"± x TAPE S121 SR64	652 626 626 626 626 626 689 630 626 GRY

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ITE	M #66	1 SGL DOOR D147 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR 156 TO IT ROOM 147 HMD/PSF	RH
3	EA	HINGE	5BB1 5" x 4.5"	652
1	EΑ	LOCKSET	ND96PD RHO x L/STRIKE	626
1	EA	PERM CYLINDER	PRIMUS?	626
1	EA	ELECTRIC STRIKE CARD READER POWER SUPPLY	6211 FSE (CONFIRM VOLTAGE) BY OTHERS BY OTHERS	630
1	EA	DOOR CLOSER	4040XP REG DEL	AL
1	EA	KICKPLATE	K10A 8" x 36.5" <u>+</u> x TAPE	630
1	EA	WALL STOP	S121	626
3	EA	DOOR SILENCER	SR64	GRY

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

ITEM #67		1 SGL DOOR D149 3'-0"± x 7'-0"± x 1-3/4" TYPE D01/F01	CORRIDOR TO MAINTENANCE OFFICE 149 HMD/PSF SITE VERIFY EXISTING OPENING	RH
3	ΕA	HINGE	5BB1 4.5" x 4"	652
1	EA	LOCKSET	ND92PD RHO x 10-025	626
1	EΑ	PERM CYLINDER	PRIMUS?	626
1	EΑ	DOOR CLOSER	4040XP REG DEL	689
1	EΑ	KICKPLATE	K10A 8" x 34.5 <u>+</u> x TAPE	630
1	EΑ	WALL STOP	S121	626
3	EΑ	DOOR SILENCER	SR64	GRY

ITEM	I #68	1 PR DOORS D150A 2/3'-2" x 7'-0" x 2"	EXTERIOR FROM EAST ENTRANCE ALD/ALF	LHR/ <i>RHRA</i>
COM	FIDM	TYPE D04/ F??	INSULCLAD	
		ACTIVE DOOR	CLITILD V EDT DDED V 00"	CI
2	EΑ		SL11HD x EPT PREP x 83"	CL
2		POWER TRANSFER	EPT-10	689
1	EΑ	REMOV. MULLION	KR4954 x 299 STRIKE	SP28
1	EA	TEMP CYLINDER (MULLION)		626
		PERM CYLINDER (MULLION)		626
1	EΑ	EXIT DEVICE	RX-QEL-98EO x 38"DR	626
1		EXIT DEVICE	RX-LX-QEL-98NL-OP x 110NL-MD x 38"DR	626
1	EΑ	TEMP CYLINDER	20-021	626
		PERM CYLINDER	BY OWNER	626
		CARD READER	BY OTHERS	
1	EΑ	POWER SUPPLY	PS904 x 2RS x 4RL	
1	EΑ	KEY SWITCH	653-1414 x L2 ??	<i>630</i>
			QEL DOGGING ON/OFF	
1	EΑ	TEMP CYLINDER (K/S)	20-001-118	626
		PERM CYLINDER (K/S)	BY OWNER	626
1	EΑ	RELAY	CX-33	
2	EΑ	DOOR PULL	SM3012-2 x #4MTG	316SS/630
1	EΑ	DOOR CLOSER	4040XP TJ x 4040XP-18G	689
1	EA	AUTO OPENER	4822 x 4820-18G	689
1	EA	CONTROL BOX	ES7982 (SHARED WITH D150A & D150B)	
<i>50</i>	FT	TUBING	925	
1	EΑ	ACTUATOR	8310-852 x WR	630
1	EΑ	ACTUATOR	8310-852	630
2	EΑ	ESCUTCHEON	8310-876	630
2	EΑ	O/H STOP	104S x 110 DEGREE	630
		TB THRESHOLD	BY DOOR AND FRAME MANUFACTURER	
		W/STRIPPING	BY DOOR AND FRAME MANUFACTURER	
		DOOR SWEEP	BY DOOR AND FRAME MANUFACTURER	
			2. 200	

SPECIAL CYLINDER DOGGING ONLY AVAILABLE WITH QEL OPTION – WALL SWITCH CAN ALSO DOG EXIT DEVICES WHEN REQUIRED – ADVISE PREFERENCE.

ADVISE IF KR CYLINDER AND KEY SWITCH TO BE KEYED INTO EXTERIOR OR INTERIOR KEY SYSTEM

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

MODE OF OPERATION:

EXIT DEVICES TO BE DOGGED THROUGH **KEY SWITCH AND OR ACCESS SYSTEM** DURING OPEN HOURS. LX FEATURE ALLOWS ACTIVATION OF OUTSIDE ACTUATOR WHEN EXIT DEVICE IS ELECTRICALLY DOGGED.

OUTSIDE ACTUATOR CONTROLLED THROUGH ACCESS SYSTEM. INSIDE ACTUATOR ACTIVE AT ALL TIME.

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		1 PR DOORS D150B 2/3'-2" x 7'-0" x 1-3/4" TYPE D04/ F??	EAST ENTRANCE VESTIBULE FROM CORRIDOR ALD/ALF	LHR/ <i>RHRA</i>
2 2 2 1 1 50 2 2	EA EA EA EA FT EA	ACTIVE DOOR CONT. HINGE DUMMY PUSH BAR DOOR PULL DOOR CLOSER AUTO OPENER CONTROL BOX TUBING ACTUATOR ESCUTCHEON O/H STOP	SL11HD x 83" 350 x 38"DR SM3012-2 x #4MTG 4040XP TJ DEL x 4040XP-18G 4822 x 4820-18G ES7982 (SHARED WITH D150A & 150B) 925 8310-852 8310-876 104S x 110 DEGREE	CL 626 630 689 689 630 630
			LIE ADINO #EC	
			HEADING #56	
ITEN	<i>I</i> I #70	1 SGL DOOR D151 3'-2" <u>+</u> x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR FROM MECH ROOM 151 HMD/PSF 45 MIN.FR	RHR
3 1 1 1 1 1 3	EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" NRP ND96PD RHO x 10-025 PRIMUS? 4040XP CUSH K10A 8" x 36.5"± x TAPE S121 SR64	652 626 626 689 630 626 GRY
			HEADING #57	
ITEN	<i>I</i> I #71	1 SGL DOOR D153 3'-2"± x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR TO STORAGE 153 HMD/PSF	LH
3 1 1 1 1 1 3	EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" ND96PD RHO x 10-025 PRIMUS? 4040XP H REG DEL K10A 8" x 36.5"± x TAPE S121 SR64	652 626 626 689 630 626 GRY

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			HEADING #58	
ITEN	/I #72	1 SGL DOOR D154 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	EAST ENTRANCE 150 FROM STORAGE 154 HMD/PSF	LHR
3 1 1 1 1 1 3	EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" NRP ND96PD RHO x 10-025 PRIMUS? 4040XP H-EDA DEL K10A 8" x 36.5" x TAPE S121 SR64	652 626 626 689 630 626 GRY
			HEADING #59	
		1 PR DOORS D201A 1 PR DOORS D209A 2/3'-0"± x 7'-0"± x 1-3/4" TYPE D04/F03	EXTERIOR FROM WEST STAIR 201 EXTERIOR FROM EAST STAIR 209 INS.HMD/PSF TRANSOM FRAME / SITE VERIFY EXISTING	LHR/RHRA LHR/RHRA OPENING
12 2 2 2	EA EA EA	HINGE EXIT DEVICE EXIT DEVICE TEMP CYLINDER PERM CYLINDER(S)	5BB1HW 4.5 x 4 NRP 9849EO x 36"DR 9849NL-OP x 36"DR 20-021 BY OWNER	630 626 626 626 626
4	EA EA	DOOR PULL DOOR CLOSER	SM3012-2 x #4MTG 4040XP EDA x ST-2731 x ST1944 MOUNT DOOR CLOSER PA SHOE ON TOP OF HEADER W/STRIP FOR CONTINUOUS SEAL	316SS/630 689
4 4 2		O/H STOP KICKPLATE TB THRESHOLD	904S x 95-100 DEGREE OPEN K10A 8" x 34.5" <u>+</u> x TAPE 254 x5AFG x 76" <u>+</u> COPE AROUND FRAME & CAULK ALL EDGES	630 630 AL
2	EA	W/STRIP (HEADER)	2891AS x 72"± x CTSK SCREW HOLES INSTALL HEADER W/STRIP PRIOR TO DOOR CLOSER & O/H STOP FOR CONTINUOUS SEAL.	AL
4 4 2	EA EA SET	W/STRIP (JAMB) DOOR SWEEP MEETING STILE ASTRAG	290AS x 84" <u>+</u> W-38S x 36" <u>+</u> LESS cUL LABEL	AL AL AL

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ADVISE TYPE OF FLOORING

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- -VERTICAL ROD EXIT DEVICES DO NOT OFFER THE BEST SECURITY.
- -NOTE THAT GAP BETWEEN DOORS AT MEETING STILE WILL MOST LIKELY BE AN ISSUE MEETING STILE ASTRAGAL HAS BEEN SPECIFIED HOWEVER AESTHETICALLY NOT PLEASING.
- -ADVISE DOOR PAINT COLOR (ASTRAGAL & DOOR SWEEP AVAILABLE IN CLR OR DRK BRZ FINISHES)

DOOR SWEEPS AND ASTRAGAL FOR CONTINUOUS SEAL.

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		1 PR DOORS D201B 1 PR DOORS D209B 3'-2" x 7'-0" x 1-3/4" TYPE D03/F01	WEST STAIR 201 FROM CORRIDOR 212 EAST STAIR 209 FROM CORRIDOR 212 HMD/PSF 45 MIN/FR	LHR/RHR LHR/RHR
12 EA 4 EA 4 EA 4 EA 4 EA		HINGE EXIT DEVICE DOOR CLOSER KICKPLATE O/H STOP	5BB1HW 5" x 4.5" 9849L-F-BE x 996L-BE-R/V-06 x LBL x 38"DR 4040XP EDA DEL x ST-1358 x 4040XP-18 K10A 8" x 36.5" x TAPE 104S x 110 DEGREE	652 626 689 630 630
			HEADING #61	
		1 SGL DOOR D202A 1 SGL DOOR D208A 3'-2" x 7'-0" x 1-3/4" TYPE D01/F01	CORRIDOR 212 TO WC 202 CORRIDOR 212 TO WC 208 HMD/PSF	LH RH
6 2	EA EA	HINGE DEADLOCK	5BB1HW 5" x 4.5" L463P INSTALL 48" CYLINDER/THUMBTURN C/L	652 626
2	EA EA	PERM CYLINDER DOOR PULL	PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF CUT FOR INSIDE THUMBTURN	626 630
2	EA	PULL PLATE	H416 (GYM SIDE) CUT PLATE FOR GYM SIDE CYLINDER	630

INSTALL @ 45" C/L AFF

925

104S

SR64

8310-852

8310-876

4811 x 4810-18 x ST-2599

K10A 8" x 36.5" x TAPE

K10A 4" x 37" x TAPE

7982 (SHARED WITH D202A & D208A)

689

630

630

630

630

630

GRY

2

1

4

4

2

2

2

100

EΑ

EΑ

EΑ

EΑ

FT

EA AUTO OPENER

TUBING

EA ESCUTCHEON

KICKPLATE

MOP PLATE

EA DOOR SILENCER

O/H STOP

EA ACTUATOR

CONTROL BOX

NOTE: CONTROL BOX MUST BE INSTALLED WITHIN 50FT OF EA DOOR – ADVISE MOUNTING LOCATION IF 50FT NOT POSSIBLE 2 CONTROL BOXES CAN BE SPECIFIED AND WILL ALLOW 100FT DISTANCE.

ITEM #79		1 SGL DOOR D202B 2'-6" x 7'-0" x 1-3/4" TYPE D01/F01	WC 202 TO ELEC ROOM HMD/PSF	RH
0	^	LUNGE	EDD4 4 5" 4"	050
3	EA	HINGE	5BB1 4.5" x 4"	652
1	EΑ	LOCKSET	ND96PD RHO x 10-025	626
1	EA	PERM CYLINDER	PRIMUS?	626
1	EA	DOOR CLOSER	4040XP REG DEL	AL
1	EA	KICKPLATE	K10A 8" x 28.5" x TAPE	630
1	EA	WALL STOP	S121	626
3	EA	DOOR SILENCER	SR64	GRY

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			HEADING #63	
ITEN ITEN	Л #81 Л #82 Л #83	1 SGL DOOR D202C 1 SGL DOOR D202D 1 SGL DOOR D208C 1 SGL DOOR D208D 2'-6" x 6'-0" x 1-3/4" TYPE D01/F01	WC 202 FROM WASHROOM CLOSET WC 202 FROM WASHROOM CLOSET WC 208 FROM WASHROOM CLOSET WC 208 FROM WASHROOM CLOSET SCWD/ PSF	LHR LHR LHR LHR
		I DOOR THICKNESS I FRAME TYPE		
8 4 4 4 4 4 12	EA EA EA EA	HINGE SPRING HINGE PRIVACY W/INDICATOR CYLINDER KICKPLATE MOP PLATE DOOR SILENCER	3CB1 4.5" x 4" 3SP1 4.5" x 4" LV9496 x OCCUPIED INDICATOR PRIMUS? K10A 8" x 28.5" x TAPE K10A 4" x 29" x TAPE SR64	652 652 626 626 630 630 GRY
			HEADING #64	
		1 SGL DOOR D202E 1 SGL DOOR D208E 3'-2" x 6'-0" x 1-3/4" TYPE D01/F01	WC 202 FROM HDCP WASHROOM CLOSET WC 208 FROM HDCP WASHROOM CLOSET SCWD/ PSF	RHR LHR
4 2 2 2 2 2 2 6 INSI	EA EA EA EA	HINGE SPRING HINGE PRIVACYW/INDICATOR CYLINDER KICKPLATE MOP PLATE DOOR SILENCER	3CB1 4.5" x 4" 3SP1 4.5" x 4" LV9496 x OCCUPIED INDICATOR PRIMUS? K10A 12" x 36.5" x TAPE K10A 4" x 37" x TAPE SR64 SUE IF HDCP ACCESSIBLE	652 652 626 626 630 630 GRY
			HEADING #65	
ITEN	Л #87 Л #88	1 SGL DOOR D203 1 SGL DOOR D213 1 SGL DOOR D214 1 SGL DOOR D215 3'-2"± x 7'-0"± x 1-3/4" TYPE D03/F01	CORRIDOR 212 TO CLASSROOM 203 CORRIDOR 212 TO CLASSROOM 213 CORRIDOR 212 TO CLASSROOM 214 CORRIDOR 212 TO CLASSROOM 215 HMD/PSF SITE VERIFY EXISTING OPENING	RH LH LH RH
12 4 4 4 4 12 CON	EA EA EA	HINGE LOCKSET PERM CYLINDER KICKPLATE WALL STOP DOOR SILENCER LOCKING FUNCTION	5BB1 5 x 4.5 ND94PD RHO x 10-025 PRIMUS? K10A 8 x 36.5± x TAPE S121 SR64	652 626 626 630 626 GRY

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ITE	M #90	1 SGL DOOR D204 3'-2" <u>+</u> x 7'-0" x 1-3/4" TYPE D01/F01	CLASSROOM 203 TO IT ROOM 204 HMD/PSF	LH
3	EA	HINGE	5BB1 5" x 4.5"	652
1	ΕA	LOCKSET	ND96PD RHO x L/STRIKE	626
1	EA	PERM CYLINDER	PRIMUS?	626
1	EA	ELECTRIC STRIKE CARD READER POWER SUPPLY	6211 FSE (CONFIRM VOLTAGE) BY OTHERS BY OTHERS	630
1	EA	DOOR CLOSER	4040XP REG DEL	689
1	EΑ	KICKPLATE	K10A 8" x 36.5"± x TAPE	630
1	EΑ	WALL STOP	S121	626
3	EΑ	DOOR SILENCER	SR64	GRY

SECURITY SYSTEM: SUPPLIED BY ACCESS CONTROL SECTION INCLUDES CARD ACCESS SYSTEM & ALL RELATED HARDWARE.

ITEM	1 #91	1 SGL DOOR D205 3'-2"± x 7'-0"± x 1-3/4" TYPE D03/F01	CORRIDOR 212 TO ADMINISTRATION 205 HMD/PSF SITE VERIFY EXISTING OPENING	LH
3 1	EA EA	HINGE DEADBOLT	5BB1 5" x 4.5" L460P INSTALL 48" CYLINDER/THUMBTURN C/L	652 626
1 1	EA EA	•	PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF	626 630
1	EA	PULL PLATE	CUT FOR INSIDE THUMBTURN H416 (CORR. SIDE) CUT PLATE FOR CORR. SIDE CYLINDER INSTALL @ 45" C/L AFF	630
1 1 1 3	EA EA EA	KICKPLATE WALL STOP	4040XPH DEL K10A 8" x 36.5" <u>+</u> x TAPE S121 SR64	689 630 626 GRY
			HEADING #68	
		1 SGL DOOR D206 1 SGL DOOR D207 3'-2" x 7'-0" x 1-3/4" TYPE D03/F01	ADMINISTRATION 205 TO OFFICE 206 OFFICE 206 TO OFFICE 207 HMD/PSF	LH RH
6 2 2 2 2 6	EA EA EA EA EA	LOCKSET PERM CYLINDER KICKPLATE	5BB1 5" x 4.5" ND92PD RHO x 10-025 PRIMUS? K10A 8" x 36.5" x TAPE S121 SR64	652 626 626 630 626 GRY

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			HEADING #69	
ITEN	/I #94	1 SGL DOOR D208B 2'-6" x 7'-0" x 1-3/4" TYPE D01/F01	WC TO JANITOR HMD/PSF 0 HOUR	LH
3 1 1 1 1 1 1	EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP AUTO DR BOTTOM GASKET	5BB1 4.5" x 4" ND96PD RHO x 10-025 PRIMUS? 4040XP REG DEL K10A 8" x 28.5" x TAPE S121 420APKL x 30" x SHIM TO SUIT UNDERCUT NGP5050 x 17FT	652 626 626 689 630 626 AL CLR
			HEADING #70	
ITEN	/ 1 #95	1 SGL DOOR D211 2'-6"± x 7'-0" x 1-3/4" TYPE D01/F01	ELEV LOBBY 210 FROM MECH ROOM 151 HMD/PSF	LHR
3 1 1 1 1 1 3	EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 4.5" x 4" NRP ND96PD RHO x 10-025 PRIMUS? 4040XP CUSH DEL K10A 8" x 28.5"± x TAPE S121 SR64	652 626 626 689 630 626 GRY
			HEADING #71	
	Л #96 Л #97	1 PR DOORS D301 1 PR DOORS D308 3'-2" x 7'-0" x 1-3/4" TYPE D02/F01	WEST STAIR 301 FROM CORRIDOR 310 EAST STAIR 308 FROM CORRIDOR 310 HMD/PSF 45 MIN/FR	LHR/RHR LHR/RHR
12 4 4 4 4 12	EA EA EA EA	HINGE EXIT DEVICE DOOR CLOSER KICKPLATE O/H STOP DOOR SILENCER	5BB1HW 5" x 4.5" 9849L-F-BE x 996L-BE-R/V-06 x LBL x 38"DR 4040XP EDA DEL x ST-1358 x 4040XP-18 K10A 8" x 36.5" x TAPE 104S x 110 DEGREE SR64	652 626 689 630 630 GRY

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			HEADING #72	
		1 SGL DOOR D302A 1 SGL DOOR D307A 3'-2"± x 7'-0"± x 1-3/4" TYPE D01/F01	CORRIDOR 310 TO WC 302 CORRIDOR 310 TO WC 307 HMD/PSF SITE VERIFY EXISTING OPENING	RH LH
6 2	EA EA	HINGE DEADLOCK	5BB1HW 5 x 4.5 L463P INSTALL 48" CYLINDER/THUMBTURN C/L	652 626
2	EA EA	PERM CYLINDER DOOR PULL	PRIMUS? SM3512-1 x #2 LESS GROMMET INSTALL @ 45" C/L AFF CUT FOR INSIDE THUMBTURN	626 630
2	EA	PULL PLATE	H416 (CORR. SIDE) CUT PLATE FOR CORR. SIDE CYLINDER INSTALL @ 45" C/L AFF	630
2 1 100	EA	AUTO OPENER CONTROL BOX TUBING	4811 x 4810-18 x ST-2599 ES7982 925	689
2 2 2 2 2 2 6	EA EA EA	ACTUATOR ESCUTCHEON KICKPLATE MOP PLATE	8310-852 8310-876 K10A 8" x 36.5" <u>+</u> x TAPE K10A 4" x 37" <u>+</u> x TAPE 104S SR64	630 630 630 630 630 GRY

REVIEW LOCATION OF FRAME IN OPENING SO NO CONFLICT WITH OPENER COVER WHEN DOOR OPEN.

ITEN	¶ #101 ¶ #102	1 SGL DOOR D302B 1 SGL DOOR D302C 2 1 SGL DOOR D307B 3 1 SGL DOOR D307C 2'-6" x 6'-0" x 1-3/4" TYPE D01/F01	WC 302 FROM WASHROOM CLOSET WC 202 FROM WASHROOM CLOSET WC 307 FROM WASHROOM CLOSET WC 307 FROM WASHROOM CLOSET SCWD/PSF	LHR LHR LHR LHR
8 4 4 4 4 4 12	EA EA EA EA EA	HINGE SPRING HINGE PRIVACY W/INDICATOR CYLINDER KICKPLATE MOP PLATE DOOR SILENCER	3CB1 4.5" x 4" 3SP1 4.5" x 4" LV9496 x OCCUPIED INDICATOR <i>PRIMUS?</i> K10A 8" x 28.5" x TAPE K10A 4" x 27" x TAPE SR64	652 652 626 626 630 630 GRY

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			HEADING #74	
		1 SGL DOOR D302D 1 SGL DOOR D307D 3'-2" x 6'-0" x 1-3/4" TYPE D01/F01	WC302 FROM HDCP WASHROOM WC307 FROM HDCP WASHROOM SCWD/PSF	RHR LHR
4 2 2 4 2 2 6	EA EA EA EA	HINGE SPRING HINGE PRIVACY W/INDICATOR CYLINDER KICKPLATE MOP PLATE DOOR SILENCER	3CB1 4.5" x 4" 3SP1 4.5" x 4" LV9496 x OCCUPIED INDICATOR PRIMUS? K10A 12" x 34.5" x TAPE K10A 4" x 37" x TAPE SR64	652 652 626 626 630 630 GRY
			HEADING #75	
ITEN	/ 1 #106	1 SGL DOOR D303A 3'-2"± x 7'-0"± x 1-3/4" TYPE D03/F01	CORRIDOR 310 TO CONFERENCE ROOM 303 HMD/PSF SITE VERIFY EXISTING OPENING	RH
3 1 1 1 1 1 3	EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" ND92PD RHO x 10-025 PRIMUS? 4040XP H REG DEL K10A 8" x 36.5"± x TAPE S121 SR64	652 626 626 689 630 626 GRY
			HEADING #76	
ITEN	Л #107	1 SGL DOOR D303B 3'-2"± x 7'-0" x 1-3/4" TYPE D03/F01	CORRIDOR 310 FROM CONFERENCE ROOM 303 HMD/PSF	LHR
3 1 1 1 1 3	EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE DOOR SILENCER	5BB1 5" x 4.5" NRP ND92PD RHO x 10-025 PRIMUS? 4040XP H-CUSH DEL K10A 8" x 36.5"± x TAPE SR64	652 626 626 689 630 GRY

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JLF	R No. 27	7672-000.1		2018/03/14
			HEADING #77	
		3 1 SGL DOOR D304 9 1 SGL DOOR D306 3'-2"± x 7'-0" x 1-3/4" TYPE D03/F01	CONFERENCE ROOM 303 TO OFFICE 304 CLASSROOM 305 TO OFFICE 306 HMD/PSF	LH RH
6 2 2 2 2 6	EA EA EA	HINGE LOCKSET PERM CYLINDER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" NRP ND92PD RHO x 10-025 PRIMUS? K10A 8" x 36.5" <u>+</u> x TAPE S121 SR64	652 626 626 630 626 GRY
			HEADING #78	
ITE	M #111	1 SGL DOOR D305 1 SGL DOOR D315 2 1 SGL DOOR D316 3'-2"± x 7'-0"± x 1-3/4" TYPE D03/F01	CORRIDOR 310 TO CLASSROOM 305 CORRIDOR 310 TO CLASSROOM 315 CORRIDOR 310 TO CLASSROOM 316 HMD/PSF SITE VERIFY EXISTING OPENING	RH LH RH
9 3 3 3 9	EA EA EA	HINGE LOCKSET PERM CYLINDER KICKPLATE WALL STOP DOOR SILENCER	5BB1 5" x 4.5" ND94PD RHO x 10-025 PRIMUS? K10A 8" x 36.5"± x TAPE S121 SR64	652 626 626 630 626 GRY
			HEADING #79	
ITE	M #113	3 1 SGL DOOR D309 2'-6" x 7'-0" <u>+</u> x 1-3/4" TYPE D01/F01	ELEV LOBBY 309 FROM MECH ROOM 309 HMD/PSF SITE VERITY EXISTING OPENING	LHR
3 1 1 1 1 1 3	EA EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 4.5" x 4" NRP ND96PD RHO x 10-025 BY OWNER 4040XP CUSH K10A 8" x 28.5" <u>+</u> x TAPE S121 SR64	652 626 626 AL 630 626 GRY

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			LIEADING #00	
		1 SGL DOOR D311 1 SGL DOOR D319 2'-2"± x 7'-0"± x 1-3/4" TYPE D01/F01	HEADING #80 CORRIDOR TO ELEC ROOM 311 CORRIDOR TO JANITOR 319 HMD/PSF SITE VERIFY EXISTING OPENING	LH RH
6 2 2 2 2 2 6	EA EA EA EA	HINGE LOCKSET PERM CYLINDER DOOR CLOSER KICKPLATE WALL STOP DOOR SILENCER	5BB1 4.5" x 4" NRP ND96PD RHO x 10-025 PRIMUS? 4040XP REG K10A 8" x 24.5" ± x TAPE S121 SR64	652 626 626 689 630 626 GRY
			HEADING #81	
		1 SGL DOOR D312 1 SGL DOOR D318 2'-8"± x 7'-0"± x 1-3/4" TYPE D03/F01	CORRIDOR FROM OFFICE 312 CORRIDOR FROM OFFICE 318 HMD/PSF SITE VERIFY EXISTING OPENING	LHR RHR
6 2 2 2 2 6	EA EA EA	HINGE LOCKSET PERM CYLINDER KICKPLATE WALL STOP DOOR SILENCER	5BB1 4.5" x 4" NRP ND92PD RHO x 10-025 PRIMUS? K10A 8" x 30.5" <u>+</u> x TAPE S121 SR64	652 626 626 630 626 GRY
			HEADING #82	
		1 SGL DOOR D313A 1 SGL DOOR D317 3'-2"± x 7'-0"± x 1-3/4" TYPE D01/F01	CORRIDOR TO OFFICE 313 CORRIDOR 310 TO OFFICE 317 HMD/PSF SITE VERIFY EXISTING OPENING	RH RH
6 2 2 2 6	EA EA	HINGE LOCKSET PERM CYLINDER KICKPLATE DOOR SILENCER	5BB1 5" x 4.5" ND92PD RHO x 10-025 PRIMUS? K10A 8" x 36.5" <u>+</u> x TAPE SR64	652 626 626 630 GRY
HEADING #83				
ITEM	/I #120	1 PR DOORS D313B 2/2'-0" x 7'-0" x 1-3/4" TYPE D01/F01	OFFICE 313 FROM CLOSET HMD/PSF	LHR/RHR
6 2 2 2	EA	HINGE ROLLER LATCHES FLUSH PULLS DOOR SILENCER	5BB1 4.5 x 4 F75 H405 SR64	652 626 626 GRY

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		HEADING #84	
ITE	M #121 1 SGL DOOR D314 3'-2" x 7'-0" <u>+</u> x 1-3/4" TYPE D03/ <i>F??</i>	OFFICE 313 TO OFFICE 314 HMD/PSF SITE VERIFY EXISTING OPENING	RH
CO	NFIRM FRAME TYPE		
3	EA HINGE	5BB1 5" x 4.5"	652
1	EA LOCKSET	ND92PD RHO x 10-025	626
1	EA PERM CYLINDER	PRIMUS?	626
1	EA KICKPLATE	K10A 8" x 36.5" <u>+</u> x TAPE	630
3	EA DOOR SILENCER	SR64	GRY

END OF SCHEDULE

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C 542/A542M-13, Standard Specification for Lock-Strip Gaskets.
 - .2 ASTM D 790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .3 ASTM D 1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics.
 - .4 ASTM D 1929-14, Standard Test Method for Determining Ignition Temperature of Plastics.
 - .5 ASTM D 2240-[05] (2010), Standard Test Method for Rubber Property Durometer Hardness.
 - .6 ASTM E 84-15a, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .7 ASTM E 330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .8 ASTM E 546-14, Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units.
 - .9 ASTM E 576-14, Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units in the Vertical Position.
 - .10 ASTM E 2190-10, Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - .11 ASTM F 1233-08(2013), Standard Test Method for Security Glazing Materials and Systems.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-2017, Safety Glazing.
 - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
 - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
 - .5 CAN/CGSB-12.6-M91, Transparent (One-Way) Mirrors.
 - .6 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .7 CAN/CGSB-12.8-97 (Amendment), Insulating Glass Units.
 - .8 CAN/CGSB-12.9-M91, Spandrel Glass.
 - .9 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
 - .10 CAN/CGSB-12.12-M90, Plastic Safety Glazing Sheets.
 - .11 CAN/CGSB-12.13-M91, Patterned Glass.
- .3 Standard Council of Canada:
 - .1 ULC Standard CAN4-S106-M80 (R1985): Fire Tests of Window Assemblies.
- .4 Environmental Choice Program (ECP):
 - .1 CCD-045-[95(R2005)], Sealants and Caulking Compounds.
- .5 Glass Association of North American (GANA):
 - .1 GANA Glazing Manual 2008.
 - .2 GANA Laminated Glazing Reference Manual 2009.
- .6 National Fire Protection Association (NFPA):
 - .1 NFPA 80, 2016 Edition: Fire Doors and Windows.
 - .2 NFPA 257, 2012 Edition: Fire Tests of Window Assemblies.
- .7 Underwriters Laboratories, Inc. (UL):
 - .1 UL 9 Fire Tests of Window Assemblies.

- .8 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN-ULC S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .2 ULC CAN4-S106-M80 (R1985), Standard Method for Fire Tests of Window and Glass Block Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor's Representative in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Provide continuity of building enclosure air / vapour using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
 - .2 Fire-rated ceramic clear glazing (wireless):
 - .1 Fire-rated glass ceramic clear and wireless glazing material listed for use in non-impact safety-rated locations such as transoms and borrowed lights with fire rating requirements ranging from 20 to 90 minutes with required hose stream test.
 - .2 Passes positive pressure test standards UBC 7-2 and UBC 7-4.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure as measured in accordance with ANSI/ASTM E330.
- .3 Provide glass type and thickness in accordance the OBC.
- .4 Limit glass deflection to 1/200 flexural limit of glass with full recovery of glazing materials.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 If requested, samples may be returned upon completion of work in this section.
 - .3 Submit duplicate 305 x 305 mm / 12" x 12" size samples of glazing units.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.6 QUALITY ASSURANCE

- .1 Fire-rated ceramic clear glazing (wireless):
 - .1 Glazing Standards: GAMA Glazing Manual and FGMA Sealant Manual.
 - .2 Each lite shall bear permanent, no removable label of UL certifying it for use in tested and rated fire protective assemblies.

.2 Mock-ups:

- .1 Construct mock-ups in accordance with Section 01 45 00 Quality Control.
- .2 Construct mock-up to include glass glazing, and perimeter air / vapour barrier and vapour retarder seal.
- .3 Mock-up will be used:
 - .1 To judge quality of work, substrate preparation, operation of equipment and material application.
 - .2 Locate where directed.
 - .3 Allow 24 hours for inspection of mock-up before proceeding with work.
 - .4 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
 - .3 Protect prefinished aluminum surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.

1.8 AMBIENT CONDITIONS

- .1 Ambient Requirements:
 - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 WARRANTY

- .1 Warrant the following types of glass against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of the work:
 - .1 Mirrors: ten (10) years
 - .2 Insulating glass: ten (10) years
- .2 Warranty to cover full replacement including stops, trims, caulking, sealants, all at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Design Criteria:
 - .1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
 - .2 Thickness and glass types specified and as indicated on drawings are minimum. Provide glass thicknesses in float, heat-strengthened or tempered glass to ASTM E330 and as required to suit wind loads, dead loads and positive and negative live loads, thermal stresses, building codes and as required by manufacturer's recommendations. Confirm any proposed substitutions from the specified glass with Consultant.
 - .3 Limit glass deflection to 1/200 with full recovery of glazing materials.
- .2 Flat Glass:
 - .1 Float glass: to CAN/CGSB-12.3, colour clear.
- .3 Heat strengthened glass: ASTM C1048-976. Perform heat strengthening using the horizontal tongfree method.
- .4 Safety glass: to CAN/CGSB-12.1-2017, transparent complete with polished edges, to minimum thickness as follows:
 - .1 Type 1: tempered, 6 mm / 1/4" thick minimum.
 - .2 Type 2: laminated with 0.76 mm / 5/64" minimum PVB interlayer, 6 mm / 1/4" thick.
- .5 Silvered mirror glass: plate glass to CAN/CGSB-12.5, 6 mm / 1/4" thick.
- .6 Spandrel glass: to CAN/CGSB-12.9, 6 mm / ¼" thick heat, float complete with opacifier coating, colour as later selected by Consultant from manufacturer's complete colour range.
 - .1 Acceptable product: 'Opaci-Coat 300' by Industrial Control Development Inc., or approved alternate.
- .7 High Performance Insulating Glass Units:
 - .1 Insulating glass units: to ASTM E 2190, double unit, 2 mm / 1" overall thickness, safety glass both lights where indicated.
 - .1 Glass: to ASTM E 546 and ASTM E 576.
 - .2 Glass thickness: to requirements of OBC for condition and glazing type indicated, but to minimum type and thickness as indicated.
 - .3 Inter-cavity space thickness: to suit overall thickness and glass thickness, argon filled, with grey non-conductive spacers.

- .4 Glass coating: Sputter Low "E" on No. 2 surface.
- .5 Inert gas fill: argon.
- .6 Colour: warm grey.
- .7 Performance Requirements:
 - .1 Visible light transmittance: 50%
 - .2 Exterior reflectance: 8%.3 Winter U-Value: 0.29.4 Summer U-Value: 0.26
 - .5 Shading coefficient: 0.33.6 Solar heat gain coefficient: 0.30
 - .7 Light to Solar gain ratio: 1.67
- .8 Acceptable product: 'Solarban 60' by Vitro, or equivalent by Pilkington Building Products (LOF), Viracon, by or approved alternate.
- .8 Sealant: in accordance with Section 07 92 00 Joint Sealants.

2.2 FIRE PROTECTIVE GLASS

- .1 Ceramic fire-rated and impact-safety rate glass: polished premium surface, 5 mm with applied safety film to CAN-ULC S104,ULC CAN4-S106 and ANZI-97 Cat II.
 - .1 Acceptable manufacturer's:
 - .1 Keralite as distributed by F1 Glazing Solutions, Etobicoke, Ontario, phone number 1-416-768-6873, email fultonF1@gmail.com.
 - .2 Pyran Platinum as distributed by Glassopolis, phone number 1 800 262 9600, web site http://www.glassopolis.com
 - .3 Firelite as distributed by Technical Glass ProductsMilton, Ontario, phone number 1 800 426 0279, web site sales@fireglass.com, or approved alternate.
 - .4 Or approved alternate.
 - .2 Maximum sheet sizes based on surface finish:
 - .1 Premium: 48 inches by 96 inches.
 - .3 Labeling: Permanently label each piece of fire-rated ceramic clear glass with the UL logo and fire rating in sizes up to 2.145 m² / 23 ft² and with manufacturer's label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
 - .4 Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ULC Standards CAN4 S-104 and CAN4 S-106.
 - .5 Accessories:
 - .1 Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 square inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
 - .2 Glazing Compound: DAP 33 putty.
 - .3 Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.
 - .1 Available Products: Dow Corning 795 Dow Corning Corp., or Silglaze-II 2800 General Electric Co., or Spectrem 2 Tremco Inc., or approved alternate.
 - .4 Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
 - .5 Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

Rating	Assembly	Maximum Exposed Area (sqm)	Maximum Width of Exposed Glazing (mm)	OR	Maximum Height of Exposed Glazing (mm)
20 to 60 min.	Other than doors	2.145 m2 / 23 ft2	2413 mm / 95"		2413 mm / 95"
90 min.	Other than doors	1.69 m2 / 18.24 ft2	1435 mm / 56½"		1435 mm / 56½"

2.3 ACCESSORIES

- .1 Setting blocks: as recommended by manufacturer to suit glazing method, glass light weight and area.
- .2 Spacer shims: neoprene Shore A durometer hardness to ASTM D 2240, [75] mm / 3" long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape:
 - .1 Preformed butyl compound, 10-15 Shore A durometer hardness to ASTM D 2240; coiled on release paper; 6 mm wide] x 3 mm thick / ¼" wide x 1/8" thick size; black colour.
- .4 Acceptable product: 'Polyshim II Tape', by Tremco or approved equivalent.
- .5 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, black colour.
- .6 Glazing clips: manufacturer's standard type.
- .7 Lock-strip gaskets: to ASTM C 542.
- .8 Mirror attachment accessories:
 - .1 Stainless steel clips.
 - .2 Mirror adhesive, chemically compatible with mirror coating and wall substrate.
 - .3 Mirror frames: stainless steel.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate:
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

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- .1 Clean contact surfaces with solvent and wipe dry.
 - .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
 - .3 Prime surfaces scheduled to receive sealant.

3.4 INSTALLATION: EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- .1 Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, 6 mm / ¼" below sight line. Seal corners by butting tape and dabbing with sealant.
- .3 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.
- .4 Place setting blocks at 1/3 points, with edge block maximum 150 mm / 6" from corners.
- .5 Rest glazing on setting blocks and push against tape and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.
- .6 Install removable stops with spacer strips inserted between glazing and applied stops 6 mm / ¼" below sight line. Place glazing tape on glazing light or unit with tape 16 mm / 5/8" below sight line.
- .7 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 9 mm / 3/8" below sight line.
- .8 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm / 1/16" above sight line.
- .3 Place setting blocks at 1/3 points, with edge block maximum 150 mm / 6" from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

3.6 BUTT SILICONE JOINTED GLAZING

- .1 Set butt joint glazing in perimeter PSF with vertical joints places to not more than 6 mm / ¼" apart.
- .2 Place glazing units plumb and level.
- .3 Apply silicone joint sealant to prevent the transfer of smoke, in accordance with Section 07 92 00 Joint Sealing.

3.7 FIRE PROTECTIVE GLASS

- .1 Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- .2 Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- .3 Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- .4 Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- .5 Place setting blocks located at quarter points of glass with edge block not more than 6 inches from corners.
- .6 Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- .7 Place glazing tape on free perimeter of glazing in same manner described above.
- .8 Install removable stop and secure without displacement of tape.
- .9 Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.
- .10 Install so that appropriate UL markings remain permanently visible.

3.8 INSTALLATION: MIRRORS

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Set mirrors with clips. Anchor rigidly to wall construction.
- .3 Set in frame.
- .4 Place plumb and level.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.

- .1 Remove traces of primer, caulking.
- .2 Remove glazing materials from finish surfaces.
- .3 Remove labels.
- .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
 - .1 Do not mark heat absorbing or reflective glass units.
- .3 Repair damage to adjacent materials caused by glazing installation.

3.11 SCHEDULE

- .1 Exterior Entrance Doors, Sidelights, Windows, Transoms and Curtain Wall, unless otherwise indicated: Insulating Glass Units, glass types as indicated.
- .2 Curtain Wall: High performance insulating glass units.
- .3 Interior Screens and Transoms: glass types as indicated unless otherwise noted.
- .4 Labeled Doors and Screens: Fire protective glass units.
- .5 Mirrors: where indicated.
- .6 Butt Joint Silicone Glazing: High performance insulating glass units as indicated on documents.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Aluminum Association (AA):
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International:
 - .1 ASTM C475/C475M-15, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C 514-04(2014), Standard Specification for Nails for the Application of Gypsum Board.
 - .3 ASTM C 557-03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .4 ASTM C 840-13, Standard Specification for Application and Finishing of Gypsum Board.
 - .5 ASTM C 954-15, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .6 ASTM C 1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .7 ASTM C 1047-11, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .8 ASTM C 1280-13a, Standard Specification for Application of Gypsum Sheathing.
 - .9 ASTM C 1177/C 1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .10 ASTM C 1178/C 1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - .11 ASTM C 1396/C 1396M-14a, Standard Specification for Gypsum Wallboard.
- .3 Association of the Wall and Ceilings Industries International (AWCI):
 - .1 AWCI Levels of Gypsum Board Finish-97.
- .4 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store gypsum board assemblies materials level off ground, indoors, and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect from weather, elements and damage from construction operations.
 - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .5 Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - .6 Replace defective or damaged materials with new.

1.4 AMBIENT CONDITIONS

- .1 Maintain temperature 10°C minimum, 21°C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Standard Board: to ASTM C36/C1396 and CAN/CSA-A82.27 regular and Type X, thickness as indicated, 1220 mm / 4'-0" wide x maximum practical length, ends square cut, edges rounded and bevelled.
 - .1 Acceptable products:
 - .1 'Sheetrock Brand Gypsum Panels' by CGC.
 - .2 'ProRoc by CertainTeed Gypsum, Inc.
 - .3 'Tough Rock Fireguard Gypsum Board', by Georgia-Pacific.
 - .4 'Firecheck' by Lafarge Canada Inc.
 - .5 Or approved alternate.
- .2 Water/Mold Resistant Board: to ASTM C1396, ASTM D3273 and CAN/CSA-A82.27, moisture and mold resistant board, 15.9 mm / 5/8" thick Type X, 1200 mm / 4'-0" wide x maximum practical length.
 - .1 Acceptable products:
 - .1 'Mold Tough Interior Panel' by CGC.
 - .2 'M2Tech Moisture and Mold Resistant Gypsum Board' by CertainTeed Gypsum, Inc.
 - .3 'Tough Rock Mold-Guard Gypsum Board', by Georgia-Pacific.
 - .4 Or approved alternate.
- .3 Cement Board: moisture and mold resistant to ASTM D3273, 13 mm thick, 914 x 1524 mm / 36" x 60".
 - .1 Acceptable products:
 - .1 'Durock Next Gen Cement Board' by CGC.
 - .2 'Fiber Cement Underlayment/Backer Board' by CertainTeed Gypsum, Inc.

- .3 'Durock Cement Board Next Gen' by USG.
- .4 Or approved alternate.
- .4 Tile Backer Board: moisture and mold resistant, fully embedded glass mat gypsum tile backer to , ASTM D3273 , ASTM C1278., 15.9 mm / 5/8" thick Type X, 1200 mm / 4'-0" wide x maximum practical length.
 - .1 Acceptable products:
 - .1 'Fiberrock Acua-Tough Tile Backerboard' by CGC.
 - .2 'Diamondback GlasRoc Tile Backer' by CertainTeed Gypsum, Inc.
 - .3 'DensShield Tile Backer', by Georgia-Pacific.
 - .4 Or approved alternate.
- .5 Abuse Board: abuse resistant gypsum panels, to ASTM C 1396, and CAN/CSA-A82.27, thickness as indicated, Type X.
 - .1 Acceptable products:
 - .1 'Sheetrock Abuse-Resistant Gypsum Panels' by CGC.
 - .2 'ProRoc Abuse Resistant Gypsum Board' by CertainTeed Gypsum, Inc.
 - .3 Sheetrock Brand Abuse-Resistant Gypsum Panels by USG.
 - .4 'Tough Rock Fireguard Abuse Board', by Georgia-Pacific.
 - .5 'Protecta AR 100' by Lafarge Canada Inc.
 - .6 Or approved alternate.
- .6 Sound Board: sound deadening gypsum panels, to ASTM E695-03, and CAN/CSA-A82.27, thickness as indicated, Type X.
 - .1 Acceptable products:
 - .1 'Quiet Rock' by CertainTeed Gypsum, Inc.
 - .2 'Toughrock Sound Deadening Gypsum Board' by Georgia Pacific.
 - .3 Or approved alternate.
- .7 Gypsum Sheathing (Fiberglass Faced Gypsum Board): to ASTM C1177 regular and Type X, thickness as indicated, 1220 mm / 4'-0" wide x maximum practical length.
 - .1 Acceptable products:
 - .1 'Securock Glass-Mat Sheathing', by CGC.
 - .2 'Glasroc Sheathing by CertainTeed Gypsum, Inc.
 - .3 'Dens-Glass Sheathing', by Georgia Pacific.
 - .4 'Firecheck Type X' by Continental Building Products.
 - .5 Or approved alternate.
- .8 Concrete Subfloor System: Structural concrete subfloor panel to ASTM E136-12, thickness as indicated.
 - .1 Acceptable products:
 - .1 'Structural Panel Concrete Subfloor', by USG
 - .2 Or approved alternate.
- .9 Shaft Wall System: Gypsum board and metal framing meeting fire rating requirements indicated, labeled by ULC.
 - .1 Acceptable products:
 - .1 Shaft Wall System by CGC.
 - .2 'M2Tech Shaftwall System' by CertainTeed Gypsum.
 - .3 'Densglass Shaftliner' by Georgia Pacific.
 - .4 'Firecheck Shaftliner' by Lafarge Canada Inc.
 - .5 Or approved alternate.

- .10 Metal Furring Runners, Hangers, Tie Wires, Inserts, Anchors: to CSA A82.30-M1980.
- .11 Drywall Furring Channels: hat shaped, zinc-coated by hot-dip process 0.5 mm / 25 ga. base thickness, 22 mm x 70 mm x 0.5 mm 7/8" x 2 3/4" x 25 ga. core thickness galvanized steel channels for screw attachment of gypsum board.
 - .1 Acceptable Product: 'D-1001 Drywall Furring Channels' by Bailey Metal Products Limited, or approved alternate.
- .12 Resilient Channels [Clips] [Drywall Furring]: 13 mm x 57 mm x 0.5 mm 1/2" x 2 1/4" x 25 ga. base steel thickness galvanized steel for resilient attachment of gypsum board.
 - .1 Acceptable product: 'RC Plus' by Bailey Metal Products Limited, or approved alternate.
- .13 Steel Drill Screws: to ASTM C 1002.
- .14 Stud Adhesive: to ASTM C 557.
- .15 Casing Beads, Corner Beads, J Beads, Control Joints and Edge Trim: to ASTM C 1047, fill type only (non-fill type will not be accepted), 0.5 mm / 25 ga. base thickness, perforated flanges, one piece length per location.
- .16 Special Beads, Trims and Profiles: to provide reveals as indicated, fill type only (non-fill type will not be accepted), 0.5 mm / 25 ga. base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A653/A653M, perforated flanges; one piece length per location.
- .17 Sealants: in accordance with Section 07 92 00 Joint Sealants.
- .18 Polyethylene Dust Barrier: to CAN/CGSB-51.34, Type 2, 0.10 mm / 10 mil thick.
- .19 Insulating Strip: rubberized, moisture resistant, 3 mm / 1/8" thick [closed cell neoprene] strip, 12 mm / 1/2" wide, with self-sticking permanent adhesive on one face, lengths as required.
- Joint Reinforcement for Water Resistant Board and Tile Backer Board: glass-fibre mesh tape, alkaliresistant self-adhering glass-fibre tape, 50 mm / 2" wide, 390 by 390 or 390 by 780 threads / m / 10 by 10 or 10 by 20 threads/inch.
- .21 Joint Compound: to ASTM C 475, asbestos-free. acceptable products:
 - .1 Interior use, all locations unless otherwise noted: 'All Purpose Joint Compound', by CGC, or 'ProRoc All Purpose Joint Compound' by CertainTeed, or 'Rapid Coat' by Continental Building Products, or approved alternate.
 - .2 Interior use, all locations to receive Water / Mold Resistant Board: 'Mold Resistant Lite All-Purpose Joint Compound' by CertainTeed, or approved alternate.
 - .3 Interior use, all locations to receive abuse board or cement board: 'Durabond 90', by CGC, or 'ProRoc Moisture and Mold Resistant 90' by CertainTeed, or 'Rapid Coat 90' by Continental Building Products, or approved alternate.
 - .4 Exterior use: 'Durabond 90', by CGC, or 'ProRoc Moisture and Mold Resistant 90' by CertainTeed, or 'Rapid Coat 90' by Lafarge Canada Inc., or approved alternate.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies' installation in accordance with manufacturer's written instructions.
 - .1 Examine work of other trades that gypsum board assemblies will be applied, for conformity to drawings.

3.2 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.
- .2 Do application of gypsum sheathing to ASTM C 1280.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840 except where specified otherwise.
- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm / 6" of each corner and at maximum 610 mm / 2'-0" around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .7 Install 22 mm x 64 mm / 7/8" x 2 1/2" drywall furring channels parallel to, and at exact locations of steel stud partition header track.
- .8 Install drywall resilient channels parallel to, and at exact locations of steel stud partition header track.
- .9 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .10 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .11 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.
- .12 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .13 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .14 Erect drywall resilient furring transversely across studs, or joists, spaced maximum 610 mm /2'-0" on centre and not more than 150 mm /6" from ceiling/wall juncture. Secure to each support with 11 mm / 7/16" pan framing screws.
- .15 Install 150 mm / 6" continuous strip of 12.7 mm / 1/2" gypsum board along base of partitions where resilient furring installed.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work has been approved.
- .2 At metal deck locations where gypsum board assemblies are identified to be installed to underside of structure, scribe top of gypsum board to fit tightly into metal deck profile.
- .3 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 300 mm / 12" on centre.
 - .1 Single-layer application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-layer application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm / 10".
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm / 10" with base layer joints.
- .4 Exterior Soffits and Ceilings: install Gypsum Sheathing perpendicular to supports; stagger end joints over supports. Install with 6 mm / 1/4" gap where boards abut other work.
- .5 Standard Board: to all locations unless otherwise noted.
- Apply Tile Backer Board to all walls identified to receive ceramic tile. Apply water resistant sealant to edges, ends, cut outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .7 Apply Abuse Board to all walls where indicated from floor level to top of all door frames with Standard Board above, using screw fasteners at maximum spacing of 305 mm / 12" o/c.
- .8 Apply water/mold resistant gypsum board in washrooms, kitchens, janitors closets, at all window head and jamb returns and where indicated. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.
- .9 Apply 12 mm / 1/2" diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .10 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm / 10".
- .11 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .12 Install gypsum board with face side out.
- .13 Do not install damaged or damp boards.

- .14 Locate edge or end joints over continuous supports. Stagger vertical joints over different studs on opposite sides of wall.
- Install Gypsum Sheathing to receive air/vapour sound and free of sharp protrusions, gaps, and voids exceeding 19 mm / 3/4" in width. Use repair materials and methods acceptable to air/vapour barrier membrane manufacturer. For voids that exceed 13 mm / 1/2" in width refer also Section 07270 Air/Vapour Barrier for air/vapour barrier void coverings.
 - .1 Provide metal framing backing as required to accept air/vapour barrier void coverings.
- .16 Install shaft wall systems where indicated in accordance with fire rated assembly design as required to achieve required rating.

3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm / 6" on centre using contact adhesive for full length.
- .2 Install fill type casing beads around perimeter of suspended ceilings.
- .3 Install fill type casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.
- .6 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .7 Provide continuous polyethylene dust barrier behind and across control joints.
- .8 Locate control joints, at changes in substrate construction, and at approximate 10 m spacing on long corridor runs to Consultant approval.
- .9 Install control joints straight and true.
- .10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.
- .11 Install expansion joint straight and true.
- .12 Install cornice cap where gypsum board partitions do not extend to ceiling.
- .13 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 300 mm on centre.
- .14 Splice corners and intersections together and secure to each member with 3 screws.

- .15 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .16 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .17 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 0: no tapping, finishing or accessories required.
 - .1 Provide Level 0 finish for temporary construction locations.
 - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
 - .1 Provide Level 1 finish for plenum areas above ceilings, in attics or in areas where the assembly will be concealed.
 - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .1 Provide Level 2 finish for water resistant gypsum backing board is used as a substrate for tile, and at fire separations in concealed spaces such as above finished ceilings.
 - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .1 Provide Level 3 finish for garages, warehouse storage or other similar areas.
 - .5 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .1 Provide Level 4 finish for light textures or wall coverings are to be applied.
 - .6 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
 - .1 Provide Level 5 finish for all locations unless otherwise indicated.
- .18 Apply skim coat of joint compound as follows:
 - .1 Mix joint compound for skim coating slightly thinner than for joint taping.
 - .2 Apply thin skim coat to provide a light, thin coating of joint compound to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks to following locations:
 - .1 Walls scheduled to receive gloss, semi-gloss or eggshell paints.
 - .2 On long walls with side lighting where differences in texture between finished sanded compound and gypsum board surface would be noticeable.
 - .3 All abuse board scheduled to be painted.
 - .3 Allow skim coat to dry completely.
 - .4 Remove ridges by light sanding or wiping with damp cloth.
- .19 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .20 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

- .21 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .22 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

3.7 SCHEDULES

.1 Construct fire rated assemblies to ULC design numbers where indicated. In case of conflict between the provisions of the tested assembly and the assembly noted in the contract documents, the more stringent provisions shall apply.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM C 645-14, Specification for Non-structural Steel Framing Members.
 - .2 ASTM C 754-15, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .3 The Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual current edition.
 - .1 MPI #26, Primer, Galvanized Metal, Cementitious.

1.2 REGULATORY REQUIREMENTS

- .1 Where fire resistant ratings are specified for Work of this section, carry out Work in strict accordance with fire test report data as per manufacturers written recommendations for ULC tested procedures. Work shall include, but is not limited to, fire separations, infill panels for Work of other sections with a fire resistance rating, backing for equipment located in a fire separation, shaft walls and shaft wall construction where indicated.
- .2 Prior to proceeding with Work, submit to the Consultant, product data and application requirements for ULC tested systems for all shaft wall construction for vertical and horizontal applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [metal framing] and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .1 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details.
 - .2 Indicate locations, dimensions, openings and requirements of related Work.
 - .2 Design suspension system to accommodate seismic restraint in accordance with Section 01 33 10 Seismic Design of Operational Functional Components.
 - .3 Submit reflected ceiling plans for suspended framing as indicated.
 - .4 Submit reflected ceiling plans for special grid patterns as indicated.
 - 1 Indicate lay out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions, and locations and acoustical unit support at ceiling fixture, lateral bracing and accessories.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal framing from damage.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Non-Load Bearing Channel Stud Framing: to ASTM C 645, stud size as indicated, roll formed, hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm /18" centres. Provide roll formed minimum gauge thickness for wall types as follows:
 - .1 25 gauge for all board types in non-loadbearing walls unless otherwise indicated.
 - .2 20 gauge for all non-loadbearing walls identified with a fire resistance rating.
 - .3 20 gauge for all non-loadbearing walls identified to receive Abuse Board or Cement Board.
- .2 Floor and Ceiling Tracks: to ASTM C 645, in widths to suit stud sizes, 32 / 1 1/4" mm flange height.
- .3 Deflection Ceiling Track: purpose made with 64 mm leg x width to suit stud depth, pre-punched 38 mm / 1 1/2" long slots spaced at 25 mm / 1" o/c.
 - .1 Acceptable product: 'Multi-slot MST 250' by Bailey Metal Products Limited, or approved alternate.
- .4 Metal Channel Stiffener: Size to suit, 1.4 mm / 1/16" thick cold rolled steel, coated with rust inhibitive coating.
- .5 Acoustical Sealant: In accordance with Section 07 92 00 Joint Sealing.
- .6 Insulating Strip: rubberized, moisture resistant 3 mm / 16 ga." thick closed cell neoprene strip, 12 mm / 1/2" wide, with self-sticking adhesive on one face, lengths as required.

PART 3 - EXECUTION

3.1 ERECTION

- .1 Refer to Section 05 41 00 Structural Metal Stud Framing, for all exterior wall framing.
- .2 Align partition tracks at floor and ceiling and secure at 610 mm / 24" on centre maximum.
- .3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .4 Place studs vertically at 400 mm / 16" on centre or as indicated and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .5 Erect metal studding to tolerance of 1:1000.
- .6 Attach studs to bottom and ceiling track using screws.
 - .1 Where walls are to accommodate deflection, erect studs using purpose made deflection ceiling tracks.
- .7 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .8 Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .9 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.
 - .1 Secure studs together, 50 mm / 2" apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .10 Install heavy gauge single jamb studs at openings.
- .11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .12 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .13 Provide 40 mm / 1 5/8" stud or furring channel secured between studs as required to accommodate wood blocking for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions. Coordinate with Section 06 08 99 Rough Carpentry.
- .14 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .15 Extend partitions to ceiling height except where noted otherwise on drawings.
- .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs
 - .1 Use 64 mm / 2 1/2" leg purpose made deflection ceiling tracks as specified.

- .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .18 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

PART 1- GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI):
 - .1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
 - .2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
 - .3 CTI A118.4-92, Specification for Latex Cement Mortar (included in ANSI A108.1).
 - .4 CTI A118.6-92, Specification for Ceramic Tile Grouts (included in ANSI A108.1).
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C 144-11, Specification for Aggregate for Masonry Mortar.
 - .2 ASTM C 207-06(2011), Specification for Hydrated Lime for Masonry Purposes.
 - .3 ASTM C 847-14a, Specification for Metal Lath.
 - .4 ASTM C979/C979M-10, Specification for Pigments for Integrally Coloured Concrete.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CGSB 71-GP-22M-78, Adhesive, Organic, for Installation of Ceramic Wall Tile.
 - .3 CAN/CGSB-75.1-M88, Tile, Ceramic.
 - .4 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .4 Canadian Standards Association (CSA International):
 - .1 CSA A123.3-05(R2015), Asphalt Saturated Organic Roofing Felt.
 - .2 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .5 Terrazzo Tile and Marble Association of Canada (TTMAC):
 - .1 Tile Specification Guide 09 30 00 (2016/2017, Tile Installation Manual.
 - .2 Tile Maintenance Guide 2000.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Provide product data in accordance with Section 01 33 00 Submittal Procedures.
 - .1 Include manufacturer's information on:
 - .1 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Chemical resistant grout (Epoxy).
 - .3 Cementitious backer unit.
 - .4 Dry-set cement mortar and grout.
 - .5 Divider strip.
 - .6 Elastomeric membrane and bond coat.
 - .7 Reinforcing tape.
 - .8 Levelling compound.
 - .9 Latex cement mortar and grout.

- .10 Organic adhesive.
- .11 Slip resistant tile.
- .12 Waterproofing isolation membrane.
- .13 Fasteners.
- .3 Provide samples in accordance with Section 01 33 00 Submittal Procedures.
 - .1 Base tile: submit duplicate, 305 x 305 mm / 12 x 24" sample panels of each colour, texture, size, and pattern of tile.
 - .2 Floor tile: submit duplicate, 300 x 300 mm / 12" x 24" sample panels of each colour, texture, size, and pattern of tile.
 - .3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
 - .4 Adhere tile samples to 11 mm / 7/16" thick plywood and grout joints to represent project installation.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.
 - .2 Manufacturer's Field Reports: provide manufacturer's field reports as specified in PART 3 FIELD QUALITY REQUIREMENTS.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling, and Unloading:
 - .1 Deliver, store, and handle materials in accordance with Section 01 61 00 Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

1.5 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12°C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not install tiles at temperatures less than 12°C or above 38°C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15°C or above 25°C.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 Closeout Submittals.
 - .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.

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.3 Maintenance material same production run as installed material.

PART 2 - PRODUCTS

2.1 FLOOR TILE

- .1 Ceramic Floor Tile (CAN2-74.1 or ANSI A118.4) for all locations unless otherwise noted: 305 mm x 610 mm / 12" x 24", colour as later selected by Consultant from manufacturer's full colour range, not more than 4 colours.
 - .1 Acceptable product: 'Pietra di Basal Series', by Ciot Canada, or approved alternate.

2.2 WALL AND CEILING TILE

- .1 Ceramic Wall Tile Type 2 (CWT2): as indicated on drawings, to CAN/CGSB 74.1, 76 x 150 mm / 3" x 6" size, straight edges, linear pattern, not more than four (4) colours as later selected by Consultant from full range of colours.
 - .1 Acceptable product: 'Colour Dimension Series', by Olympia Tile or approved alternate.
- .2 Ceramic Wall Tile Type 3 (CWT3): as indicated on drawings, to CAN/CGSB 74.1, 50 x 50 mm / 2" x 2" size, straight edges, linear pattern, not more than four (4) colours as later selected by Consultant from full range of colours.
 - .1 Acceptable product: 'Quebec Series', by Olympia Tile or approved alternate.
- .3 Ceramic Wall Tile Type 4 (CWT4): as indicated on drawings, to CAN/CGSB 74.1, 25 x 25 mm / 1" x 1" (size, straight edges, linear pattern, not more than four (4) colours as later selected by Consultant from full range of colours.
 - .1 Acceptable product: 'Quebec Series', by Olympia Tile or approved alternate.

2.3 BASE TILE

- .1 Ceramic Base Tile (CB1): 305 mm x 610 mm / 12" x 24", cut tile, with factory finish exposed to view, (no cove, no radius top) colour as later selected by Consultant from manufacturer's full colour range, not more than 2 colours.
 - .1 Acceptable product: 'Pietra di Basal Series', by Ciot Canada, or approved alternate 'or approved alternate.

2.4 TRIM SHAPES

- .1 Corner Joint: PVC profile for inside corners and at floor and wall transitions, coved-shaped capable of absorbing movement, c/w corner, end cap adaptors, and all accessories for complete system.
 - .1 Acceptable product: 'DILEX-HK', 'DILEX-EKE', by Schluter at floor transitions and 'DILEX-HKW', by Schluter for inside corners, c/w corner and end cap adaptors or approved alternate.
- .2 Corner Joint: clear satin anodized aluminum, profile for inside corners and at floor and wall transitions, coved-shaped capable of absorbing movement, c/w corner, end cap adaptors, and all accessories for complete system.
 - .1 Acceptable product: for floor/wall transitions and for inside wall corners, c/w corner and end cap adaptors, 'DILEX-AHK', by Schluter, or approved alternate.

- .3 Transition Trim: purpose made metal extrusion; satin aluminum beads and trims at all outside corners, floor, wall and floor base transitions, and edge protection
 - .1 At location where ceramic floor tile meets adjacent floor finishes.
 - .1 Acceptable product: 'Satin anodized aluminum Schlüter Schiene', by Schlüter or approved alternate.
 - .2 At all outside corner locations and above all ceramic floor tile bases.
 - .1 Acceptable product: 'Anodized aluminum Schlüter Jolly', by Schlüter or approved alternate.

2.5 TILE UNDERLAYMENT

- .1 Tile Underlayment: Ready-to-use, flexible, mold and mildew resistant waterproofing crack isolation membrane to form a smooth, monolithic, watertight surface over walls, floors and ceilings, minimum thickness 50 mils wet film thickness including waterproofing mesh at all substrate joints, field seams, inside corners, outside corners, anywhere vertical surfaces meet horizontal surfaces such as curbs, bench seats, columns, etc., or anywhere dissimilar materials meet, drains and expansion/control joints.
 - .1 Acceptable product: TEC HydraFlex Waterproofing Crack Isolation Membrane and TEC brand Waterproofing Mesh by TEC, or approved alternate.

2.6 MORTAR AND ADHESIVE MATERIALS

- .1 Cement: to CAN/CSA-A3000.
- .2 Sand:
 - .1 To ASTM C 144.
 - .2 Crushed or pit run consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .3 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB 8.1.
 - .4 Table:

Sieve Designation	% Passing	
4.75 mm / # 4	100	
2.36 mm / # 8	95 - 100	
1.18 mm /# 16	60 - 100	
0.600 mm / # 30	35 - 80	
0.300 mm / # 50	15 - 50	
0.150 mm / # 100	2 - 15	
0.075 mm / # 200	0 - 5	

- .3 Hydrated lime: to ASTM C207.
- .4 Latex additive: formulated for use in cement mortar.
- .5 Water: potable and free of minerals which are detrimental to mortar and grout mixes.
- .6 Dry set mortar:
 - .1 To ANSI A108.1
 - .2 Water retentive cement mortar.
- .7 Elastomeric adhesive: to CGSB 71 GP 29M.

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- .8 Epoxy adhesive: to CGSB 71 GP 30M, Type 1.
- .9 Modified mortar adhesive: to CGSB 71 GP 30M, Type 2.
- .10 Colour pigment: non fading mineral oxides, unaffected by lime or cement and which will not stain tile.

2.7 BOND COAT

- .1 Floor and wall tile for tile size less than 330 x 330 mm / 13" x 13": latex cement mortar to ANSI A118.1, two-component universal dry-set mortar, sag resistant, having the following physical characteristics:
 - .1 28 Day Shear Strength for glazed wall tile: 3.11 to 4.83 MPa / 450 to 700 psi.
 - .2 28 Day Shear Strength for impervious ceramic tile (porcelain) mosaics: 2.76 to 3.45 MPa / 400 to 500 psi.
 - .3 28 Day Shear Strength for quarry tile: 3.45 to 5.52 MPa / 5000 to 800 psi.
 - .4 28 Day Shear Strength for quarry tile / plywood: 1.73 to 2.42 MPa / 250 to 350 psi.
 - .5 Initial Cure: 24-48 hours.
 - .6 Final Cure: 28 days.
 - .7 VOCs: 0 g/L.
 - .8 Acceptable product: 'Flexible 51 mortar mixed with Flexible 44 additive', by Flextile Ltd., or equivalent by Mapei, or Latacrete, or approved alternate.
- .2 Floor and wall tile for tile size more than 330 x 330 mm / 13" x 13": to ANSI A118.4 and A118.11, polymer-modified, sag-resistant mortar having the following physical characteristics:
 - .1 28 Day Shear Strength for glazed wall tile: 3.11 to 4.14 MPa / 450 to 600 psi.
 - .2 28 Day Shear Strength for impervious ceramic tile (porcelain) mosaics: 2.59 to 3.45 MPa / 375 to 500 psi.
 - .3 28 Day Shear Strength for quarry tile: 2.42 to 3.45 MPa / 350 to 500 psi.
 - .4 28 Day Shear Strength for quarry tile / plywood: 1.21 to 1.79 MPa / 175 to 250 psi.
 - .5 Initial Cure: 24-48 hours.
 - .6 Final Cure: 28 days.
 - .7 VOCs: 0 g/L.
 - .8 Acceptable product: '56SR', by Flextile Ltd., or equivalent by Mapei, or equivalent by Latacrete, or approved alternate.
- .3 Epoxy Bond Coat: to ANSI A118.3, non-toxic, non-flammable, non-hazardous during storage, mixing, application, and when cured. To produce shock and chemical resistant mortars having the following physical characteristics:
 - .1 Initial Cure: 24 hours.
 - .2 Final Cure: 7 days.
 - .3 Compressive strength: 60.0 MPa (8700 psi).
 - .4 Tensile strength: 8.4 MPa (1220 psi).
 - .5 Thermal strength: 3.9 MPa (565 psi).
 - .6 Shore D Hardness (24 hr.): 85.
 - .7 Linear Shrinkage: 0 %.
 - .8 Specific Gravity (paste) 1.40.
 - .9 Finished mortar and grout to be resistant to urine, dilute acid, dilute alkali, sugar, brine and food waste products, petroleum distillates, oil and aromatic solvents.

.10 Acceptable product: '100 Flex-Epoxy 100% solids epoxy mortar', by Flextile Ltd., or equivalent by Mapei, or Latacrete, or approved alternate.

2.8 FLOOR GROUT

- .1 Floor Grout: stain resistant, fast setting, crack and shrink resistant, mold and mildew resistant, to ANSI A118.3 and A118.7, not more than two (2) colours as later selected by Consultant, having the following characteristics:
 - .1 28 Day Compressive Strength: 41.0-47.9 MPa / 6000-7000 psi.
 - .2 28 Day Tensile Strength: 4.1-4.8 MPa / 600-700 psi.
 - .3 28 Day Flexural Strength: 8.2-8.9 MPa / 1200-1300 psi.
 - .4 27 Day Linear Shrinkage: 0.07-0.08% shrinkage.
 - .5 Water Absorption: 2-3% absorption.
 - .6 Initial Cure: 3 to 4 hours.
 - .7 Final Cure: 21 days.
 - .8 Acceptable product: 'TEC Power Grout' by H.B. Fuller Construction Products Inc., as distributed by Centura, or approved alternate.

2.9 ACCESSORIES

- .1 Reinforcing Mesh: 50 x 50 x 1.6 x 1.6 mm / 2" x 2" x 1/16" x 1/16" galvanized steel wire mesh, welded fabric design, in flat sheets.
- .2 Sealant: in accordance with Section 07 92 00 Joint Sealants.
- .3 Floor Sealer and Protective Coating: for intended use, to CAN/CGSB-25.20, Type 1 to tile and grout manufacturer's recommendations.
- .4 Thresholds: Carrava marble, 15.8 mm thick, bevelled two sides, honed finish to exposed surfaces, size to suit door opening and frame width.

2.10 MIXES

- .1 Cement:
 - .1 Scratch coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, and latex additive where required. Adjust water volume depending on water content of sand.
 - .2 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.
 - .3 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
 - .4 Mortar bed for walls and ceilings: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
 - .5 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
 - .6 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.
 - .7 Measure mortar ingredients by volume.

- .2 Dry Set Mortar: mix to manufacturer's instructions.
- .3 Organic Adhesive: pre-mixed.
- .4 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .5 Adjust water volumes to suit water content of sand.

2.11 PATCHING AND LEVELLING COMPOUND

- .1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
 - .1 Compressive strength 25 MPa.
 - .2 Tensile strength 7 MPa.
 - .3 Flexural strength 7 MPa.
 - .4 Density 1.9.
- .3 Capable of being applied in layers up to 50 mm thick / 2", being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in forty-eight (48) hours after application.

2.12 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2016/2017, "Ceramic Tile", except where specified otherwise.
- .2 Tile Underlayment: Install tile underlayment where indicated in accordance with manufacturer's written instructions.
 - .1 Prepare substrate as per manufacturer's recommendations.
 - .2 Install all products as per manufacturer's standard installation instructions.

- .3 Apply membrane in two coats. Apply first coat to minimum thickness of 25 mils wet. Apply second coat 25 mils wet film thickness to achieve total combined thickness of 50 mils wet, curing to dry film thickness of 30 mils.
- .3 Apply tile or backing coats to clean and sound surfaces.
- .4 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .5 Maximum surface tolerance 1:800.
- .6 Make joints between tile uniform and approximately 1.5 mm / 1/16" wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .7 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .8 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .9 Make internal angles square, external angles rounded.
- .10 Install divider strips at junction of tile flooring and dissimilar materials.
- .11 Allow minimum twenty-four (24) hours after installation of tiles, before grouting.
- .12 Clean installed tile surfaces after installation and grouting cured.
- .13 Control Joints:
 - .1 Make control joints at 8 m / 25' in each direction where indicated and at abutting dissimilar materials. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00 Joint Sealants. Keep building expansion joints free of mortar and grout.
 - .2 Install control joints as recommended by material manufacturer. Set control joints slightly lower than finish tile surface.

3.3 FLOOR AND WALL TILE

.1 Do tile work in accordance with Installation Manual 2000, "Ceramic Tile", produced by Terrazzo Tile and Marble Association of Canada (TTMAC), except where specified otherwise.

3.4 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.

- .2 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and application of acoustical units for direct application or for application and installation within a suspended ceiling.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM C 423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - .2 ASTM E 1264-14, Standard Classification for Acoustical Ceiling Products.
 - .3 ASTM E 1477-98a(2013), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction and Amendment No. 1, 1988.
 - .2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
- .3 Canadian Standards Association (CSA International):
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .6 Underwriter's Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.
- .3 Submit duplicate full size samples of each type acoustical units.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by Canadian Certification

Organization accredited by Standards Council of Canada.

.2 Mock-up:

- .1 Construct mock-ups in accordance with Section 01 45 00 Quality Control.
- .2 Construct mock-up 10 m² / 100 sq. ft. minimum of each type acoustical panel ceiling including one inside corner and one outside corner.
- .3 Construct mock-up where directed.
- .4 Allow 48 hours for inspection of mock-up by Consultant before proceeding with ceiling work.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work to Consultant approval.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection:
 - .1 Protect acoustic panels from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
 - .2 Store acoustic panels indoors, in dry, well ventilated room, off floor, in accordance with manufacturer's recommendations.
 - .3 Protect acoustic panels from scratches, handling marks and other damage.
 - .4 Store acoustic panels away from direct sunlight.

.2 Waste Management and Disposal:

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
- .4 Separate for reuse and recycling and place in designated waste containers in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers in accordance with Section 01 35 43 Environmental Procedures.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .7 Ensure emptied containers are sealed and stored safely in accordance with Section 01 35 43 Environmental Procedures.
- .8 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Permit wet work to dry before beginning to install.
- .2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20-40% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

1.7 EXTRA MATERIALS

- .1 Provide extra materials of acoustic units in accordance with Section 01 78 00 Closeout Submittals.
- .2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.
- .3 Ensure extra materials are from same production run as installed materials.
- .4 Clearly identify each type of acoustic unit, including colour and texture.
- .5 Deliver to Owner, upon completion of the work of this section.
 - .1 Store where directed by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Acoustic units for suspended ceiling system, Type 1: to CAN/CGSB-92.1, non-fire rated, wet-formed mineral fibre acoustic ceiling panels with factory applied vinyl latex paint:
 - .1 Type: square lay-in.
 - .2 Class A.
 - .3 Pattern: non-directional, Class A.
 - .4 Textures: medium.
 - .5 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
 - .6 Smoke developed 50 or less in accordance with CAN/ULC-S102.
 - .7 Noise Reduction Coefficient (NRC) designation of 0.55. Sound Absorption Average (SAA) of 0.9 to ASTM C 423.
 - .8 Ceiling Attenuation Class (CAC) rating 35, in accordance with ASTM E 1264.
 - .9 Light Reflectance (LR) range of 0.85.
 - .10 Edge type: square.
 - .11 Colour: white.
 - .12 Size: 15.8 mm / 5/8" thick, size as indicated.
 - .13 Shape: flat.
 - .14 Acceptable Material: 'Fine Fissured, Square Lay-in/Medium Textured #1729' by Armstrong, or equivalent by CGC Interiors.
 - .15 Location: throughout, unless otherwise noted.
- .2 Acoustic Units for Suspended Ceiling System, Type 2: to CAN/CGSB-92.1, non-fire rated, wetformed mineral fibre acoustic ceiling panels with soil-resistant polyester film (vinyl-faced membrane):
 - .1 Type: square lay-in.
 - .2 Class A.
 - .3 Pattern: random, Class A.
 - .4 Textures: smooth, fine.
 - .5 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
 - .6 Smoke developed 50 or less in accordance with CAN/ULC-S102.
 - .7 Noise Reduction Coefficient (NRC) designation of 0.95. Sound Absorption Average (SAA) of 0.9 to ASTM C 423.
 - .8 Light Reflectance (LR) range of 0.86.

- .9 Edge Type: square.
- .10 Colour: white.
- .11 Size: 15.8 mm / 5/8" thick, size as indicated.
- .12 Shape: flat.
- .13 Acceptable Material: 'Clean Room VL, non-perforated Fissured', by Armstrong, 'Capaul Vinylshield A', by BPB America, or equivalent by CGC Interiors.
- .14 Location: washrooms as noted on drawings.
- .3 Adhesive: low VOC type recommended by acoustic unit manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.

3.2 INSTALLATION

- .1 Install acoustical panels and tiles in ceiling suspension system.
- .2 Refer to Section 07 21 16 Blanket Insulation for acoustical batt insulation.

3.3 APPLICATION

- .1 Install acoustic units to clean, dry and firm substrate.
- .2 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width with directional pattern running in same direction. Refer to reflected ceiling plan.
- .3 Scribe acoustic units to fit adjacent work. Butt joints tight.

3.4 INTERFACE WITH OTHER WORK

- .1 Coordinate with Section 09 53 00.01 Acoustical Suspension.
- .2 Coordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.

- .2 Waste Management: separate waste materials for [reuse] [and] [recycling] in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 SCHEDULE

.1 Refer to Room Finish Schedule and Reflected Ceiling Plans.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM C635/C635M-13a, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - .2 ASTM C636/C636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for acoustical suspension and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada. Include in the design, anchorage details for each wall/ceiling/bulkhead connections, as per seismic requirements. Submit reflected ceiling plans for special grid patterns as indicated.
- .2 Design suspension system to accommodate seismic restraint in accordance with Section 01 33 10 - Seismic Design of Operational Functional Components.
- .3 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions, and locations and acoustical unit support at ceiling fixture, lateral bracing and accessories.

.4 Samples:

- .1 Submit for review and acceptance of each unit.
- .2 Submit one representative model of [each type] ceiling suspension system.
- .3 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for acoustical suspension for incorporation into manual.

1.4 QUALITY ASSURANCE

- .1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 Common Product Requirements] [and] [with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect acoustical ceiling tiles and tracks from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials, as specified in Construction Waste Management Plan, Waste Reduction Work Plan in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

.1 Design Requirements: maximum deflection: 1/360th of span to ASTM C 635/ASTM C635M deflection test.

2.2 MATERIALS

- .1 Heavy duty system to ASTM C 635/ASTM C635M.
- .2 Basic Materials for Suspension System: commercial quality cold rolled steel], zinc coated.
- .3 Suspension System: non fire rated, made up as follows:
 - .1 2 directional exposed tee bar grid.
 - .2 2 directional concealed tee spline.
 - .3 Concealed tee access spline.
 - .4 Concealed tongue and groove runner.
 - .5 Concealed H runner, tee spline, and flat steel spline.
 - .6 Concealed zee runner and flat steel spline.
 - .7 Metal pan special tee system.

- .4 Fire-resistance rated suspension system: certified for use in one hour, floor/ceiling and roof/ceiling assembly.
- .5 Exposed tee bar grid components: shop painted satin sheen, white. Components die cut. Main tee with double web, rectangular bulb and 25 mm / 1" rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
- .6 Hanger Wire: galvanized soft annealed steel wire:
 - .1 3.6 mm / 3/16" diameter for access tile ceilings.
 - .2 To ULC design requirements for fire rated assemblies.
- .7 Hanger Inserts: purpose made.
- .8 Accessories: splices, clips, wire ties, retainers and wall moulding [lush, to complement suspension system components, as recommended by system manufacturer.
- .9 Acceptable Material: 'Prelude XL' 24 mm / 15/16" exposed tee system by Armstrong, surface Finish: baked polyester, 'Traditional Seismic 1200' System by Chicago Metallic, surface finish: baked enamel, or equivalent by CGC.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for acoustical ceiling tile and track installation in accordance with manufacturer's written instructions.
 - .1 Examine work of other trades that acoustical suspension systems will be applied, for conformity to drawings.
 - .2 Visually inspect substrate in presence of Consultant.
 - .3 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Installation: to ASTM C 636/C 636M except where specified otherwise.
- .3 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements]
- .4 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.
- .5 Secure hangers to overhead structure using attachment methods acceptable to Consultant.
- .6 Install hangers spaced at maximum 1220 mm / 4'-0" centres and within [50]mm / 6" from ends of

main tees.

- .7 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width and according to reflected ceiling plan. Report all discrepancies immediately upon discovery to Consultant prior to commencing with work for acoustical suspension systems.
- .8 Ensure suspension system is coordinated with location of related components.
- .9 Install wall moulding to provide correct ceiling height.
- .10 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles and speakers.
- .11 Support at light fixtures, diffusers with additional ceiling suspension hangers within 150 mm / 6" of each corner and at maximum 610 mm / 2'-0" around perimeter of fixture.
- .12 Interlock cross member to main runner to provide rigid assembly.
- .13 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .14 Install access splines to provide 10, 25, 50% ceiling access.
- .15 Finished ceiling system to be square with adjoining walls and level within 1:1000.
- .16 Install system to seismic requirements in accordance with manufacturer's written instructions.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Touch up scratches, abrasions, voids and other defects in painted surfaces.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by acoustical suspension installation.

PART 1- GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM F 1303-04(2014), Standard Specification for Sheet Vinyl Floor Covering with Backing.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Test Reports:
 - .1 Submit two (2) copies of ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - .2 Submit two (2) copies of ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for resilient sheet flooring and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm 12" x 12" sample pieces of sheet material, 300 mm long feature strips, edge strips.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 Closeout Submittals.
 - .2 Provide 10 m² / 100 sq.ft. of each colour, pattern and type flooring material required for project for maintenance use.
 - .3 Extra materials one piece and from same production run as installed materials.
 - .4 Identify each roll of sheet flooring and each container of adhesive.
 - .5 Deliver to Owner, upon completion of the work of this section.
 - .6 Store where directed by Owner.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

- .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect specified materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Resilient Sheet Flooring: to ASTM F 1913-98, CAN/ULC S102-2M88, sheet flooring complete with all necessary accessories for complete installation, 2.0 mm / 5/64", antibacterial and fungicidal, non-directional, homogeneous, colour as later selected by Consultant from manufacturer's standard colour range; not more than four (4) colours:
 - .1 Acceptable Product: 'MCS Sheet' by Forbo, or approved alternate.
- .2 Gymnasium (sport flooring system): to ASTM F 1913-98, CAN/ULC S102-2M88, sheet flooring complete with all necessary accessories for complete installation, 2.0 mm / 5/64",antibacterial and fungicidal, non-directional, homogeneous, colour as later selected by Consultant from manufacturer's standard colour range; not more than six (6) colours:
 - .1 Acceptable Product: 'MCS Sheet' by Forbo, or approved alternate.
 - .2 Refer to Gymnasium Court Line Drawing A85 for details.
- .3 Rubber Flooring (RUB):
 - .1 Stair Landings:
 - .1 Rubber, square pattern, 4.76 mm / 0.187" uniform thickness, colour as later selected by Consultant from manufacturer's complete colour range, not more than one (1) colour.
 - .2 Acceptable manufacturer: Johnsonite, or equivalent by Mondo, Endura, Amtico, or approved alternate.
 - .2 Stair Covering:
 - .1 Combination one-piece studded rubber stair tread, nosing and riser, square pattern, square nosing, tapered tread from 5.33 mm / 0.210" to 3.89 mm / 0.153", colour as later selected by Consultant from manufacturer's complete colour range, not more than one (1) colour.
 - .2 Acceptable manufacturer: Johnsonite, or equivalent by Mondo, Endura, Amtico, or approved alternate.
- .4 Safety Flooring (SF): vinyl safety floor at ramps, 2.5 mm / 3/32" thick, complete with all necessary accessories for complete installation, not more than two (2) colours.
 - .1 Acceptable product: 'Altro Designer 25', as distributed by Compass Flooring Ltd.; 'Polysafe Vogue Ultra' by Polyflor, or approved alternate.
- .5 Tactile Warning Strips: 900 mm 920 mm (35.43"-36.22") deep x full width of stair, one tread depth from edge of the stair. Refer to manufacturer's written product Specification and Installation. Solid contrasting colour. Part of single manufacturer's stairwell system.
 - .1 Location: As noted on drawings.

- .6 Resilient Base (VB): Refer to 09 65 19 - Resilient Tile Flooring.
- .7 Adaptors, Filler strips, Edge Guards, Transition Strips, Reducers and Cove Caps: thickness and width to suit floor thickness and condition.
 - .1 Acceptable manufacture: Johnsonite, or approved alternate.
- 8. Primers and adhesives: waterproof, of types recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
- Sub floor filler and leveller: polymer modified quick setting cement based or other type as .9 recommended by flooring manufacturer for use with their product.
 - .1 Acceptable product: '5900 Flex-Flo Plus', by Flextile, or approved alternate.
- Cleaner, Sealer and Finisher: as recommended by flooring manufacturer's printed instructions. .10
- .11 VCT Cleaner, Sealer and Wax: Owner Supplied/Owner Installed. Coordinate with Owner. Refer to Section 01 11 00 Summary of Work.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 **EXAMINATION**

- Verification of Conditions: verify that conditions of substrate previously installed under other Sections .1 or Contracts are acceptable for resilient sheet flooring installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
- .2 Conduct the following tests on concrete slab before product installation:
 - .1 ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - .2 ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .3 Inform Consultant of unacceptable conditions immediately upon discovery.
- .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.3 SITE VERIFICATION OF CONDITIONS

- Verification of Conditions; verify conditions of substrates previously installed under other Sections or .1 Contracts are acceptable for resilient sheet flooring work in accordance with manufacturer's written instructions.
 - Examine work of other trades that resilient sheet flooring systems will be applied, for conformity to drawings

- .2 Report all discrepancies and unacceptable conditions immediately upon discovery to Consultant prior to commencing with work for resilient sheet flooring systems.
- .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.4 SUB-FLOOR TREATMENT

- .1 Remove existing resilient flooring.
- .2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.
- .3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .4 Prime, seal concrete slab and plywood sub-floor. Prepare and finish to resilient flooring manufacturer's printed instructions.

3.5 SUB FLOOR FILLER AND LEVELER

- .1 Where resilient flooring abuts other flooring of different thickness, provide cementitious underlayment allowing for smooth and level transition between finished floor surfaces.
- .2 Mix, apply and finish underlayment in accordance with latex admixture manufacturer's recommendations.

3.6 GENERAL

- .1 Provide adaptors, filler strips, edge guards, transition strips, & reducers to manufacturers written instructions, at all locations where floor covering changes material, or terminates.
- .2 Install resilient flooring on all floor surfaces including under all millwork and equipment.

3.7 APPLICATION: FLOORING

- .1 Acclimatize subfloor, all flooring material and adhesive for forty eight (48) hours prior, during and after the installation by maintaining the room temperature between 18°C / and 24°C.
- .2 Provide high ventilation rate, with maximum outside air, during installation, and for forty-eight (48) to seventy-two (72) hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.
- .3 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .4 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

- .5 Run sheets in direction of traffic. Double cut sheet joints and continuously seal heat weld according to manufacturer's printed instructions.
- .6 Heat weld seams of linoleum sheet flooring in accordance with manufacturer's printed instructions.
- .7 As installation progresses, and after installation roll flooring with roller to ensure full adhesion using methods and roller weight to manufacturer's written recommendations.
- .8 Install feature strips and floor markings where indicated. Fit joints tightly.
- .9 Install flooring in pan type floor access covers. Maintain floor pattern.
- .10 Unless otherwise indicated, cut flooring around fixed objects. Caulk joint neatly with clear opaque sealant. Refer to Section 07 92 00 - Joint Sealants for sealant type.
 - .1 Continue flooring over areas which will be under built-in furniture.
 - .2 Continue flooring through areas to receive plumbing fixtures such as but not limited to water closets without interrupting floor pattern. Caulk joint neatly with clear opaque sealant. Refer to Section 07 92 00 Joint Sealants for sealant type.
 - .3 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
 - .4 Continue flooring through areas to receive millwork without interrupting floor pattern.
- .11 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .12 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.8 APPLICATION: STAIRS

.1 Adhere one (1) piece stair nosings, stair treads and risers for full width of stair over entire surface and fit accurately.

3.9 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
 - .1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.
 - .2 Clean, seal and wax floor and base surface to flooring manufacturer's instructions. In carpeted areas clean, seal and wax base surface prior to carpet installation.

- .3 Coordinate with Owner for the cleaning, sealing and polishing of resilient floors by Owner immediately after installation.
- .4 Provide verification to Owner's and Consultant satisfaction that floors have been installed in accordance with manufacturer's directions prior to requesting acceptance.
- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 PROTECTION

- .1 Protect new floors from time of final set of adhesive after initial waxing until final inspection.
- .2 Prohibit traffic on floor for forty-eight (48) hours after installation.
- .3 Use only water-based coating for linoleum.

3.12 SCHEDULES

.1 Refer to Room Finish Schedule for locations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM F 1066-(2014)e1, Standard Specification for Vinyl Composition Floor Tile.
 - .2 ASTM F 1344-15, Standard Specification for Rubber Floor Tile.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
 - .2 CAN/CGSB-25.21-95, Detergent-Resistant Floor Polish.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Test Reports:
 - .1 Submit two (2) copies of ASTM 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - .2 Submit two (2) copies of ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for resilient tile flooring and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Samples:
 - .1 Submit duplicate tile in size specified, 300 mm / 12" long base, nosing, feature strips, treads, edge strips.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials of resilient tile flooring, base and adhesive in accordance with Section 01 78 00 Closeout Submittals.
 - .2 Provide 10 m² / 100 ft² of each colour, pattern and type flooring material required for this project for maintenance use.
 - .3 Extra materials from same production run as installed materials.
 - .4 Identify each container of floor tile and each container of adhesive.
 - .5 Deliver to Owner, upon completion of the work of this section.
 - .6 Store where directed by Owner.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees C for 48 hours before, during and for 48 hours after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Vinyl composition tile (VCT1): to ASTM F1066, Composition 1 non asbestos through pattern tile, plain, 3.2 mm / 1/8", 305 x 305 mm / 12" x 12" size, colour as later selected by Consultant from manufacturer's standard colour range, not more than two (2) colours.
 - .1 Acceptable material: 'Standard Excelon' by Armstrong, or 'Azrock Cortina colours and Cortina Classics', by Tarkett, or approved alternate.
- .2 Resilient base (VB): 3 mm / 1/8" thick, 100 mm / 4" height, coloured vinyl base, coved base, unless noted otherwise. Provide flat base at millwork, colour as later selected by Consultant from full range of colours, not more than two (2) colours.
 - .1 Gymnasium Floor Base: Refer to Section 09 66 00 Athletic Sheet Flooring.
 - .2 Acceptable material: coloured vinyl base by Johnsonite, Flexco or approved alternate.
 - .1 content.
- .3 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.
- .4 Transition trim:
 - .1 Vinyl Composite Flooring (VCT) to Safety Flooring (SF): 'CTA-XX-N', Wheeled Traffic Transitions by Johnsonite or approved alternate.
 - .2 Vinyl Composite Tile (VCT) to Sealed Concrete (S.CONC): 'SSR-XX-B', reducer by Johnsonite or approved alternate.
 - .3 Vinyl Composite Flooring (VCT) to Resilient Athletic Flooring (SPORT): 'CTA-XX-N', Wheeled Traffic Transitions by Johnsonite or approved alternate.
 - .4 Vinyl Composite Flooring (VCT) to Resilient Sheet Flooring (RSF1): 'CTA-XX-N', Wheeled Traffic Transitions by Johnsonite or approved alternate.

- .5 Metal edge strips: aluminum extruded, smooth, mill finish, polished with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .6 Cleaner, Sealer and Finisher: VCT Cleaner, Sealer and Finisher: as recommended by flooring manufacturer's printed instructions.
- .7 VCT Cleaner, Sealer and Wax: Owner Supplied/Owner Installed. Coordinate with Owner. Refer to Section 01 11 00 Summary of Work.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSPECTION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for resilient tile flooring work in accordance with manufacturer's written instructions.
 - .1 Examine work of other trades that resilient flooring systems will be applied, for conformity to drawings.
 - .2 Visually inspect substrate in presence of Consultant.
 - .3 Conduct the following tests on concrete slab before product installation:
 - .1 ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - .2 ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
 - .4 Report all discrepancies and unacceptable conditions immediately upon discovery to Consultant.
 - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant].
- .2 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer.

3.3 SUB-FLOOR TREATMENT

- .1 Remove existing resilient flooring.
- .2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.
- .3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .4 Prime, seal, concrete slab plywood sub-floor. Prepare and finish to resilient flooring manufacturer's printed instructions.

3.4 SUB FLOOR FILLER AND LEVELER

- .1 Where resilient flooring abuts other flooring of different thickness, provide cementitious underlayment allowing for smooth and level transition between finished floor surfaces.
- .2 Mix, apply and finish underlayment in accordance with latex admixture manufacturer's recommendations.

3.5 GENERAL

- .1 Provide adaptors, filler strips, edge guards, transition strips, and reducers to manufacturers written instructions, at all locations where floor covering changes material, or terminates.
- .2 Install resilient flooring on all floor surfaces as indicated on drawings, including under all millwork and equipment.

3.6 TILE APPLICATION

- .1 Acclimatize subfloor, all flooring material and adhesive for forty eight (48) hours prior, during and after the installation by maintaining the room temperature between 18°C / and 24°C.
- .2 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.
- .3 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .4 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
- .5 Install flooring to square grid pattern with joints aligned with pattern grain parallel to length of room.
- .6 Border tiles: half tile width minimum.
- .7 As installation progresses and after installation, roll flooring with roller to ensure full adhesion using methods and roller weight to manufacturer's written recommendations.
- .8 Cut tile and fit neatly around fixed objects. Caulk joint neatly with clear opaque sealant in accordance Section 07 92 00 - Joint Sealants for sealant type.
- .9 Install feature strips and floor markings where indicated. Fit joints tightly.
- .10 Install flooring in pan type floor access covers. Maintain floor pattern.
- .11 Unless otherwise indicated, cut flooring around fixed objects.
 - .1 Continue flooring over areas which will be under built-in furniture.
 - .2 Continue flooring through areas to receive plumbing fixtures such as but not limited to water closets without interrupting floor pattern. Caulk joint neatly with clear opaque sealant in accordance with Section 07 92 00 Joint Sealants for sealant type.

- .3 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .4 Continue flooring through areas to receive millwork without interrupting floor pattern.
- .12 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
- .13 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.7 **BASE APPLICATION**

- Lay out base to keep number of joints at minimum. Base joints at maximum length available or at .1 internal or premoulded corners.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg/ 6.5 lbs. hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles, minimum 300 mm each leg. Wrap around toeless base at external corners.

3.8 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 **CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.
- .3 Remove excess adhesive from floor, base and wall surfaces without damage.
- Clean, seal and wax floor and base surface to flooring manufacturer's instructions. In carpeted areas .4 clean, seal and wax base surface before carpet installation.
- .5 Coordinate with Owner for the cleaning, sealing and polishing of resilient floors by Owner immediately after installation.

- .6 Provide verification to Owner's and Consultant's satisfaction that floors have been installed in accordance with manufacturer's directions prior to requesting acceptance.
- .7 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Protect new floors from time of final set of adhesive.
- .2 Prohibit traffic on floor for 48 hours after installation.

3.11 SCHEDULE

.1 Refer to Room Finish Schedule for loations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .2 The Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual February 2004.
 - .2 Standard GPS-1-05, MPI Green Performance Standard for Painting and Coatings.
- .3 National Fire Code of Canada.
- .4 Society for Protective Coatings (SSPC):
 - .1 Systems and Specifications, SSPC Painting Manual 2005.

1.2 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Contractor: To have a minimum of five (5) years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Journeymen: Qualified journeypersons as defined by local jurisdiction to be engaged in painting work
 - .3 Apprentices: May be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.
 - .4 Conform to latest MPI requirements for exterior painting work including preparation and priming.
 - .5 Materials: In accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
 - .6 Paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.
 - .7 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.
 - .8 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm / 3'-0" at 90 degrees to surface.
 - .2 Soffits: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 PERFORMANCE REQUIREMENTS

- .1 Environmental Performance Requirements:
 - .1 Provide paint products meeting MPI "Environmentally Friendly" E2 E3 ratings based on VOC (EPA Method 24) content levels.
 - .2 Green Performance in accordance with MPI Standard GPS-1.

1.4 SCHEDULING

- .1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Consultant for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about building.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS Material Safety Data Sheets in accordance with Section 02 81 01 Hazardous Materials.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).
- .4 Provide samples in accordance with Section [01 33 00 Submittal Procedures].
 - .1 Submit duplicate 203 x 305 mm / 8" x 12" sample panels of each paint, stain, clear coating special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
 - .2 When approved, samples will become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
 - .3 Submit full range of available colours where colour availability is restricted.

1.6 QUALITY CONTROL

- .1 Provide mock-up in accordance with Section 01 45 00 Quality Control.
- .2 When requested by Consultant or Paint Inspection Agency, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.7 MANUFACTURER'S FIELD SERVICES

.1 Arrange for initial job start-up site attendance, periodic site attendance of membrane manufacturer's technical representative during installation work, together with written report.

- .2 The Contractor must at all times enable and facilitate access to the work site by said representative.
- .3 Notify Consultant of date and time of inspection, a minimum of 48 hours prior to inspection. Provide one copy of manufacturer's report to the Consultant within 48 hours of inspection being carried out.

1.8 MAINTENANCE

- .1 Extra Materials:
 - .1 Submit maintenance materials in accordance with Section 01 78 00 Closeout Submittals.
- .2 Submit one four litre can of each type and colour of primer, stain, finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements, supplemented as follows:
 - .1 Deliver and store materials in original containers, sealed, with labels intact.
 - .2 Labels: to indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
 - .3 Remove damaged, opened and rejected materials from site.
 - .4 Provide and maintain dry, temperature controlled, secure storage.
 - .5 Observe manufacturer's recommendations for storage and handling.
 - .6 Store materials and supplies away from heat generating devices.
 - .7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
 - .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
 - .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
 - .10 Remove paint materials from storage only in quantities required for same day use.
 - .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
 - .12 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on

- these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .7 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.
- .8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.10 AMBIENT CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with Owner and Consultant and ensure its operation during and after application of paint as required.
 - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .6 Perform no painting work unless a minimum lighting level of 23 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by and product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10 degrees C.
 - .2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 Relative humidity is above 85% or when dew point is less than 3 degrees C variance between air/surface temperature.
 - .5 Rain or snow is forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

- .2 Perform no painting work when maximum moisture content of substrate exceeds:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Metre, except test concrete floors for moisture using a simple "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

- .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
- .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
- .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
- .5 Do not apply paint when:
 - .1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.
 - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
 - .3 Surface to be painted is wet, damp or frosted.
- .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
- .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
- .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
- .9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Consultant and Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems: To be products of single manufacturer.
- .3 Only qualified products with E2 E3 "Environmentally Friendly" ratings are acceptable for use on this project.
- .4 Waterborne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .5 Waterborne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

- .6 Waterborne surface coatings and recycled waterborne surface coatings must have flash point of 61.0 degrees C or greater.
- .7 Both waterborne surface coatings and recycled waterborne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .8 Waterborne paints and stains, recycled waterborne surface coatings and waterborne varnishes, must meet a minimum "Environmentally Friendly" E2 rating.
- .9 Recycled waterborne surface coatings must contain 50% post-consumer material by volume.
- .10 Recycled waterborne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility, which has been accredited by the Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma Atomic Emission Spectroscopy) Technique No. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique No. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique No. 8081 as defined in EPA SW-846.

2.2 COLOURS

- .1 Consultant will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of four base colours and three accent colours. No more than seven colours will be selected for entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturer's full range of colours.
- .4 Where specific products are available in restricted range of colours, selection will be based on limited range.
- .5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss: Defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 Degrees	Sheen @ 85 Degrees
Gloss Level 1 – (Matte Finish)	Maximum 5	Maximum 10
Gloss Level 2 – (Velvet)	Maximum10	10 to 35
Gloss Level 3 – (Eggshell)	10 to 25	10 to 35
Gloss Level 4 – (Satin)	20 to 35	Minimum 35
Gloss Level 5 – (Semi-Gloss)	35 to 70	
Gloss Level 6 – (Traditional Gloss)	70 to 85	
Gloss Level 7 – (High Gloss)	More than 85	

.2 Gloss level ratings of painted surfaces as specified.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 Asphalt Surfaces: zone/traffic marking for drive and parking areas, etc.
 - .1 EXT 2.1B Alkyd zone/traffic marking finish.
 - .2 Painting of traffic/zone line layouts on exterior asphalt surfaces to be in accordance with approved drawing SP-01, and MPI Architectural Painting Specification Manual requirements.
- .2 Structural Steel and Metal Fabrications:
 - .1 EXT 5.1D Alkyd G5 finish.
- .3 Galvanized Metal: Not chromate passivated for high contact/high traffic areas (doors, frames, railings, misc. steel, pipes, etc.):
 - .1 EXT 5.3B Alkvd G5 finish.

2018/07/06

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXAMINATION

- .1 Exterior painting and repainting work: Notify Consultant in writing minimum of one (1) week prior to commencement of work.
- .2 Exterior surfaces requiring painting and repainting: Prior to commencing with exterior painting Work, examine surfaces to be painted for defects and acceptance. Notify Consultant in writing of defects or problems, prior to commencing painting and repainting work, or after surface preparation if unseen substrate damage is discovered.
- .3 Commence with exterior painting and repainting Work only after preparation, repair or replacement of such unforeseen or noted defects are corrected.

3.3 PREPARATION

- .1 Perform preparation and operations for exterior painting in accordance with manufacturer's written instructions and MPI Maintenance Re painting Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.
- .3 Clean and prepare exterior surfaces to be repainted in accordance with manufacturer's written instructions and MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture metre before commencing work.
 - .5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
 - .6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.
- .4 Clean metal surfaces to be painted and repainted by removing rust, dirt, oil, grease and foreign substances in accordance with manufacturer's written instructions and MPI requirements. Remove such contaminates from surfaces, pockets and corners to be painted and repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime,

and apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

- .6 Do not apply paint until prepared surfaces have been reviewed by Consultant.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.4 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture metre, except test concrete floors for moisture using a simple "cover patch test" and report findings to Consultant. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:

.1 Stucco: 12 %. .2 Concrete: 12 %.

.3 Clay and Concrete Block/Brick: 12 %.

.4 Wood: 15 %.

3.5 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Consultant.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about building.
- .5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.
- .6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Consultant.

3.6 APPLICATION

- .1 General:
 - .1 Finish all exposed to view unfinished materials and all previously painted surfaces.
 - .2 Finish paint all primed surfaces.
 - .3 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
 - .4 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.
 - .5 Do not paint baked enamel; chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory.
 - .6 Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.
 - .7 Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas, which have been cut and patched. Patch paint will not be accepted.
 - .8 Advise Consultant when each applied paint coat may be inspected. Do not recoat until directed by Consultant in writing. Tint each coat slightly to differentiate between applied coats.
 - .9 Sand smooth enamel and varnish undercoats prior to recoating.
 - .10 Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.
 - .11 Apply materials in accordance with manufacturer's directions and specifications. Do not use adulterants. Any reduction of coating's viscosity to only be permitted in accordance with manufacturer's directions.
 - .12 Finishes and number of coats specified hereinafter in Exterior Finishes Schedule are intended as minimum requirements guide only. Refer to manufacturer's recommendations for exact instructions for thickness of coating to obtain optimum coverage and appearance. Some materials and colours may require additional coats and deeper colours may require use of manufacturers' special tinted primers. Unless otherwise specified, provide 3 coats of finish minimum.
 - .13 Obtain colour chart giving colour schemes and gloss value for various areas as directed by Consultant. Colour chart shall give final selection of colours and surface textures of all finishes, and whether finishes are transparent (natural) or opaque (paint).
 - .14 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Consultant.
 - .15 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
 - .16 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
 - .17 Sand and dust between coats to remove visible defects.
- Apply paint by brush, roller, air sprayer, airless sprayer. Method of application to be as approved by Consultant. Conform to manufacturer's application instructions unless specified otherwise.
 - .1 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
 - .2 Spray Application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .4 Brush out immediately runs and sags.
- .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .6 Spray paint all doors and frames scheduled to be painted. Final coat may be brushed or rolled to accommodate finished adjacent surfaces.
- .7 Spray paint overhead doors.

3.7 MECHANICAL / ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.
- .4 Paint fire protection piping red.
- .5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

- .1 Inspection:
 - .1 Advise Consultant when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.9 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
 - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.10 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Material and installation of site applied paint finishes to new interior surfaces, including site painting of shop-primed surfaces.

1.2 REFERENCES

- Environmental Protection Agency (EPA): .1
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .3 Master Painters Institute (MPI):
 - .1 MPI Architectural Painting Specifications Manual, 2004.
- .4 National Fire Code of Canada - 1995.
- .5 Society for Protective Coatings (SSPC):
 - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.3 **QUALITY ASSURANCE**

- .1 Qualifications:
 - .1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
 - .3 Apprentices: working under direct supervision of qualified tradespersons in accordance with trade regulations.
 - .4 Paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer and to be compatible with other coating materials as required.

MANUFACTURER'S FIELD SERVICES 1.4

- .1 Arrange for initial job start-up site attendance, periodic site attendance of paint manufacturer's technical representative during installation work, together with written report.
- .2 The Contractor must at all times enable and facilitate access to the work site by said representative.
- .3 Notify Consultant of date and time of inspection, a minimum of 48 hours prior to inspection. Provide one copy of manufacturer's report to the Consultant within 48 hours of inspection being carried out.

1.5 SCHEDULING

- .1 Submit work schedule for various stages of painting to Consultant for review. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Consultant for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

- .1 Submit product data and instructions for each paint and coating product to be used.
- .2 Submit product data for the use and application of paint thinner.
- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

- .1 Submit full range colour sample chips to indicate where colour availability is restricted.
- .2 Submit duplicate 203 x 305 mm / 8" x 12" sample panels of each paint, stain, clear coating, special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation and application instructions.
- .6 Closeout Submittals: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.

1.7 MAINTENANCE

.1 Extra Materials:

- .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
- .2 Quantity: Provide one four litre can of each type and colour of primer stain finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Delivery, storage and protection: comply with Consultant requirements for delivery and storage of extra materials.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
 - .1 Identify products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well-ventilated area with temperature range 7°C to 30°C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Fire Safety Requirements:
 - .1 Provide one 9 kg / 20 lbs., Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan (WMP).
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.
 - .7 Ensure emptied containers are sealed and stored safely.
 - .8 Unused paint coating materials must be disposed of at official hazardous material collections site as approved by Consultant.
 - .9 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these

- controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .14 Set aside and protect surplus and uncontaminated finish materials. Consult with Owner for direction with surplus and uncontaminated materials.

1.9 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with Consultant and ensure its operation during and after application of paint as required.
 - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .6 Provide minimum lighting level of 323 Lux on surfaces to be painted.
 - .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless pre-approved written approval by Consultant and product manufacturer, perform no painting when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is above 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
 - The relative humidity is under 85% or when the dew point is more than 3°C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3°C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
 - .4 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .5 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can withstand 'normal' adverse environmental factors.

- .2 Perform painting work when maximum moisture content of the substrate is below:
 - .1 Allow new concrete and masonry to cure minimum of 28 days.
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
- .3 Test for moisture using calibrated electronic Moisture Metre. Test concrete floors for moisture using "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
 - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Only qualified products with E2 E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .7 Provide paint products meeting MPI "Environmentally Friendly" E2 E3 ratings based on VOC (EPA Method 24) content levels.
- .8 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
 - .1 Water-based; Water soluble; Water clean-up.
 - .2 non-flammable; biodegradable.
 - .3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 Manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .9 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

- .10 Flash point: 61.0°C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .11 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
 - .1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.
- .12 Water-borne paints and stains recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.
- .13 Recycled water-borne surface coatings to contain 50% post-consumer material by volume.
- .14 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

- .1 Consultant will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of five base colours and three accent colours. Not more than eight colours will be selected for entire project and not more than three colours will be selected in each area.
- .3 Selection of colours from manufacturers' full range of colours.
- .4 Where specific products are available in restricted range of colours, selection based on limited range.
- .5 Second coat in three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Consultant for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions. . If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss	Gloss @ 60	Sheen @
Level-Category	degrees	85 degrees
Gloss Level 1 – (Matte Finish)	maximum 5	maximum 10
Gloss Level 2 – (Velvet)	maximum10	10 to 35
Gloss Level 3 – (Eggshell)	10 to 25	10 to 35
Gloss Level 4 – (Satin)	20 to 35	minimum 35
Gloss Level 5 – (Semi-Gloss)	35 to 70	
Gloss Level 6 – (Traditional Gloss)	70 to 85	
Gloss Level 7 – (High Gloss)	more than 85	

.2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Concrete horizontal surfaces: Floors and stairs:
 - .1 INT 3.2F Concrete floor sealer.
- .2 Clay masonry units: Pressed and extruded brick:
 - .1 INT 4.1A Latex G3 finish.
- .3 Concrete masonry units: Smooth and split face block and brick:
 - .1 INT 4.2A Latex G3 finish.
- .4 Structural steel and metal fabrications: Columns, beams, joists:
 - .1 INT 5.1E Alkyd G6 finish.
- .5 Galvanized metal: High contact/high traffic areas (doors, frames, railings and handrails, etc.).
 - .1 INT 5.3C Alkyd G5 finish (over cementitious primer).
- .6 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2A Latex G3 finish (over latex sealer).
 - .2 INT 9.2K Latex G3 finish (over alkyd primer) for plaster surfaces only.

2.6 INTERIOR REPAINTING

- .1 Interior repainting:
 - .1 Structural Steel and Metal Fabrications: Columns, beams, joists and miscellaneous metal.
 - .1 RIN 5.1E Alkyd G6 finish.
 - .2 Galvanized Metal: High contact/high traffic areas (doors, frames, railings and handrails, etc.).
 - .1 RIN 5.3C Alkyd G5 finish.

- .3 Plaster and Gypsum Board: Gypsum wallboard, drywall, "sheet rock" type material, etc.
 - .1 RIN 9.2A Latex G3 finish.
 - .2 RIN 9.2C Alkyd G3 finish.

2.7 SOURCE QUALITY CONTROL

- .1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility, which has been accredited by Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma Atomic Emission Spectroscopy) Technique No. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique No. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique No. 8081 as defined in EPA SW-846.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture metre, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Stucco, plaster and gypsum board: 12%.
 - .2 Concrete: 12%.
 - .3 Clay and Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.4 PREPARATION

.1 Protection:

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Consultant.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation:

- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval Consultant.
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Clean following surfaces with high pressure water washing: Existing interior brick.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to manufacturer's written instructions to MPI No. 36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

- .8 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air or vacuum cleaning.
- .9 Touch-up of shop primers with primer as specified.
- .10 Do not apply paint until surfaces are properly prepared in accordance with manufacture's written recommendations.

3.5 APPLICATION

- .1 General:
 - .1 Finish all exposed to view unfinished materials and all previously painted surfaces in area of new Work and as scheduled.
 - .2 Finish paint all primed surfaces.
 - .3 Do not paint baked enamel; chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory.
 - .4 Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.
 - .5 Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas, which have been cut and patched. Patch paint will not be accepted.
 - .6 Sand smooth enamel and varnish undercoats prior to recoating.
 - .7 Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.
 - .8 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
 - .9 Apply coats of paint continuous film of uniform thickness:
 - .1 Repaint thin spots or bare areas before next coat of paint is applied.
 - .10 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
 - .11 Sand and dust between coats to remove visible defects.
 - .12 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting window stool ledges.
- Apply paint by brush roller air sprayer airless sprayer. Method of application to be as approved by Consultant. Conform to manufacturer's application instructions unless specified otherwise:
 - .1 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
 - .2 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

- .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
- .4 Brush out immediately all runs and sags.
- .5 Use brushes and rollers to work paint into cracks, crevices and places, which are not adequately painted by spray.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Boiler room, mechanical and electrical rooms: Paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: Leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch-up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint natural gas piping yellow.
- .11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .12 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

- .1 Walls: No defects visible from a distance of 1000 mm / 3'-0" at 90 degrees to surface.
- .2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

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3.8 FIELD QUALITY CONTROL

- Prior to commencing with interior painting Work, examine surfaces to be painted for defects and .1 acceptance. Notify Consultant and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
- .2 Commence with interior painting Work only after preparation, repair or replacement of such noted defects are corrected.
- .3 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .4 Field inspection of painting operations to be carried out by independent inspection firm as designated by Consultant.
- .5 Advise Consultant when each applied paint coat may be inspected. Do not recoat until directed by Consultant in writing. Tint each coat slightly to differentiate between applied coats.
- .6 Cooperate with inspection firm manufacturer's representative and provide access to areas of work.
- .7 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

3.9 **CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.10 **RESTORATION**

- Clean and reinstall hardware items removed before undertaken painting operations. .1
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid .4 scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.11 CLEANING

- .1 Proceed in accordance with Section 01 74 11 Cleaning.
 - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Aluminum Association (AA):
 - .1 DAF 45-03 (R2009), Designation System for Aluminum Finishes.
- .2 ASTM International:
 - .1 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A 924/A 924M-14, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .3 Porcelain Enamel Institute (PEI):
 - .1 PEI 501 Properties of Porcelain Enamel.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [whiteboards] and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Installation Drawings:
 - .1 Submit installation drawings.
 - .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm / 12" x 12" sample of whiteboard and 300 mm long sample of trim.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 Closeout Submittals.
 - .2 Affix maintenance instruction labels to whiteboards.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect whiteboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Laminating adhesive: to manufacturer's standard.
- Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .3 Anchor clips, brackets and fasteners: concealed type as recommended by whiteboard manufacturer.
- .4 Facings:
 - .1 12.7 mm / ½" thick porcelain enameled board with min. 0.75 mm / 22 ga. thick steel writing surface laminated to 11 mm / 7/16" particle board core and 0.48 mm / 1/64" thick stretcher levelled zinc coated steel back magnetic sheet, listed and labelled.
 - .1 Porcelain enamel finish to requirements of Porcelain Enamel Institute Standard S104.

2.2 COMPONENTS

.1 Extruded aluminum: aluminum Association alloy AA 6063-T5. Minimum 1.5 mm / 1/16" thick.

2.3 TRIM AND ACCESSORIES

- .1 Fixed magnetic whiteboards: (All trim and accessories by Architectural School Products unless otherwise indicated, or approved alternate.)
 - .1 Material: 1.5 mm / 1/16" minimum wall thickness, extruded aluminum clear anodized sections AA6063-T5, satin finish.
 - .2 Perimeter trim: Series 205.
 - .3 Divider strip: #207.
 - .4 Map rail: #206 complete with cork insert, end stops, and two (2) combination roller map hooks per section.
 - .5 Marker rail below each board:
 - .1 #212 complete with contour fitting end castings
 - .2 65 mm / 2½" deep 915 mm / 36" long removable aluminum magnetic accessory tray smooth angle cut ends, finish to match trim, or approved alternate.

- .1 Acceptable product: 'Magtray' by Optima Inc.
- .2 Approved equivalent.
- .6 Transition section: #207.

2.4 FABRICATION

- .1 Fabricate whiteboard panels to sizes indicated.
- .2 Factory laminate whiteboards, consisting of facing sheet, with core and backing sheet with adhesive in accordance with manufacturer's recommendations.
- .3 Make finished panels flat and rigid and fit with joint reinforcement.
- .4 Fit joints between abutting whiteboard panels with joint reinforcement except where covering trim is required.
- .5 Install trim on panels in factory. Make mitres and joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush.
 - .1 No exposed fasteners permitted.
- .6 Overlap trim 6 mm / 1/4" onto panels.
- .7 Install map rails and marker rails complete with closed ends.
- .8 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and make ready for reassembly on site.

2.5 MANUFACTURER

.1 Acceptable Product: 'Series 200' wall mounted whiteboard by Architectural School Products, or equivalent by Martack Specialties Ltd., or approved alternate.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for whiteboard installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 INSTALLATION

- .1 Install whiteboards where indicated in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure writing surface.
- .2 Mechanical attachment:
 - .1 To concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved.
 - .2 To hollow masonry use toggle bolts or equivalent.
 - .3 To wood or sheet metal use screws. Secure into framing members in stud walls.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
 - .3 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
 - .4 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by whiteboard installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM A 167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A 240/A 240M-15a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A 480/A 480M-15, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
 - .4 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
 - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel Air Drying and Baking.
 - .3 CAN/CGSB-1.104M-91, Semigloss Alkyd, Air Drying and Baking Enamel.
- .3 CSA International:
 - .1 CSA B651-12, Accessible Design for the Built Environment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal toilet compartments and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Installation Drawings:
 - .1 Indicate fabrication details, plans, elevations, hardware, and installation details.

1.3 QUALITY ASSURANCE

- .1 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 Quality Controll.
 - .2 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, and material application.
 - .3 Locate where directed.
 - .4 Allow 24 hours for inspection of mock-up before proceeding with work.
 - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work to Consultant approval.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal toilet compartments from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sheet steel: commercial quality to ASTM A480 with ZF001 designation zinc coating.
- .2 Minimum base steel thickness:
 - .1 Panels and doors: 0.8 mm / 20 gauge.
 - .2 Pilasters: 1.0 mm / 18 gauge.
 - .3 Reinforcement: 3.0 mm / 1/8".
- .3 Stainless steel sheet metal: to ASTM [A167] [A240], Type 302, with polished finish.
- .4 Panel core material: honeycomb core of pre-expanded resin impregnated Kraft paper having maximum 25 mm / 1" hexagonal shaped cells.
- .5 Metal filler: polyester based metal filler for painted panels.
- .6 Brackets: anodized aluminum or chrome plated die-cast zinc alloy stirrup brackets.
- .7 Attachment: stainless steel tamperproof type screws and bolts.

2.2 COMPONENTS

- .1 Dimensions: components are not necessarily of standard size. Verify exact size by checking Drawings and taking site measurements. Unless otherwise indicated provide:
 - .1 Compartments: sizes as indicated.
 - .2 Doors 610 mm / 2'-0" wide x 1460 mm / 4'-9" high, 813 mm x 1460 mm / 2'-8" x 4'-9" at doors to stalls barrier free stalls.
 - .3 Maximum clearance between panels: 13 mm / 1/2" between panels and walls: 19 mm / 3/4".
 - .4 Top of headrail: 2083 mm / 6'-10" above floor.
 - .5 Finish floor to underside of panels and doors: 305 mm / 12".

.2 Panels, doors and pilasters:

- .1 Construction: sheet steel face sheets adhesive bonded under pressure to both sides of core material. Provide solid reinforcement in core to receive fasteners required for attachment of surface applied accessories.
- .2 Panel edge construction: form steel face sheets around edges and electrically weld together at maximum 450 mm / 18" o/c. Seal edges with continuous rigid vinyl or steel oval crown locking strip, mitred, welded and finished at corners.
- .3 Make all panels and doors 25 mm / 1" thick, using minimum 1.0 mm / 20 ga. thick sheet steel.

.3 Toilet Compartments:

- .1 Extend pilasters from floor to headrail. Provide jack leveling bolt at floor and 75 mm / 3" high stainless steel.
- .2 Fabricate overhead bracing from continuous steel or aluminum sections, approximately 32 mm x 41 mm / 1-1/4" x 1-5/8"; anti-grip profile.

.4 Privacy / Urinal Screens:

- .1 1460 mm / 4'-9" high panels, complete with 150 mm / 6" wide floor mounted pilaster.
- .2 Extend pilasters from floor to top of screen. Provide jack leveling bolt at floor and 75 mm / 3" high stainless steel.

.5 Hardware:

- .1 Concealed "in door" design of non-ferrous die cast metal, unless otherwise indicated.
- .2 Hang each compartment door on two universal, adjustable gravity type pivot hinges, one top and one bottom. Bearings: nylon. No vertical movement in door during operation is permitted.
- .3 Equip each compartment door with chrome plated non-ferrous slide bolt and keeper. Provide flush exterior escutcheon plate slotted for emergency access.
- .4 Provide D-pull inside and outside at doors to barrier-free stalls.
- .5 Provide convex style panel mounted door stop for toilet partition doors.
- .6 Coat hook: combination hook and rubber door bumper, chrome plated non-ferrous.

.6 Finishes:

- .1 Panels and pilasters: clean, degrease and chemically pre-treat metal surfaces, apply prime coat and two coats of baking enamel applied electrostatically in dust-free atmosphere and baked on under controlled temperature conditions.
- .2 Hardware, brackets: chrome plated non-ferrous.
- .3 Colours: manufacturer's standard colours; as later selected by Consultant.

.7 Acceptable Product: floor mounted, overhead braced system:

- .1 "Headrail Braced" by Hadrian Mfg. Inc.;
- .2 "Epic" by GSS;
- .3 "Concord" by Ontario Accurate Partitions;
- .4 "Model O.B. Overhead Rail Braced" by Shanahan's;
- .5 "Global Partitions' series toilet partitions" by Watrous;
- .6 Approved alternate.

2.3 FABRICATION

- .1 Include 1.0 mm thick type 316 stainless steel protective shields on urinal side of toilet partition panels next to urinals and on urinal screens.
 - .1 Make protective shields 1000 mm high with top of shield 1200 mm above finished floor.

- .2 Make shields to full width of partition or screen panel.
- .3 Fasten with stainless steel screws.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal toilet compartment installation in accordance with manufacturer's written instructions.

3.3 PREPARATION

.1 Ensure supplementary anchorage, if required, is in place.

3.4 ERECTION

- .1 Perform work in accordance with CSA-B651.
- .2 Partition erection.
 - .1 Install partitions secure, plumb and square.
 - .2 Leave 12 mm / 1/2" space between wall and panel or end pilaster.
 - .3 Anchor mounting brackets to masonry/concrete surfaces using screws and shields: blocking/backing must be provided to hollow walls using bolts and toggle type anchors.
 - .4 Attach panel and pilaster to brackets with self-drilling screws with through type sleeve bolt and nut.
 - .5 Equip doors with hinges, latch set, and each stall with coat hook mounted on door, mounting heights as indicated on shop drawings and confirmed by Consultant. Adjust and align hardware for easy, proper function. Set door open position at 30 degrees to front. Install door bumper on wall or door as required to prevent projections from damaging partitions or adjacent walls.
 - .6 Equip out-swinging doors with door pulls on inside and outside of door in accordance with CAN/CSA-B651.
 - .7 Install hardware grab bars.

3.5 ADJUSTING

- .1 Adjust doors and locks for optimum, smooth operating condition.
- .2 Lubricate hardware and other moving parts.

3.6 CLEANING

- .1 Perform cleaning in accordance with Section 01 74 11 Cleaning.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
 - .1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
 - .2 Clean aluminum with damp rag and approved non-abrasive cleaner.
 - .3 Clean and polish hardware and stainless components.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal toilet compartment installation.

END OF SECTION

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PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM A 167-99 (2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM B 456-11, Standard Specification for Electrodeposited Coatings of Copper plus Nickel plus Chromium and Nickel plus Chromium.
 - .3 ASTM A 653/A 653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A 924/A 924M-14, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
 - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-B651.2-07 (R2012), Accessible Design for the Built Environment.
 - .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA Z316.6-14, Evaluation of single-use and reusable medical sharps containers for biohazardous and cytotoxic waste.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Tools:
 - .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 Closeout Submittals.
 - .2 Deliver special tools to Owner.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and / or return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sheet steel: to ASTM A 653/A 653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A 167, Type 304, with satin finish.
- .3 Stainless Steel Tubing: to AISI No. 4, commercial grade, seamless welded, 1.2 mm wall thickness, satin luster finish.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 MANUFACTURER

- .1 Products specified are manufactured by Frost unless otherwise indicated. Should an alternate product to Frost be specified, provide only the specified product or an approved alternate.
- .2 Equivalent products by Bobrick or Watrous will be acceptable to Frost products unless otherwise indicated.
- .3 Supply only those products listed or approved alternates in accordance with Section 00 21 13 Instructions to Bidders.
- .4 Provide all accessories with concealed fasteners and concealed tamperproof screws.

2.3 COMPONENTS

- .1 Toilet Tissue Dispenser (TPD): jumbo size see through dispenser, 18 ga. Type 304 stainless steel with brushed finished, double roll complete with lock, 520 mm / 20 ½" long x 283 mm / 11 ¼" high x 145 mm 5 ¾" deep:
 - .1 Acceptable product: 'Code 169' by Frost.
 - .2 Or approved equivalent.
- .2 Toilet Tissue Dispenser (TTD Barrier Free stalls only): double roll type 320 mm / 12⁵/₈" long x 83 mm / 83¹/₈" high x 113 mm / 4¼" deep, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.
 - .1 Acceptable product (double roll): 'Code 150' by Frost.
 - .2 Or approved equivalent.
- .3 Wall Mounted Waste Receptacle (SMWR): surface mounted, open top, Type 304 No 4 satin finish stainless steel, 22 ga. welded construction, 68 litre / 15 gal capacity, approximately 387 mm / 151/4" wide x 610 mm / 241/4" high x 292 mm / 111/2" deep:
 - .1 Acceptable product: 'Code 327' by Frost.
 - .2 Or approved equivalent.
- .4 Semi-Recessed Combination Towel Dispenser/Waste Receptacle (PTD): 304 stainless steel, recessed towel dispenser and semi-recessed mounted waste receptacle complete with push bar lever action dispense roll type paper toweling, front loading, all doors complete with full-length stainless steel piano hinges, stainless steel back, keyed locked, approximately 1423 mm / 56" high x 438 mm / 171/4" wide x 203 mm / 8" deep and 101 mm / 4" recessed:
 - .1 Acceptable product: "Code 422-50" by Frost.
 - .2 Or approved equivalent.
- .5 Soap Dispenser (SD): lotion soap dispenser, high impact plastic body complete with lock mechanism, large push bar, sight window, removable inner soap reservoir, 114 mm wide, 230 mm / 9" high x 101 mm / 4" deep:
 - .1 Acceptable product: 'Code 707', by Frost.
 - .2 Or approved equivalent.
- Sanitary Napkin Disposal Bin (SND): surface mounted, 203 mm / 8" wide x 336 mm 131/4" high x 114 mm 41/2" deep, stainless steel, Type 304 No.4 brushed finish:
 - .1 Acceptable product: 'Code 622' by Frost.
 - .2 Or approved equivalent.
- .7 Hand Dryer (HD): listed under re-examination service of ULC and CSA approved, hands free, surface mounted, brushed steel finished, 11" wide x 9" high x 5" deep,
 - .1 Acceptable product:
 - .1 Code 1194" by Frost.
 - .2 Or approved equivalent.
- .8 Shower and Tub Curtain: 100% polyvinyl chloride (PVC), 0.2 mm / 8 ga. thick, mildew proof and cold crack treated to -15°C, ring grommets reinforced with concealed aluminum shower, white in colour, complete with stainless steel hooks and hold back hook and chain:
 - .1 Acceptable products:
 - .1 Tub Curtain (TC): 1780 mm x 1830 mm / 70" x 72", "Code 1144-503" by Frost or approved equivalent.
 - .2 Curtain Hooks: quantity to suit, "Code 1144-501L" by Frost or approved equivalent.

- .9 Shower Rods (SR): 32 mm diameter / 1¼", 18 ga., stainless steel complete with concealed fasteners heavy duty, length as required.
 - .1 Acceptable product: "Code 1145-S" by Frost or approved equivalent.
 - .2 Acceptable product:
 - .1 1525 mm / 60" long "Code 1145-S" by Frost or approved equivalent.
- .10 Shower Seat (SS): folding one piece seat, 13 mm thick, solid phenolic melamine surface complete with drainage slots, secure to base, base from 18 ga. stainless steel, Type 304, satin finish, complete with mounting flanges, baseplate, spring and guide bracket, right or left hand installation, 840 mm wide x 565 mm deep / 33" wide x 22 5/16" deep,
 - .1 Acceptable product: "Model B5181" by Bobrick or approved equivalent.
- .11 Grab Bars: 32 mm diameter 18 ga. wall tubing of stainless steel, 83 mm diameter wall flanges, exposed concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grip. Grab bar material and anchorage to withstand downward pull of 2.2 kN.
 - .1 Acceptable product: 'Code 1000 series', by Frost.
 - .1 GB1: 610 mm / 24" long straight bar.
 - .1 Acceptable material: 'Code 1001-24' by Frost.
 - .2 Or approved equivalent.
 - .2 GB2: 762 mm / 30" long straight bar.
 - .1 Acceptable material: 'Code 1001-30' by Frost.
 - .2 Or approved equivalent.
- .12 Coat Hook (CH): stainless steel, single robe hook.
 - .1 Acceptable product: "Code 1138S" by Frost.
 - .2 Or approved equivalent.
- .13 Fixed Mirror: one piece stainless steel channel frame with mitered corners, bright anneal finish, vandal resistant, concealed fastening, 4 mm glass with shock resistant full galvanized back panel, size as indicated.
 - .1 Acceptable product:
 - .1 (MR): 610 m x 914 mm / 24" x 36", 'Code 941-2436' by Frost.
 - .2 Or approved equivalent.
- .14 Shelf: heavy duty, 22 ga. stainless steel brushed finish with rounded corners, size as indicated.
 - .1 Acceptable product:
 - .1 (S1): 140 mm wide x 610 mm long x 102 mm high / 5½" wide x 24" long x 4" deep, 'Code 950-24' by Frost.
 - .2 Or approved equivalent.
- .15 Infant Change Table Wall Surface Mounted (ICT WSM): high density polyethylene, 912 mm / 36" long x 517 mm / 20" deep (in down position) x 565 mm / 221/4" high, with deep concave flip down table with 100 mm / 4" depth in up position, 115 kg. (250 lbs.) load capacity, oversized hinge with safety stop system, child protection strap, diaper bag hooks an tamper proof hardware.
 - .1 Acceptable product: 'Code 1125' by Frost.
 - .2 Or approved equivalent.
- .16 Corner guard (CG): 18 ga. stainless steel with No 4 brushed finished, 100 mm x 100 mm x 1016 mm long with full adhesive backing.
 - .1 Acceptable product: 'Code 1117' by Frost.
 - .2 Or approved equivalent.

.17 Sharps Container (for disposal of needles, knives, scalpels, blades, scissors and other sharp objects): puncture resistant, closable, leakproof, labeled and colour coded, 1.4 liter size minimum container with fill line, to CSA Standard Z316.6-07.

2.4 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm / $\frac{1}{16}$ " radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

2.5 FINISHES

- .1 Chrome and nickel plating: to ASTM B 456, satin finish.
- .2 Manufacturer's or brand names on face of units not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

3.2 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - .2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.

- .4 Toilet and shower compartments: use male to female through bolts.
- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use concealed tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.
- .5 Install mirrors in accordance with Section 08 80 50 Glazing.

3.3 ADJUSTING

- .1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Locate accessories where indicated on drawings.

END OF SECTION

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PART 1 - GENERAL

1.1 REFERENCES

- .1 American Iron and Steel Institute (AISI).
- .2 American National Standards Institute (ANSI).
- .3 American Society for Testing and Materials International (ASTM).
- .4 Canadian Standards Association (CSA International).
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .6 The Public Health and Safety Company (NSF International).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations and the following:
 - .1 Description of equipment giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- .3 Closeout Submittals:
 - .1 Provide operation and maintenance data for all specified equipment for incorporation into manual specified in Section 01 78 00 Closeout Submittals.
- .4 Submit detailed shop drawings. Indicated clearly method of assembly and operation. Show connections, anchorage, installation requirements, materials and finishes.

1.3 QUALITY ASSURANCE

- .1 Assume responsibility for the design of each unit specified herein. Comply with applicable by-laws and requirements.
- .2 Electrical equipment shall be CSA approved.
- .3 Acceptable Installers: gymnasium equipment shall be installed by forces authorized or licensed by manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

- .1 Stainless Steel: to AISI Grade 18-8, of types and finishes specified herein.
- .2 Gymnasium equipment specified herein, unless otherwise noted is based on products by Royal Stewart Ltd. (RSL). Equivalent products by Hussey, Porter, Gymnasium & Health Equipment, Sheridan, Sport Systems Canada, or approved alternate.

2.2 FLOOR SOCKETS

- .1 Floor Sockets: hinged cap floor sockets, type as follows for all floor types except floating floors:
 - .1 3.060" ID floor sockets constructed of non-rusting, solid cast bronze with a steel floor sleeve and hinged cap to fit flush into top of finished floor.
 - .2 Socket Depth: 241 mm / 9½" into concrete sub floor.
 - .3 Acceptable Product: 'Volleyball Hinged-Cap Socket 209' by Spieth-Anderson, or approved alternate.

2.3 BASKETBALL BACKSTOPS

- .1 Unless otherwise indicated, construct backstops of square steel tube framing, minimum 50 mm / 2" square complete with all clamps, supports, connectors and bracings. Shop finish all metal components with two coats of metal enamel of colour selected by Consultant.
- .2 Follow O.A.S.B.O. Health and Safety Committee's recommendations as far as applicable:
 - .1 Use closed type connectors; avoid "S" hooks, "J" bolts and other open connectors.
 - .2 Install stop clamps and markings on winching cable, indicting when to stop.
 - .3 Locate winches to one side, not directly below backstop.
 - .4 Connect cables to bottom frame. Connect top framework to bottom frame using metal strips.
- .3 Ceiling suspended forward folding electrically operated backstops, consisting of the following:
 - .1 Backstop: Model RS 200 HD by Royal Stewart Ltd., consisting of 50 mm / 2" square tube framing, 6 mm / ¼" aircraft hoisting cable, pulleys, clamps and anchoring devices.
 - .2 Backboard: Model RS 95 by Royal Stewart Ltd. rectangular glass backboard; double sided backboard padding covering bottom of board and sides 610 mm/ 2'-0" high from bottom.
 - .3 Goal: Heavy duty break-away/ snap back goal with regulation type net.
 - .4 Winch: Model RS 340 by Royal Stewart Ltd. electric winch with flush mounted, 3-position key switch; cover plate stainless steel.
 - .5 Backstop Safety Lock: 50 mm / 2" wide nylon strap capable of holding 2700 kg / 6000 lbs., designed to automatically lock at any point during operation should sudden surge of speed occur due to malfunction.
- .4 Wall mounted, fixed backstops consisting of the following:
 - .1 Backstop: Model RS 112 HD by Royal Stewart Ltd., consisting of 50 mm / 2" square framing and mounted to the wall by means of 102 mm x 190 mm x 6 mm / 4" x 7" ½" x ¼" steel wall plates.
 - .2 Backboard: Model RS 97 Model RS 95 by Royal Stewart Ltd. steel fan shaped.
 - .3 Maximum extension of unit: is 914 mm / 36".
 - .4 Finish: flat black.

.5 Goal: Heavy duty break-away/ snap back goal and regulation type net.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions.
- .2 Coordinate connection of mechanical and electrical services.
- .3 Adjust equipment for smooth and proper operation.
- .4 Lay out anchor bolt locations and floor sockets as indicted and review locations with Consultant prior to building in.
- .5 Install gymnasium equipment in accordance with manufacturer's current printed directions.
- .6 Securely anchor components to supporting building elements so that they will remain rigid, stable and secure under expected use.
- .7 Make adjustments where necessary to provide level and plumb installation.
- .8 Mount wall mounted backstops with through wall anchors. At exterior walls located anchor plate behind the inside wythe of the wall.
- .9 Install gymnasium floor socket in gymnasium floor as indicated on drawings.
- .10 Set floor sockets plumb and flush with finished floor in designated locations. Prevent displacement until concrete encasement is in place and cured.
- .11 Coordinate with Sections 03 30 00 and 04 20 00 for building in of components supplied by this Section into their work.

3.3 CLEANING

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

3.4 SCHEDULE

- .1 Provide the following gymnasium equipment:
 - .1 Ceiling suspended, forward folding electrically operated backstop with glass backboard and safety stop: two (2) required.
 - .2 Wall mounted, fixed backstop with steel fan backboard: four (4) required.

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.3 Sockets for game standards: quantity as indicated in gymnasium.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM A446M, Specification for Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- .2 ASTM A480M, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .3 ASTM B221, Specification for Aluminum-Alloy Extruded Bar Rods, Wire, Shapes, and Tubes.
- .4 CAN3-A172, High Pressure Paper Base, Decorative Laminates.
- .5 CAN3-B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .6 CAN/CSA-G40.21, Structural Quality Steels.
- .7 CAN4-S104, Fire Tests of Door Assemblies.
- .8 CAN/CSA B44-M90, Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks.
- .9 CAN/CSA C22.1, Canadian Electrical Code.
- .10 CSA C22.2 No. 77, Motors with Inherent Overheating Protection.
- .11 CSA C22.2 No. 141, Unit Equipment for Emergency Lighting.
- .12 CSA 0121, Douglas Fir Plywood.
- .13 CAN/CGSB-104.1, Enamel, Alkyd, Semi-gloss, for Machinery.
- .14 CAN/CGSB-132.1, Primer, Zinc Chromate, Low Moisture Sensitivity.
- .15 CAN/CGSB-198.1, Primer, Cementitious (for Galvanized Surfaces).

1.2 SYSTEM DESCRIPTION

.1 Single Telescopic Holeless Front Mounted Jack hydraulic elevator, in complete compliance with CAN/CSA B.44-M90.

1.3 TEMPORARY ELEVATOR

.1 Do not use elevator for temporary service.

1.4 REGULATORY AGENCY

.1 Ensure to submit all required documents to TSSA for pre-approval. Coordinate with Client and Consultant to ensure all the correct information is shared and filled in required submittals.

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1.5 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Include on shop drawings:
 - .1 Size and location of machines, controllers and piping.
 - .2 Size and location of cars, hoisting beams, guide rails, buffers and other components in hoistway.
 - .3 Rail bracket spacing and maximum loads on guide rails. Indicate exact location of brackets and confirm dimension of required steel plates, Support plates supplied are designed to be 12"x24".
 - .4 Reactions at points of support.
 - .5 Weights of principal components.
 - .6 Top and bottom clearance and overtravel of car.
 - .7 Location of circuit breakers, switchboard panels or disconnect switch, light switches and feeder extension points in machine room.
 - .8 Location in hoistway for connection of travelling cables for car light and telephone.
 - .9 Loads on hoisting beams.
 - .10 Expected heat generation of equipment in machine room.
 - .11 Detailed information of cylinders, and piping, and working pressure.
 - .12 Each shop drawing submitted shall bear stamp of qualified professional engineer registered in the Province of Ontario.
 - .13 Include on general arrangement drawings:
 - .1 Type, size, location of hoistway entrances showing details of fastening to hoistway structure, including fastening of sill support angle.
 - .14 Provide detailed calculations for seismic design.
- .3 Provide product data for:
 - .1 Signal and operating fixtures, operating panels, indicators.
 - .2 Cab design and components.
 - .3 Doors and frame details.

1.6 SAMPLES

- .1 If requested, submit samples in accordance with Section 01 33 00.
- .2 Submit two samples, 300 x 300mm in size, illustrating: cab interior, cab ceiling, cab door, hoistway entrance door and frame finishes.

1.7 PROJECT RECORD DOCUMENTS

.1 Submit project record documents which record actual locations of equipment, names of equipment manufacturers and suppliers, concealed conduit and boxes, concealed devices, disconnects, etc.

1.8 WARRANTY

.1 Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop within 1 year after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

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1.9 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual.
- .2 Include description of elevator system's method of operation and control, including group supervisory control system, motor and pump unit, door operation, signals, firefighter's services, emergency power operation, and special or non-standard features provided.
- .3 Provide parts catalogues with complete list of equipment replacement parts with equipment description and identifying numbers.
- .4 Legible schematic of hydraulic piping and wiring diagrams covering electrical equipment installed, including changes made in final work, with symbols listed corresponding to identity or markings on both machine room and hoistway apparatus.
- .5 Lubrication chart.
- .6 Planned maintenance tasks and their frequencies.
- .7 Maintenance of special finishes.

1.10 MAINTENANCE SERVICE

- .1 Furnish complete service and maintenance of elevator system components during elevator contract warranty period of 12 months.
- .2 Systematically; every month, examine, clean, adjust, and lubricate equipment as per planned maintenance tasks and frequencies.
- .3 Maintenance to include systematic examination, adjustment and lubrication of elevator equipment; maintain hydraulic fluid levels, repair or replace parts whenever required. Use genuine parts produced by the manufacturer of specific equipment.
- .4 Perform work without removing cars during peak traffic periods.
- .5 Provide emergency call back service during regular work hours for this maintenance period.
- Maintain locally, near the place of work, an adequate stock of parts for replacement or emergency purposes and have qualified installation personnel available to ensure fulfillment of this maintenance service without unreasonable loss of time.
- .7 Perform maintenance work using competent personnel, under supervision and in direct employ of elevator manufacturer.
- .8 Maintenance service shall not be assigned or transferred to any agent of subcontractor without prior written consent of Owner.

PART 2 - PRODUCTS

2.1 ELEVATOR CHARACTERISTICS

- .1 Characteristics of elevator as follows:
 - .1 Application: Telescopic Holeless Front Mounted Jack.

- .2 Service: General Purpose Passenger Class A Loading.
- .3 Quantity: 1.
- .4 Capacity: 2500 lbs.
- .5 Speed: 100 fpm.
- .6 Travel: 26 feet 10 inches.
- .7 Landings: 3.
- .8 Front Openings: 3.
- .9 Rear Openings: n/a.
- .10 Operation: Microprocessor Single Car Automatic Operation with Onboard Diagnostic Capabilities.
- .11 Machine Room: remote to elevator hoistway.
- .12 Platform Size: 6'-1" wide x 5'-4" deep.
- .13 Door Type: Single Speed Side Opening.
- .14 Cab Height: 8'-0".
- .15 Guide Rails: Equivalent to 16 lb. per foot.
- .16 Hoistway Entrances: 3'-0" wide x 7'-0" high doors.
- .17 Power Supply: 600V 3-phase 60 Hz.
- .18 For lighting: 120V, 15A, single phase, 60 Hz, alternating current.
- .19 To suit existing hoistway already partially constructed. Verify dimensions on site.

.2 Elevator Components:

- .1 Anti-stall feature.
- .2 Braille and audible signals.
- .3 Door open and close stall protection.
- .4 Emergency lighting.
- .5 Firefighter's Service: Sensors as required by Code and/or regulation.
- .6 Independent service feature.
- .7 Infrared light curtain door protection.
- .8 Low oil return.
- .9 Overload sensors.
- .10 Phase protection.
- .11 Soft Start Electronic Starting.
- .12 Locking Service Panel in Car Operating Panel.
- .13 Pressure Switch.
- .14 Remote Monitoring Capability.
- .15 Telephone (ADA compliant).
- .3 In the event of power failure of unit, elevator shall return to ground floor, open doors and automatically close doors after a predetermined time and remain inoperative until power is restored.
- .4 Upon annunciation of fire alarm, elevator shall be capable of being manually recalled to ground floor, open doors and remain there.

2.2 ELEVATOR PERFORMANCE

.1 Provide smooth acceleration and deceleration of car without perceptible steps so adjusted as not to cause passenger discomfort.

2.3 FIREFIGHTER'S OPERATION

- .1 Provide manual Firefighter's Operation in accordance with CAN/CSA B44.
- .2 Locate two-position keyed switch, with pilot light, illuminated when this operation is in effect, marked ON-OFF with key removable in OFF position only, marked Firefighter's switch-Elevators, at ground floor of building in designated location.
- .3 Do not permit sensing devices to restore normal service.
- .4 Furnish two position keyed switch with key removable in OFF position only, marked 'Firefighter's Switch' in car, located in or adjacent to operating panel marked ON and OFF/CANCEL calls.
- .5 In the event of a power failure provide automatic emergency power selection.
- .6 In the event of power failure a signal will be transmitted through a set of normally closed contacts, from the transfer switch to the control panel in the elevator machine room, by Division 16. Terminations at elevator control panel to be made by this section.
- .7 Arrange elevator to operate on emergency power to operate in accordance with CAN/CSA-B44.
- .8 Provide indicator lights in corridor above call buttons stating 'Elevator on essential power'.
- .9 Provide sign at ground floor which states 'Firefighters Elevator'.

2.4 MATERIALS AND COMPONENTS

- .1 Finish: Stainless Steel: #4 Satin.
- .2 UL or CSA Approved: Motors, pumps, valves, fluid tank, hydraulic fluid, microprocessor controller, controls, pushbuttons, and wiring.
- .3 Spring Buffers, Attachment Brackets, and Anchors: Design and size according to building code with safety factors.
- .4 Pump: Positive displacement screw type, design for steady discharge with minimal pulsations.
- .5 Muffler: Reduce noise transmission.
- .6 Telescopic Holeless Jack System:
 - .1 Jack Cylinder: Mount to car structure.
 - .2 Synchronization of Jack Stages: Direct mechanical means to ensure elevator moves at steady speed and provides smooth ride.

2.5 ELEVATOR CAB

- .1 Height: 8'-0" from finished floor to underside of canopy.
- .2 Elevator Car Enclosure Wall Sections:
 - .1 Minimum 16 gauge (0.060-inch) steel panels, allowing maximum deflection of 1/4".
 - .2 Cab Wall: Plastic laminate, colour Cherrywood.

- .3 Base, Frieze, and Reveals: #4 Stainless Steel.
- .4 Ceiling:
 - .1 Suspended with concealed frame finished in #4 Stainless Steel.
 - .2 Lighting: Six compact fluorescent downlights with trim rings and protective screens.
- .5 Cab Returns: Integral construction, Finish: #4 Stainless Steel.
- .6 Transoms:
 - .1 Run full width of cab.
 - .2 Finish: #4 Stainless Steel.
- .7 Cab Doors:
 - .1 Flush design both sides.
 - .2 Rib construction.
 - .3 Finish: #4 Stainless Steel.
- .8 Infrared Light Curtain Door Protection:
 - .1 Equip leading edges of car doors with concealed transmitter and receiver infrared beam devices to detect presence of object in process of passing through hoistway entrance and car doorway.
 - .2 Use multibeam scanning without moving parts to detect obstructions in door opening.
 - .3 Detector Device: Prevent doors from closing, or if they have already started closing, cause doors to reopen and remain open while object is within detection zone.
 - .4 Horizontal Beams: Minimum of 40 horizontal beams to fill doorway from ground level to a height of 6 feet.
- .9 Exhaust Fan:
 - .1 Single speed.
 - .2 Mount in cab transom or canopy.
- .10 Handrail:
 - .1 1/2" x 2" flat in #4 stainless steel.
 - .2 Mount on rear and side walls.
- .11 Threshold: Aluminum.
- .12 Cab Finish Flooring: as indicated on plans and as specified in Section 09 65 19 Resilient Tile Flooring.

2.6 HOISTWAYS ENTRANCE

- .1 Hoistway Doors and Frames:
 - .1 UL rated with required fire rating.
 - .2 Doors: Rigid flush panel construction with sound-deadening material.
 - .3 Frames: Securely fasten at corners to form unit frame. Frames shall be bolted.
- .2 Exposed Areas of Corridor Frames: #4 stainless steel on all floors.
- .3 Doors: #4 stainless steel on all floors.
- .4 Sills: Aluminum on all floors.

2.7 CAB FIXTURES

- .1 Main Car Operating Panel:
 - .1 Mount in return.
 - .2 Comply with handicap requirements.
 - .3 Pushbuttons: Illuminate using long-lasting LEDs included for each floor served.
 - .4 Emergency Buttons and Switches: Provide in accordance with code.
 - .5 Switches for car light and accessories.
- .2 Cab Fixtures:
 - .1 Car Lantern(s).
 - .2 Digital Car Position Indicated.
 - .3 Locking Service Panel in Car Operating Panel.
 - .4 Telephone (ADA compliant).

2.8 HALL FIXTURES

- .1 Push buttons:
 - .1 Up button and down button at intermediate floors.
 - .2 Single button at each terminal floor.
 - .3 Height: Comply with handicap requirements.
 - .4 Illumination: Illuminate using long-lasting LEDs.
- .2 Hall Fixture Finish: Clear lexan.
- .3 Fixture Cover Plates: Mount with tamper-resistant screws in same finish as fixture.

2.9 DESIGN FOR HANDICAPPED

.1 Comply with CAN/CSA B44 Elevator Safety Code – Appendix E.

2.10 SEISMIC DESIGN CRITERIA

.1 Design and assemble elevator equipment and components to withstand earthquake forces in accordance with "Class D" seismic classification requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- .1 Examine structural steel rail bracket supports location as described in the elevator shop drawings before starting elevator installation.
- .2 Verify hoistway, pit, machine room, and openings are of correct size, within tolerances, and are ready for work of this section.
- .3 Verify walls and sill supports are plumb, where openings occur.

- .4 Verify hoistway is clear and plumb, with maximum variation of 1/2" at any point.
- .5 Verify minimum fire-resistance rating of hatch walls.
- .6 Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of elevators.
- .7 Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer/installer.
- .8 Coordinate with TSSA for all necessary documentation and approval before inspection. Notify TSSA inspector once elevator installation is complete and ensure to submit all records to Consultant.

3.2 INSTALLATION

- .1 Install elevators in accordance with manufacturer/installer's instructions and ANSI/ASME A17.1.
- .2 Set entrances in vertical alignment with car openings, and aligned with plumb hoistway lines.

3.3 COORDINATION WITH OTHER SYSTEMS

- .1 Ensure to coordinate all hardware installation that are to be functioning with other systems such as, card access, control buttons with remote unlock, electric strikes, cameras, and other with the concerned trades.
- .2 Allow trades to have access to work in the elevator during the elevator installation for their work within the elevator only, and ensure to supply a qualified worker to supervise during the installation of their systems as required by TSSA or other safety regulations.

3.4 FIELD QUALITY CONTROL

.1 Perform and meet tests required by CAN/CSB-B44.

3.5 CLEANING

- .1 Remove protective coverings from finished surfaces and components.
- .2 Clean surfaces and components ready for inspection.

3.6 ADJUSTMENTS

- .1 Adjust elevators for proper operation in accordance with manufacturer/installer's instructions.
- .2 Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.

- .3 Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in levelling zone and stopping at that landing.
- .4 Adjust automatic floor levelling feature at each floor to within 1/4" of landing.
- .5 Repair minor damages to finish in accordance with manufacturer/installer's instructions and as approved by Architect.
- .6 Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

END OF SECTION





Maison de la francophonie d'Ottawa

2720 Richmond Road, Ottawa, Ontario

Electromechanical Specifications 7342-001-000

July 23, 2018

For Tender

Mechanical

Electrical

This document should not be used for construction purposes

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General Requirements Concerning Common Work Results

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1. General

1.1 The general conditions and supplementary conditions of the contract as defined in the Owner's and Architect's specifications apply.

2. Definitions

- 2.1 The following definitions used throughout this Division applies.
- 2.1.1 The expression "Owner" corresponds to the expression "Client" and identifies: "Maison de la francophonie d'Ottawa".
- 2.1.2 The expression "Engineer" corresponds to the expression "Professional" and identifies: "Pageau Morel & associés inc."
- 2.1.3 The expression "Structural Engineer" identifies: "JL Richards & Associates Ltd.".
- 2.1.4 The expression "Architect" identifies: " JL Richards & Associates Ltd."
- 2.1.5 The expression "Contractor" identifies the company, which will be awarded the contract for the execution of the works and applies to all subcontractors employed by this company.
- 2.1.6 The expression "Construction Manager" identifies: n/a
- 2.1.7 The expression "Site" identifies the building of 2720 Richmond Road, Ottawa, ON.
- 2.1.8 The expression "Division" used in the present specifications identifies the company or companies responsible for the execution of the work covered by the named Division.
- 2.1.9 The expression "Section" used in the present specification identifies the company or companies responsible for the execution of the work covered by the named Section.

3. Work Schedule

3.1 Work shall be executed according to the schedules established by the Owner.

4. Documents issued for tender and construction

- 4.1 Electromechanical plans and specifications issued indicate broadly the spirit of the client applications. Efforts were made to represent these requests on the documents.
- 4.2 The Contractor as well as its subcontractors are responsible to provide a functional and operational project in any point. If in the event of an equipment, an accessory or any other element is missing because it has not been specified or shown in the drawings, the system is under the full responsibility of the contractor, the latter will provide, install and connect the equipment, accessory or any other element missing and this, without charge or extra to the contract.
- 4.3 Only a change in the Client program may justify a monetary supplement.

5. Shop Drawings

- 5.1 The expression "Shop Drawings" means drawings, schematics, illustrations, tables, execution graphics, brochures or other data that the Contractor must submit to show in detail some part of the work.
- Review all shop drawings before submittal to the Engineer. This review implies that the Contractor has determined or will determine measurements and has verified or will verify on the site, the construction criteria, materials, catalog numbers and similar data, and that he has reviewed and coordinated each shop drawing with the Contractual Documents and Specifications.

- 5.3 Submit shop drawings to the Engineer within reasonable delays and in a logical sequence in compliance with the construction schedule. Should it be required either by the Contractor or by the Engineer, a table showing the dates of submittal and return of the drawings shall be prepared.
- 5.4 The Engineer's review consists in reviewing the conformity of shop drawings with the contract documents for recommendation to the Client or Owner. The Engineer is not liable for any responsibility for dimensions, details nor quantities.
- Shop drawings relating to products, special design systems or installations, custom equipment or similar to, all of which are not standard or catalogued products, will be considered engineering documents and as such, shall be authenticated by their author engineer. Authentication shall be in conformity with current Province Laws and By-Laws. As an example, not limited to, shop drawings of a custom air-handling unit are covered by the present article and as such, constitute engineering documents that will require an authentication by their author engineer.
- 5.6 When shop drawings are resubmitted, indicate in writing all revisions other than those required by the Engineer.
- 5.7 Submit for review by the Engineer, within five (5) weeks of the contract award, the complete set of shop drawings required under this Division. Faxed shop drawings are not accepted. For shop drawings where the entire document's format does not exceed 11" x 17", submit one (1) copy, paper or PDF (one file).
- 5.8 When accepted by Owner, shop drawings can be submitted in electronic format. The following rules must be followed entirely:
 - The identification form must be included:
 - A cover sheet hereby mentioned shall be included;
 - A single file in PDF format for each shop drawing shall be submitted. In the case where more than one document constitute the drawing, they must all be incorporated into a single file;
 - Printing parameters of the drawings must be incorporated in the file to assure a scaled printing on a commercial printer;
 - The file must be of an excellent graphical quality;
 - Transmission of the shop drawings must follow the path of communication established for the project:
 - A transmittal sheet shall be attached to submitted drawings.
- 5.8.1 Shop drawings not following these directives will be returned to the contractor with a "Rejected" recommendation.
- 5.9 Each shop drawing or shop package of drawings shall be presented with an identification form. The cover sheet shall include as a minimum the following information:
 - Owner's name;
 - · Project's name;
 - Engineer's name;
 - Contractor's name;
 - Name of sender;
 - Sub contractor's name;
 - Supplier's name;
 - Specialty;
 - Description;
 - Specifications section number and article number;
 - Revision number;
 - Blank space for stamp of Conformity Review.

5.10 An identification form model is included at the end of this Section 5.11 Submit all shop drawings in English or French, certified for construction by the manufacturer. 5.12 Drawings for non-standard articles or materials shall be produced, especially for the project. 5.13 Shop drawings shall include: 5.13.1 Construction details, dimensions, weights and equipment or material characteristics together with supplementary information such as bulletins, illustrations and exploded views of constituting parts. Marketing folders or publicity brochures will not be accepted. 5.13.2 Graphs, curves, capacities, efficiency and other technical data submitted by the manufacturer or requested by the Engineer concerning the operation of the equipment. Wiring diagrams, single line diagrams, principle diagrams, control diagrams, operating sequences 5.13.3 and all interconnections with other systems when required. 5.13.4 Flow diagrams for air, water, oil, fuel, etc. if applicable. Shop drawings will be returned with one or two of the following mentions: "Reviewed", "Modify and 5.14 resubmit", "Modify as noted", "Rejected". 5.14.1 Drawings stamped "Reviewed" will not be further commented. Drawings comply with contractual documents. 5.14.2 Drawings stamped "Rejected" shall be done over again and resubmitted for approval. Drawings do not comply with contractual documents. 5.14.3 Drawings stamped "Modify as noted" shall not be resubmitted. Conditionally to the corrections indicated, drawings comply with contractual documents. 5.14.4 Drawings stamped "Modify and resubmit" shall be resubmitted, in part or in whole, as indicated for further examination. Drawings do not comply with contractual documents. 5.14.5 Drawings stamped "Modify as noted" and "Modify and resubmit" shall be resubmitted in part or in whole, as indicated, for further examination. Conditionally to the corrections indicated, drawings comply with contractual documents. 5.15 The Engineer's examination of the shop drawings does not relieve the Contractor from supplying equipment conforming to current standards and bylaws and to the requirements of this specification. 5.16 Any equipment, which is manufactured without the Engineer's prior examination, may be rejected. Assume all costs inherent to such a rejection. 5.17 The Engineer reserves a period of 10 working days, upon reception of the shop drawings, for their review. 5.18 Shop drawings on electronic support 5.18.1 An electronic copy of Engineer's drawings is available to help the production of Contractor's shop drawings. 5.18.2 To receive a copy, the Contractor must address a written demand to Pageau Morel & Associates Inc. The Contractor must specify the trade required and the transmittal mode, with his demand. That

demand must include the responsibility disclaim form at the end of this section, duly filled-out.

- 5.18.3 To prevent any confusion about drawings nature and revisions, Contractor must respect the following instructions:
 - Do not modify nor remove elements to PAGEAU MOREL block;
 - Identify Contractor's drawing independently, indicating at least:
 - Enterprise name:
 - Drawing title;
 - Drawing number;
 - · Revisions and revision dates.
- 5.18.4 The electronic name of the Contractor's drawing shall differ from the Engineer's drawing.
- 5.18.5 At printout, the Contractor drawing identification must be shown.

6. Related Works

- 6.1 Coordinate and take necessary measures to execute the works described herein in accordance with the drawings and specifications and as required by the installation.
- 6.2 Excavation and filling-in for buried works shall be done according to layout and at the indicated depth. Install protection materials around and above services and supervise closely.
- 6.3 Obtain the structural Engineer's approval for openings, boring and other works on concrete structural elements.
- 6.4 Concrete bases are required under all mechanical and electrical equipment laid on floor. Concrete bases required to rest the equipment have a 100 mm (4") height and exceed the equipment on all sides by at least 50 mm (2") and 150 mm (6") at supports and springs, and have chamfered edges.
- Obtain the Structural Engineer's approval for openings, boring and other works on metal structural elements before executing the work.
- Surface mounted distribution equipment shall be hanged on fire proof 19 mm (¾") thick plywood installed 604 mm (12") from the finished floor up to 1827 mm (8') in height. The supply and installation of this plywood is governed by this Division.
- Boring, repair and installation of access doors in floor finishing materials, walls and ceilings, and painting are governed by the present Division.

7. Acceptable Products

- 7.1 The tender shall be based on the acceptable specified products and installation methods identified in the tender documents.
- 7.2 The name of manufacturers, catalog, numbers, trade names, trademarks specified herein are used to clearly indicate the type and quality of the required products and materials.
- 7.3 When two or more manufacturer names or trademarks are specified, the choice between them is up to the Contractor.
- 7.4 Inform the Engineer immediately should equipment, products or materials be discontinued. The Engineer shall advise as to the acceptable products to be used.

- 7.5 Substitutions
- 7.5.1 Substitutions to manufacturer names or trademarks specified may be proposed if the following conditions are met:
- 7.5.2 The proposed substitutes must conform to all specified requirements (characteristics, performances, conformity with standards, etc.)
- 7.5.3 Assume all costs related to the substitutions including those in other Sections or Divisions and those resulting from adjustments due to the acceptance of the substitution.
- 7.6 Proof of equivalence
- 7.6.1 Submit proof of equivalence, for each proposed substitute.
- 7.6.2 To prove an equivalence supply all the following information:
 - Characteristics;
 - Performance;
 - Performance curves;
 - Manufacture and finish;
 - Dimensions and weight;
 - Conformity with standards;
 - Any other pertinent information.
- 7.6.3 Indicate all differences with the tender documents.
- 7.6.4 The proof of equivalence shall be approved by the Engineer. The Owner does not commit himself to accept a substitute even if the proof of equivalence is established.
- 7.7 Use materials from manufacturers established in Quebec, Ontario or New-Brunswick. The Owner may require the name and address of the manufacturers of the purchased products and materials to verify their price, quality and origin.

8. Codes and Standards

- 8.1 The design, materials, equipment, the construction and arrangement of all the equipment, components and accessories shall conform to pertinent codes, standards, ordinances, decrees and bylaws, and to revision bulletins produced by municipal, provincial, federal or other agencies and shall also conform to current practice.
- For each particular case, the ordinance, statute, standard, code or bylaw having the strictest rules shall have precedence over the others.
- When a standard is specified, the most recent edition prior to the starting date of the work shall apply.
- 8.4 All equipment shall bear the label or seal of the different organizations governing the standards and approval of such equipment.
- 8.5 Should there be no alternative but to supply non-validated equipment, it shall be possible to use equipment approved by other recognized organization provided that the Contractor assume the cost of special approval by organization responsible for inspection of the installation.

9. Security Codes

9.1 Insure that all works and installation methods conform to the latest editions and bulletins, statutes, codes or bylaws.

10. Materials and Equipment

- 10.1 Unless stated otherwise, use new equipment and materials free from any defects.
- Supply materials and equipment conforming to the specifications for design, quality and performance and for which spare parts are readily available.
- 10.3 Unless stated otherwise, use equipment from one manufacturer only for equipment or materials of the same type or of the same class.
- 10.4 Corresponding components of the same equipment or of identical equipment shall be interchangeable and when having been interchanged shall have equal performances.
- 10.5 Equipment shall be designed to be installed, dismantled and maintained at minimal cost.
- 10.6 Control panels and constituent elements of the same equipment shall be shop assembled.

11. Materials Shipping and Storage

- 11.1 Deliver and store the materials according to the Manufacturer's instructions and insure that all seals and labels are intact.
- 11.2 Deliver and store in an upright position all floor mounted equipment.
- 11.3 Close all equipment doors and keep them locked. Protect material from dust and damages.
- 11.4 If required block all moving parts to prevent their damage during shipping or moving and remove the blocks according to the manufacturer's recommendations.
- 11.5 Equipment scheduled for indoor installation shall be stored indoor or in a weather proof shelter.

12. Safe Keeping of Tools and Materials

12.1 The Contractor is responsible for the safe keeping of materials and tools which he brings on site. He shall assume all losses resulting from damages or thefts, vandalism or other depravation where his materials and/or his tools are concerned.

13. Cleanliness of the Site

13.1 The Contractor shall maintain the site free of debris, empty containers, used materials and pay for their regular removal from the site as the work progresses. At the end of the work, the Contractor shall evacuate from the site all excess debris and litter and leave the site clean and spotless.

14. Equipment Installation

- 14.1 Insure that maintenance and dismantling may be executed without moving of pipe joints or conduits by using flanges, unions or valves and insure that structural elements do not constitute obstacles. Dismantling must be done without draining pipes and/or stop supply of other equipment's.
- 14.2 All seals and labels from manufacturer and approving organization shall be readily seen and readable once the equipment is in its final location.
- 14.3 Unless indicated otherwise use the most recent manufacturer's written recommendations concerning materials, equipment and installation methods to be used.
- 14.4 Inform the Engineer in writing concerning any discrepancy between this specification and the manufacturer's instruction. The Engineer shall define which document to use.
- Supply anchoring devices and accessories of same metal and finish as that of the supporting element. Use non-corrosive anchors, supports and shims for outdoors and indoors.
- 14.6 Insure that floors and slabs onto which the equipment is to be mounted are on a level.

- 14.7 Verify all connections done at the factory and tighten if necessary to assure installation integrity.
- 14.8 Supply an easy means to lubricate the material, including "Lifetime" bearings.
- 14.9 Bring equipment drainage piping to drains.
- 14.10 Align the edges of equipment elements, as well as those of rectangular lids and of other similar articles, with the building's walls.

15. Coordination with Utilities

15.1 Coordinate the installation with utilities firms to make sure services are available when required.

16. Coordination with Other Divisions

- The drawings show the general arrangement of the systems. Plan and coordinate the works with that of other Divisions to prevent any interference and to insure ultimate use of space.
- The material and equipment shown on the drawings shall be installed in conjunction with pipes, conduits, ventilation ducts and material shown on drawings of other Divisions in order to prevent conflicts.
- Any conduit or material incorrectly installed because of faulty coordination, which conflict with piping, conduits, ducts or equipment of other Divisions specified in the tender documents shall be removed and properly installed without cost to the Owner.
- When an equipment or article is shown on a detail or elevation drawing from the Architect, they shall be installed as shown. No monetary compensation will be allowed to relocate these incorrectly installed parts due to not consulting such detail or elevation drawing before the installation.

17. Obstruction and Interference Drawings

- 17.1 Arrange equipment and materials for distribution networks in a manner to minimize the occupied space.
- 17.2 In case of an obstruction, the Engineer must approve the resulting equipment or material location change.
- 17.3 If required, prepare interference drawings to show that the equipment fits into the specified space and location without hindering the equipment of other Divisions and while still providing sufficient maintenance clearances for all concerned equipment.
- 17.4 The Engineer may require for a particular location the preparation of interference drawings should he suspect interferences in this particular location.
- 17.5 The Contractor is responsible for the coordination of the electromechanical elements location in the building, mostly in false ceilings, shafts and equipment rooms. He is also responsible for the preparation of interference drawings.

18. Provision for Future Expansion

18.1 When space is shown for future equipment, make sure that the equipment under this specification is installed in such a manner that the future equipment may be installed without the re-working of the floor, walls or ceiling or even a part of the electrical or mechanical equipment.

19. System Cleanliness

19.1 At the end of each working day, all pipes, conduits openings shall be capped, and equipment shall be covered to prevent the entry of dust, dirt or other foreign matter.

19.2 It is forbidden to use the Owner's garbage containers, compactor and plumbing fixtures to dispose of solvents, construction debris or other liquids.

20. Mounting Heights

- 20.1 Mounting heights are shown on the legend or on the drawings and are generally measured from the finished floor to the center of the equipment or outlet, unless indicated differently.
- 20.2 Mounting heights shown on the drawings are approximate and shall be confirmed by the Engineer or Architect.
- 20.3 If the equipment mounting height is not shown obtain the information from the Engineer before proceeding with the installation.
- 20.4 Final apparent equipment mounting heights shall be confirmed, on the site, by the Architect or Engineer.

21. Symmetry

Installation of the equipment, conduits and piping etc., to be symmetrical. They shall be installed in the same plan without unnecessary deviations and parallel to the building lines.

22. Painting and Retouching

- Clean, prepare surfaces and apply at least one coat of corrosion resistant primer to clamps, supports, ferrous metal parts, before shipping to the site unless parts are galvanized.
- 22.2 Galvanized parts which are later subjected to welding shall be painted with Galvicon or an approved equivalent coating.
- 22.3 Clean, prepare and retouch surfaces which are finished in the shop and which have been scratched or damaged during shipping and installation. Use a paint color assorted to the original color.

23. Access Doors

- Supply access doors in furred ceilings or spaces to service equipment's and accessories or for inspection of safety, operating or fire devices. Include all doors to access manual or automatic valves, flow monitor, traps, motors, mixing boxes, balancing dampers, motorized dampers, heating and cooling coils, filters.
 - Supply access doors according to the section responsible for their installation, in agreement with the section concerning walls and ceilings construction. The access door shall be installed by section erecting the walls or ceilings.
- Access doors shall be flush mounted 600 mm x 600 mm (24"x 24") for body entry and 300 mm x 300 mm (12"x 12") for hand entry unless otherwise noted. Doors shall open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Steel shall be prime coated.
- 23.3 Provide stainless steel access doors for tiled, marble or terrazzo or similar types of surfaces.
- Where ceilings and partitions are fire rated one hour and two hours provide access doors that are rated 45 minutes and one hour and a half respectively.
- 23.5 Access doors are not required in suspended ceilings with lay-in acoustic tiles.
- 23.6 Acceptable products: Acudor, Airobec, Can-Aqua.

24. Connection of Motors and Controls

- Unless otherwise indicated, Division 26 describe the starters, push buttons and other control devices, and method of installation for all motors. Divisions 21, 22, 23 and 25 describe the motors and variable frequency speed controllers. Division 26 together with Divisions 23, are responsible for the startup of motors. The installer shall be the sole responsible for the proper operation of his equipment.
- 24.2 Before operating motors for the first time check:
- 24.2.1 That the rotation of the motor is in the adequate direction for the equipment;
- 24.2.2 That the motor protection and overloads are appropriate;
- 24.2.3 All control and selector stations:
- 24.2.4 The voltage and current at the connection point of each motor;
- 24.2.5 The type of winding on motors;
- 24.2.6 The available voltage at each starter.
- 24.3 The Contractor shall submit to the Engineer the "Tests on motors" form, annexed to Division 26 of the specifications which shall show all readings required in the above paragraphs.
- 24.4 If necessary or if required by the Engineer, make arrangements for the presence of a manufacturer representative during motor start-ups.
- 24.5 No motor start up shall take place before the above procedures are implemented. The party responsible for starting up motors before first implementing these procedures shall solely assume all related costs for ensuing damages.

25. Equipment Start Up

- 25.1 Startup of the equipment to be done by the Manufacturer. The Contractor shall collaborate closely with the Manufacturer for the startup of the equipment, which shall be done with the Engineer in attendance.
- The Manufacturer shall insure the presence of a qualified technical representative to supervise the startup of the equipment and to verify, adjust, balance and calibrate various elements. Apply all corrective measures.
- Supply the above services for the desired period and for the necessary number of visits to start up the equipment and to insure its proper operation.

26. On Site Tests

- 26.1 Execute all tests required under the present specification. The following requirements are in addition to those required under the specification.
- 26.2 All tests shall be done with the Engineer in attendance and to his satisfaction.
- 26.3 The Engineer may require a test of the installations and equipment before acceptance.
- Obtain a written statement before attempting the temporary start up or testing of permanent equipment or installation before the acceptance by the Engineer.
- 26.5 Give the Engineer a 48 hours' notice before the tests.
- 26.6 Supply all metering equipment, materials and personnel for the execution of the tests during the course of the works up to the acceptance of the installation by the Engineer. Assume all related costs.

- Do not cover any part of the work without first having it tested and approved. Follow the work schedule and take all necessary steps to prepare for the tests.
- If a piece of equipment or component becomes defective during the tests, it shall be immediately replaced and all related costs shall be assumed by the Contractor, including those for recalibrating, balancing and adjustments.
- 26.9 Keep dust, dirt and debris from entering the installation and equipment during the tests.
- 26.10 Obtain from the Manufacturers and submit to the Engineer a letter confirming that each network has been installed to the manufacturer's satisfaction.
- 26.11 Submit all test results in writing to the Engineer.

27. Temporary Usage and Warranty

- 27.1 The temporary operation of electrical or mechanical equipment for testing or running-in purposes shall not imply that the said equipment has received the Owner's acceptance and shall not modify the terms of the warranty.
- The Contractor shall keep the responsibility for maintenance of the equipment during this temporary utilization period. The Owner will reject all claims for damages or failures during this period.
- 27.3 The warranty shall remain in force for its full duration notwithstanding the acceptance of the works, their payment or other conditions in the contractual documents.

28. As Built Drawings

- Additional copies of the drawings will be supplied by the Engineer for the production of as built drawings.
- 28.2 Carefully mark a copy of the drawings, using red color, showing all deviations of the work from the contractual drawings supplied, following the execution as it progresses. Keep this copy on the site for consultation by the Engineer or Owner's representative.
- 28.3 On this copy of the drawings indicate particularly without this being a limitation:
- 28.3.1 The location of all supplies and feeders to main and secondary services for each system.
- 28.3.2 The new final location of all relocated equipment.
- 28.3.3 Changes to circuit, zone and other arrangements.
- 28.3.4 Conduit diameters and number of installed conductors.
- 28.3.5 Exact location of underground or concealed work using coordinates from a reference point.
- 28.3.6 Submit a complete copy of the as built drawings to the engineer at the time of request for the substantial performance of the work. Such drawings shall reflect, at the termination of the work, the final state of the installation including the exact location of all equipment and all supplies.

29. Instruction of Operation Personnel

- 29.1 Supply the services of competent instructors to instruct the operation personnel in the maintenance, adjustment and operation of the equipment and all modifications performed on the equipment under the guarantee.
- 29.2 The instruction of the personnel shall take place during regular working hours and before the acceptance and handover of the systems to the Owner.
- 29.3 The operation and maintenance manuals shall be used during the instruction of the personnel.

30. Operation and Maintenance Manuals

- 30.1 Supply four (4) copies of the operation and maintenance manuals, in English, describing the operation and maintenance of the systems. Submit these copies to the Engineer at the time of request for substantial performance of the work.
- 30.2 Separate each section of the manuals with a blank sheet with colored tabs showing the proper identification. Insert an index, at the beginning of the manuals showing section titles and tab identification.
- 30.3 Each manual shall include:
- 30.3.1 Regular maintenance instructions (greasing, adjustment, calibration, lubrication etc.). Starting and stopping procedures, periodical verifications.
- 30.3.2 Detailed descriptive information on each constitutive component, construction characteristics, function of each component, to permit an easier maintenance, repair, transformation, prolongation and expansion of any part or characteristic of the installation.
- 30.3.3 A numbered list of all parts and components.
- 30.3.4 A list of all spare parts.
- 30.3.5 The names and addresses of all local suppliers of the items listed in the operation and maintenance manuals.
- 30.3.6 A copy of all approved shop drawings.

31. Receipts

- 31.1 Hand over to the Owner the followings articles:
- 31.1.1 Maintenance products and specified portable material.
- 31.1.2 Specified spare parts.
- 31.1.3 Keys for all material supplied with a lock.
- 31.2 Obtain from the Owner receipts for all above articles and hand them over to the Engineer.

32. Certificate of Compliance

- 32.1 Each sub-Contractor shall hand over to the Engineer, at the completion of the work, the certificate of compliance joined to this Section, by which he states that all works have been executed in compliance with the plans and specifications and conform to all applicable codes.
- 32.2 Submit this certificate to the Engineer at the same time as the request for substantial achievement of the work.
- 32.3 Have this form signed by a company executive and have the seal of the company apposed.

33. Warranty

- 33.1 All work performed under this Contract shall be contract by warranty for a period of one (1) year for materials and workmanship, except for the longer periods indicated in other sections. Longer warranties supplied by the manufacturers shall be transferred to the Owner.
- The Contractor shall, on receipt of notice in writing from the Owner, and at his own expense, make good all defects of whatever nature, which may develop during a period of one year.

In the event of the Contractor refusing or neglecting to do so, the Owner may employ some other person or persons to make good any such defects, loss or damage, and the expense of employing such person or persons to make good any such defects, loss or damage, shall be charged to and paid for by the Contractor and/or Insurance Company.

34. Seismic Protection

- 34.1 General
- 34.1.1 Contractor is responsible to evaluate, furnish and install seismic protection for all technical components installed under his responsibility.
- 34.1.2 Hire an Engineer, member in good standing of the Professional Engineer Ontario, for the evaluation of the seismic risk and calculation of seismic force resisting systems. The hired Engineering shall demonstrate recognized expertise in seismic protection. Contractor shall provide his contact details no more than two (2) weeks after contract signature.
- During an earthquake, seismic protection devices shall prevent permanent displacements and damages caused by vertical and horizontal motions and overturns.
- 34.2 Design criteria's
- 34.2.1 Site class D.
- 34.2.2 Importance category of building is normal (1.0).
- 34.2.3 Short period seismic hazard (Ottawa): 0.64
- 34.2.4 Seismic index: leFaS(0.2) = 0.73
- 34.2.5 Height of building
 - .1 Refer to Architectural Drawings
- 34.3 Evaluation and mitigation of seismic effects
- 34.3.1 Evaluation of seismic effects shall be done as per requirements of Part 4 of the Ontario Building Code.
- 34.3.2 Seismic force resisting systems shall be designed as per following standards:
 - NFPA 13 et 20;
 - SMACNA Seismic Restraint Manual Guidelines for Mechanical System;
 - ASHRAE Seismic and Wind Design;
 - FEMA;
 - Engineering documents from earthquake-resistant devices manufacturers.
- 34.4 Evaluation and mitigation of seismic effects report
- 34.4.1 Submit to the Engineer the evaluation and mitigation of seismic effects report before beginning the installation of the technical components.
- 34.4.2 The report shall include, at least, the following information:

- .1 General data for the project:
 - Location of the building;
 - General description of the building including height of the building (h_n);
 - Site class at the location of the building;
 - · Importance category of the building;
 - Value of S_a (0.2);
 - Value of Fa;
 - Value of le;
- .2 List of all technical components included in the contract which need to be have an evaluation of the seismic effects.
- .3 List of all technical components which may be exempted with the justifications.
- .4 For each technical component (CT) the evaluation of the seismic effect and the seismic force resisting system applied. Include following elements:
 - Identification of the CT as per drawings and specifications;
 - Location of the CT including height (h_x);
 - Description of CT including:
 - Type of equipment;
 - Make and model;
 - Dimensions:
 - Maiabt
 - Weight;
 - Category and values of C_p, A_r et R_p.
 - Calculation of lateral force V_p, and forces on building structure;
 - Description of the resisting system applied, including:
 - · Make and model of chosen material;
 - Installation drawing specific for this project;
 - Drawing showing the location of the seismic resisting systems.
- .5 For each CT located on the ground, on a slab or on an equipment base, the overturn force calculation and description of the resisting system. Included following elements:
 - Identification of the CT as per drawings and specifications;
 - Location of the CT including height (h_x);
 - Description of CT including:
 - Type of equipment;
 - Make and model;
 - Dimensions:
 - Weight;
 - Location of gravity center;
 - Calculation of the overturn force;
 - Description of the resisting system applied, including:
 - · Mark and model of chosen material;
 - Installation drawing specific for this project;
 - Drawing showing the location of the seismic resisting systems.
- 34.5 Installation
- 34.5.1 Install seismic force resisting system as per the indications of the evaluation and mitigation of seismic effects report.

- 34.5.2 Any modification to the seismic force resisting system for any reason, shall be subject to a new calculation by the Engineer responsible for the seismic protection, and issued as an amendment to the report.
- 34.5.3 Following requirements apply to the installation of electrical and mechanical material:
 - Power-driven and drop-in anchors are not permitted for traction loads;
 - C-clamps are not allowed to support CT unless they have a retainer mechanism;
 - · C-clamps are not allowed for seismic resisting systems;
 - Equipment base shall be anchored to the slab;
 - All vibration isolators shall be designed for seismic protection;
 - Oval bolt adjusting hole are prohibited.
- 34.6 Work approval
- 34.6.1 The Engineer who prepared the evaluation and mitigation of seismic effects report shall inspect the work related to the seismic force resisting systems.
- 34.6.2 Obtain from the seismic protection engineer a written and signed certification and report indicating that the seismic force resisting systems have been installed as per the report and the amendments to the report. Submit this certification and report before submitting of the work certificate of compliance.
- 34.6.3 Include in the operation and maintenance manual all documents issued by the seismic protection engineer.

35. Questions and Explanations

35.1 Questions shall be addressed to:

Mechanical

Mr. Bruno Tremblay from Pageau Morel & Associates Inc. Email: btremblay@pageaumorel.com Fax: (819) 776-4775 ext. 3223

Electrical

Mr. Jérôme Rivard from Pageau Morel & Associates Inc. Email: <u>irivard@pageaumorel.com</u> Fax: (514) 382-5150 ext. 2309

CERTIFICATE OF COMPLIANCE

PROJECT	:	
PROJECT ADDRESS	:	
TRADE	:	
SPECIFICATIONS SECTIONS	:	
	points,	quipments used, and all visible or hidden works that we performed or conform to drawings, specifications, addendum and changes of ageau Morel & Associates Inc.
TRADE NAME	:	
ADDRESS	:	
TELEPHONE NUMBER	:	
SIGNER'S NAME	:	
SIGNATURE	:	
TITLE	:	
		·

SEAL

RESPONSIBILITY DISCLAIM

PROJECT	:
PROJECT ADDRESS	:
OBJECT	: UTILIZATION CONVENTION OF ELECTRONIC DRAWINGS
electronic files having been used installation's drawings.	ase PAGEAU MOREL of any responsibility resulting from the use of the for tenders or construction, for the development of our own detailed
We recognize and agree:	
	les in question are lent to us free for our use only, and we commit ourselves ithout PAGEAU MOREL authorization;
That no insurance isThat we will not hold	given regarding coherent and exactitude of the enclosed information; d responsible PAGEAU MOREL additional clause that the electronic files in ertain inaccuracies or errors;
We commit ourselve	es checking the exactitude of information which are contained there, like if the totality of these drawings ourselves.
Also we will undertake:	
	and coordinate the accuracy of information, of existing conditions and enclosed as if we realized the electronic files."
ADDRESS	;
TELEPHONE NUMBER	:
SIGNATORY NAME	:
SIGNATURE	:
SIGNATORY TITLE	:
	FIN DE SECTION

7342-001-000

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1. Ownership

1.1 This Section is an integral part of Section 20 05 00 – "General Requirements Concerning Common Work Results".

2. Levels

2.1 Before proceeding with the installation of water, sewage or other piping, check all indicated levels on drawings to insure that indicated slopes could be obtained. By failing to do so or to advise the Engineer of all errors found on drawings, the Contractor is responsible for all necessary changes and this, without any additional charge.

3. Instrumentation Openings

- 3.1 Make provisions for all necessary openings for control instruments installation in piping of primary and secondary chilled water, steam and condensate, heating water, domestic hot water and all other piping, as well as in air ducts and equipment.
- 3.2 Openings to be wells, threaded inside, fitted to pipes and ducts and of sufficient length to allow insulation. Openings diameter and exact location to be determined with the supplier responsible for these instruments.

4. Motors

- 4.1 All required motors to be supplied integral to driven machinery.
- 4.1.1 Bearings of 1 HP motors and over to be fitted with facilities for lubrication and grease release. Fractional motors to have factory lubricated and sealed bearings.
- 4.2 Induction type, CEMA design B, wound stator, squirrel cage rotor, CEMA class B insulation, 90°C (162°F) temperature rise at 40°C (104°F) ambient temperature, type T frame, sliding base, ball bearings pillow block
- 4.3 Service factor to be 1.15 for open motors and 1.10 for totally enclosed motors. As a general rule, motors of less than ½ HP operate on a single phase, 120 Volts, 60 Hz electrical system and motors of ½ HP and over operate on a three phase, 600 Volts, 60 Hz system.
 - Motor connection junction boxes to be accessible at all times and located opposite to machinery.
- 4.4 All motors 30 HP and over to be provided with three (3) PTC type thermistors to protect windings against excessive temperature rises, compatible with type Siemens 3RN1 relay.
- 4.5 Paragraphs .1 to .4 do not apply to fire pumps.
- 4.6 Continuous duty motors of 1 HP and over to be of the high efficiency type with minimum efficiencies as follows, to CSA C390-93. These elements are excluded from this category:
 - Submersible drainage pump.

	Motors – Minimum efficiency								
Horsepower	3600 T/m		1800	1800 T/m		1200 T/m		900 T/m	
Horsepower	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC	
	Open	Enclosed	Open	Enclosed	Open	Enclosed	Open	Enclosed	
1 HP	77.0	77.0	85.5	85.5	82.5	82.5	74.0	74.0	
1,5	84.0	84.0	86.5	86.5	86.5	87.5	75.5	77.0	
2	85.5	85.5	86.5	86.5	87.5	88.5	85.5	82.5	
3	85.5	86.5	89.5	89.5	88.5	89.5	86.5	84.0	
5	86.5	88.5	89.5	89.5	89.5	89.5	87.5	85.5	
7,5	88.5	89.5	91.0	91.7	90.2	91.0	88.5	85.5	
10	89.5	90.2	91.7	91.7	91.7	91.0			
15	90.2	91.0	93.0	92.4	91.7	91.7			
20	91.0	91.0	93.0	93.0	92.4	91.7			
25	91.7	91.7	93.6	93.6	93.0	93.0			
30	91.7	91.7	94.1	93.6	93.6	93.0			
40	92.4	92.4	94.1	94.1	94.1	94.1			
50	93.0	93.0	94.5	94.5	94.1	94.1			
60	93.6	93.6	95.0	95.0	94.5	94.5			
75	93.6	93.6	95.0	95.4	94.5	94.5			
100	93.6	94.1	95.4	95.4	95.0	95.0			
125	94.1	95.0	95.4	94.4	95.0	95.0			
150	94.1	95.0	95.8	95.8	95.4	95.8			
200	95.0	95.4	95.8	96.2	95.4	95.8			

4.7 All motors associated with a variable frequency drive must comply with standard MG-1, part 31.

5. V-Belt Drives

- 5.1 Fit reinforced belts in sheaves matched to drive. Multiple belts on unit to be matched set.
- 5.2 Use cast iron or steel sheaves secured to shafts with removable keys.
- For motors ½ HP to 10 HP maximum, use standard adjustable pitch drive sheaves, having ±10% range. Use mid-position of range for specified rpm.
- For motors over 10 HP, use sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- 5.5 Minimum drive rating: 1.2 times nameplate rating on motor for fans and pumps of less than 10 HP and 1.5 times for 10 HP and over. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- 5.6 Mount motor on slide rail adjustment plates and provide space to allow for centre line adjustment.

6. Guards

- 6.1 Provide guards for exposed drives.
- 6.2 Guards for drives shall have:
- 6.2.1 Expanded metal screen welded to 25 mm (1") steel angle frame.
- 6.2.2 1.3 mm (18 gauge) thick galvanized sheet metal tops and bottoms.

- 6.2.3 Removable side (s) for servicing. 6.2.4 38 mm (1.5") diam. hole on shaft center for insertion of tachometer. 6.3 Provide means to permit lubrication and use of test instruments with guards in place. 6.4 Install belt guards to permit movement of motors for adjusting belt tension. 6.5 For flexible couplings, provide removable, "U" shaped, 2.7 mm (0.1") thick galvanized frame and 1.3 mm thick (18 gauge) expanded mesh face. 6.6 Provide galvanized mesh wire screen, prefabricated by manufacturer, on inlet or outlet of exposed fan blades. 7. **Sleeves and Openings** 7.1 Supply and install pipe sleeves at points where pipes pass through masonry or concrete. 7.2 Use cast iron sleeve or steel pipe sleeves with annular fin continuously welded at midpoint: 7.2.1 Where sleeve extends above finished floor. 7.2.2 Through mechanical or technical room floors. 7.2.3 Plastic sleeves are accepted in all other locations. 7.3 Sizes 7.3.1 6 mm (¼") clearance all around, between sleeve and pipes or between sleeve and insulation. 7.3.2 Provide sleeves for glass pipe minimum 50 mm (2") greater in diam. than pipe. 7.3.3 Where piping passes below footings, provide minimum clearance of 50 mm (2") between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing. 7.4 Terminate sleeves flush with surface of concrete and masonry and 50 mm (2") above floors. Not applicable to concrete floors on grade. 7.5 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp
- 7.5.1 Acceptable product: Jay R. Smith 1720 or approved equal.

flashing to clamp device; make watertight durable joint.

- 7.6 Fill voids around pipes.
- 7.6.1 Use prefabricated watertight packing rings in foundation walls and in floors below grade.
- 7.6.2 Acceptable product: "Link Seal" from Corrosion Services or approved equal.
- 7.6.3 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe and sleeve with fiberglass. Seal space at each end of sleeve with waterproof, fire retardant, non-hardening mastic.

device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof

- 7.6.4 Ensure no contact between copper tube or pipe and ferrous sleeve.
- 7.6.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint. (Galvicon).

- 7.7 Where pipes pass through fire rated walls, floors and partitions, pack space with mastic to CGSB 19-GP.9Ma or with fireproof caulking paste.
- 7.7.1 Acceptable products: Flame Safe from Thomas & Betts, Instant Firestop from Isolation Miral or approved equal.

8. Escutcheons and Plates

- 8.1 Provide escutcheons on pipes passing through finished walls, partitions, floors and ceilings.
- 8.2 Use chrome or nickel plated brass, solid type SS no. 302 with set screws for ceiling or wall mounting.
- 8.3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.
- 8.4 Where sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.
- 8.5 Secure to pipe or finished surface but not to insulation.

9. Dielectric Couplings

- 9.1 Provide dielectric couplings wherever pipes of dissimilar metals are joined.
- 9.2 Provide insulating unions for pipe sizes 50 mm (2") and under. Provide flanges with gasket having bolts mounted through plastic or fiber sleeves and washers for pipe sizes over 50 mm (2").

10. Vibration Isolation

- Supply and install springs, isolators, floating pads, etc. to reduce equipment vibration transmission, and on the three first hangers of piping at inlet and outlet of those equipment.
- 10.2 Elastomeric pads (type P)
- 10.2.1 Type P-1: Waffered or open neoprene pad, 50 durometer.
- 10.2.2 Type P-2: Mix plate made of two neoprene pads joined to a steel plate.
- 10.2.3 Acceptable products: Vibro-Acoustics, model N (type P-1) or model NSN (type P-2), Korfund, Vibron.
- 10.3 Elastomeric mounts (type M)
- 10.3.1 Type M-1: Color coded neoprene mounts in shear; 60 durometer.
- 10.3.2 Type M-2: Same as M-1 with steel cage for suspended load.
- 10.3.3 Acceptable products: Vibro-Acoustics, model MD (type M-1) or HD (type M-2), Korfund, Vibron.
- 10.4 Antiseismic Mounts (type MS)
- 10.4.1 General: Design for a minimum of 1.0 g acceleration force with neoprene cushions to reduce impacts.
- 10.4.2 Type MS-1: For on slab installation, steel construction with 2 thick neoprene cushions.
- 10.4.3 Type MS-2: For suspended load, steel construction with 2 thick neoprene cushions.
- 10.4.4 Acceptable products: VMC (Racan, model SR (type MS-1) and SRD (type MS-2), Mason.

- 10.5 Spring isolators (type R)
- 10.5.1 Select springs for a deflection no greater than $\frac{2}{3}$ the maximum deflection. Springs to be color-coded.
- 10.5.2 Type R-1: Open spring mounted on non-slip neoprene pad, with level adjustment and equipment bolting.
- 10.5.3 Type R-2: Enclosed single or double spring with neoprene pad, stabilizing rubber, level adjustment and equipment bolting.
- Type R-3: Enclosed limited displacement spring similar to R-2 with removable spacer plates and built-in resilient limit stops and control rod.
- 10.5.5 Type R-4: Box type hanger with steel box, hanger rod, spring guide and acoustic washer.
- 10.5.6 Acceptable products: Vibro-Acoustics, model FS (type R-1), model CM (type R-2), model CSR (type R-3), model SH (type R-4), Korfund, Vibron.
- 10.6 Anti-seismic Spring Isolators (type RS)
- 10.6.1 General: Design for a minimum of 1.0 g acceleration force with neoprene cushions to reduce impacts.
- Type RS-2: Enclosed single spring, neoprene pad, neoprene cushion, level adjustment and equipment bolting, for on slab installation. Space between adjustment bolt and enclosure is protected by an all direction neoprene grommet to prevent impacts.
- 10.6.3 Type RS-3: Enclosed limited displacement double spring similar to RS-2.
- 10.6.4 Acceptable products: VMC (Racan), model AEQM (type RS-2) and AWMR (type RS-3), Vibron, model FYS (type RS-2), Mason.
- 10.7 Structural bases (type B)
- 10.7.1 Type B-1: Structural steel base with pre-drilled holes to receive equipment anchor bolts and isolation elements.
- Type B-2: Structural steel frame base and reinforced concrete pad with welded in place steel rods. Welded base brackets to receive isolation elements. Poured in place concrete is done by Section 3300, under supervision of the present Section.
- 10.7.3 Acceptable products: Vibro-Acoustics, model S (type B-1) and C (type B-2), Korfund, Vibron.
- 10.8 Flexible Couplings (type J)
- Type J-1: Synthetic rubber joint, single arch, neoprene and nylon reinforcement fabric, and steel flange.
- Type J-2: Synthetic rubber joint, double arch, neoprene and nylon reinforcement fabric, steel triangle or threaded connectors.
- 10.8.3 Type J-3: Flexible stainless steel connector, limited displacement, steel flange and bolts.
- 10.8.4 Type J-4: Flexible stainless steel hose, flange or threaded connection.
- 10.8.5 Acceptable products: Flexonics, model R1 (type J-1), R2-U and R2 (type J-2), TCS-R (type J-3) and BSN, BCS, BSF (type J-4), FloFab ST, SM, SS (type J-4).

- 10.9 Vibration isolation base for rooftop ventilation unit
- Base for curb mounted rooftop equipment composed of anti-vibratory tracks supported by springs, fabricated of corrosion-resistant structural metal meeting the applicable para-seismic requirements, with springs housed within the para-seismic box beam structure and localized to support the required loads. Springs have adjustment knobs to level the ventilation unit independently of the base. The curb is surrounded by 50 mm thick thermal insulation panels in between springs. The base has joints with gaskets and other accessories required to resist water penetration from below the unit and to extend the sealing system of the roof at the curb.
- 10.9.2 Nominal deflection of 75 mm (3"). Operational deflection of 50 mm (2").
- 10.9.3 Conduct base installation and unit levelling according to the manufacturer's instructions. The manufacturer will need to provide an installation conformity report.
- 10.9.4 Fill the bottom of the interior cavity of the curb with a 100 mm (4") thick high-density fiberglass acoustic barrier.
- 10.9.5 Install acoustic panels in the cavity of the curb so as to completely close any residual openings. Panels are double-walled, 50 mm (2") thick, made of perforated steel sheets, and filled with high-density fiberglass covered with a protective film.
- 10.9.6 Acceptable products: Vibration Mountings and Controls (VMC) P&R series, Mason Industries RSC series.

11. Vibration Analysis

- 11.1 Generalities
- 11.1.1 It is necessary to conduct tests of vibration on rotating equipment to ensure that the level of vibration of equipment in operation is acceptable and that the vibration or noise are not transmitted to the frame of the building.
- 11.1.2 The analysis must be conducted by a firm specializing in the vibration analysis and tests, carried out by a technician with five (5) years of experience. The choice of the firm and the methodology used must be approved.
- 11.1.3 Vibration analysis applies to:
 - Fans and pumps equipped with a 3 HP and more motor;
 - The range of frequencies for variable frequency drive mechanisms.

11.1.4 Standards:

- ANSI/AMCA 204-05, 204-96;
- ANSI/ASA S2.71-1983 (R2006) and ISO 2631-2;
- ISO 14694-2003;
- ISO 14695-2003;
- ASHRAE (sound and vibration control).
- 11.1.5 The range of the frequencies to be used for analysis is between 600 cpm (10 Hz) and 600,000 cpm (10,000 Hz). The accuracy of the sensor bandwidth must be of the order of 1% of the scale of the sensor.

- 11.1.6 Criteria to meet are the following:
 - Non-filter global value for the complete bandwidth frequencies:
 - · Vibration maximum speed: 0.20 in./sec.
 - Filtered value (by bandwidth frequency):
 - Top vibration maximum speed: 0.10 in./sec.
- 11.2 Execution
- 11.2.1 Before proceeding with the analysis, it is essential that:
 - Ensure that the system is adjusted and balanced according to design requirements;
 - Visually inspect equipment to detect any installation error or any element creating obstruction;
 - Implement operation equipment and self-imposed it. If necessary, balance and/or align. In the case of bearings failure, replace the bearings.
- 11.3 Procedure
- 11.3.1 Take rotation speed readings of the equipment with a tachometer or a stroboscope
- 11.3.2 Take bearings for the turbine shaft and engine vibration readings with an accelerometer. Ensure that the accelerometer is firmly attached and that the surface of membership is free of any debris or rust.
- 11.3.3 Radial readings (horizontal and vertical) and axial are required for each equipment. The accelerometer must always be attached as close as possible of the bearing for radial readings and towards the center for axial measurements.
- 11.3.4 Submit an analysis of the equipment at high frequencies to detect mechanical defects (spike energy).
- 11.3.5 Submit the equipment at a time-frequency analysis to detect electrical errors.
- 11.3.6 Analyze gathered data and make needed corrections to operate the equipment within the acceptable limits of operation.
- 11.3.7 Submit a report to the Engineer with the following information:
 - Analyzed equipment identification and measured points, the date, recorded vibration values as well as the corresponding frequency and the used filter;
 - Tables and curves corresponding to the readings made at each measurement point;
 - Description of tests made on the equipment;
 - Used equipment;
 - Corrections made;
 - Analysis conclusion.
- 11.3.8 Acceptable manufacturers: Decibel Consultants, Hydrauliques R & O Services inc., Paul Gilles Vibration, Vibra K Consultants, Vibro Mec JPB, Silentec Consultants.

END OF SECTION

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1. Ownership

1.1 This Section is an integral part of Section 20 05 00 – "General Requirements Concerning Common Work Results".

2. Electrical code and CSA standards

- 2.1 Manufactured products to comply with related CSA Standards, although these Standards may not be specifically designated by number in this specification.
- 2.2 All electrical works shall conform to the Ontario Electrical Safety Code (26th edition-2015), specified standards and revisions in force at the time of the bid.

3. Material identification

- 3.1 Identify all equipment supplied under the present Division.
- 3.2 Distribution equipment
- 3.2.1 All panels, transformers, safety switches, junction and pull boxes, starters, contactors, each main panel circuit and all other supplied equipment under this Division shall bear an identification plate. See plate details on the drawings.
- 3.2.2 The plate shall bear the three (3) following identifications corresponding to those shown on the drawings:
 - Top: Identification of load apparatus (except for panels and motor control centers: no identification)

"P-0011"

Center: Equipment identification

"T-0011"

· Bottom: Identification of source apparatus

"PD-0011"

- 3.2.3 Use lamicoid plastic screwed on nameplates, with black letters machine engraved on white background. Use white letters on red background for equipment connected to the emergency network.
- 3.2.4 Provide enough space to engrave about 25 characters.
- 3.2.5 Submit list of identifications for approval.
- 3.2.6 Inside all main panels and splitter boxes, phases "A", "B", "C", "N" shall be identified by 51 mm (2") high letters.
- 3.3 120/208 V service panels.
- 3.3.1 Identify each panel circuit in the typewritten schedule inserted in a plastic holder on the inside of the panel door. The circuit numbers shall be those shown on the drawings. Theses schedules shall be included in the operation and maintenance manuals.
- 3.3.2 For modified electric panels, supply a new updated typewritten list.
- 3.4 Outlets
- 3.4.1 Identify all service outlets with a self-adhesive marker showing the panel and circuit numbers on the outside plate surface.
- 3.4.2 The adhesive marker shall be similar to Brother's P-Touch 2000. It shall have black lettering on clear substrate, normal 16 points lettering.
- 3.5 Conduits, boxes and cables
- 3.5.1 Assign a colour code to conduit, boxes, and metal armoured cables.

- 3.5.2 Apply color banding, paint or plastic tape, at every 15.2 m (50'-0") and at wall, ceiling or floor intersections on all cables and conduits.
- 3.5.3 Boxes shall be painted with brush and paint or with CFC free spray canisters.
- 3.5.4 The width of the base color band shall be 25 mm (1") wide and that of the complementary color shall be 19 mm ($\frac{3}{4}$ ") wide.
- 3.5.5 The color coding shall be as follows:

Network	Base color	Complementary color
Up to 250 V (120 and 120/208 V) normal	Yellow	
Fire Alarm	Red	
Telephone	Green	
Audio/visual	Green	Yellow
Security, door supervision, CCTV	Red	Yellow
Grounding	Green	Yellow-Green
Extra-low voltage lighting control	Blue	Yellow

3.5.6 Write the panel number and circuit numbers or its function on junction or pull box covers with a black felt pen marker.

Identification to be as follows:

C.1 : For circuit number

C.1 (P-100) : For circuit and panel number

Al : For fire alarm

TEL : For telephone

SEC : For security

COM : For communication

- 3.6 Wiring
- 3.6.1 Identify all wiring according to the applicable Electrical Code.
- 3.6.2 Every conductor in panels, relay boxes, motor control center, cabinets, etc., shall be identified with its circuit number with Z markers from Wieland or Thomas & Betts equivalent according to size.
- 3.6.3 Identify each conductor, inside equipment including junction boxes, with its circuit and panel number or its function (alarm, circuits 1, 2 3 etc.) with Thomas & Betts series WBC vinyl markers or equivalent from Wieland or Brady.
- 3.6.4 Wiring between relay boxes and lighting control panels.
 - .1 Identify connection points on incoming terminal strips from lighting control panels.
 - .2 Identify local controls with switch subscript at relay box terminal strip and lighting control panel terminal strip.

- 3.6.5 Fire alarm and communication wiring.
 - .1 Each conductor shall be identified as shown on the drawings, with Thomas and Betts series WBC vinyl markers or equivalent from Wieland or Brady, in each panel, junction or pull box, heat detector, ionization smoke detector, pull station, alarm bell, emergency telephone, end of line resistor or loud speaker.
 - .2 Since each zone cable is made up of two conductors, each shall be respectively labeled with the letters "A" and "B".

4. Nominal voltages

- 4.1 Operating voltages shall conform to standard CAN3-C235.
- 4.2 Each motor, electric heater and control and distribution device shall operate satisfactorily at a frequency of 60 Hz and inside voltage limits established in the above mentioned standard. Equipment to operate under extreme conditions mentioned in the standard without damage.

5. Abbreviations

- 5.1 CSA means Canadian Standards Association (CSA).
- 5.2 AMEEC means Association des manufacturiers de produits électriques et électroniques du Canada (see EEMAC).
- 5.3 ANSI means American National Standard Institute and replaces ASA, American Standard Association.
- 5.4 SSC means Supply and Services Canada (ASC).
- 5.5 ASTM means American Society for Testing and Materials.
- 5.6 BS means British Standard.
- 5.7 CBM means Certified Ballast Manufacturer.
- 5.8 CEMA means Canadian Electrical Manufacturer Association (now known as EEMAC).
- 5.9 CMB means Construction Materials Board (CMC).
- 5.10 NBC means National Building Code (CNB).
- 5.11 EEMAC means Electrical and Electronic Manufacturers Association of Canada (see AMEEC).
- 5.12 FM means Factory Mutual.
- 5.13 ICEA means Insulated Cable Engineers Association.
- 5.14 IEEE means Institute of Electrical and Electronic Engineers.
- 5.15 IES means Illuminating Engineering Society.
- 5.16 NEMA means National Electrical Manufacturer Association.
- 5.17 NFPA means National Fire Prevention Association.
- 5.18 CGSB means Canadian Government Standards Bureau (ONGC).
- 5.19 ULC means Underwriter's Laboratory of Canada.

- 5.20 The following abbreviations shall apply:
 - A ampere(s)
 - am amplitude modulation
 - AWG American Wire Gauge
 - ac alternating current
 - dc direct current
 - dB decibel(s)
 - fm frequency modulation
 - Hz Hertz
 - kHz kilohertz
 - kV kilovolt(s)
 - kVA kilovoltampere(s)
 - kW kilowatt(s)
 - kWh kilowatthour(s)
 - Im lumen
 - mA milliampere
 - MHz megahertz
 - rms root-mean-square
 - rpm revolution-per-minute
 - · vhf very high frequency
 - uhf ultra high frequency
 - V volt(s)
 - W watt(s)
- 5.21 Refer to CSA Standard Z85 for other abbreviations.

6. Passage through walls and ceilings

- 6.1 Sleeves shall be installed prior to the pouring of concrete. Sleeves passing through concrete shall be schedule 40 steel pipes, having a sufficiently large diameter to allow free passage of the conduit and exceeding the floor or wall by 51 mm (2").
- When cables or conduits pass through a fire rated wall or ceiling, fill the space between the sleeve and the cables or conduits with ULC or FM approved sealant. The fire rating of the installation shall be equivalent to the fire rating of the wall or ceiling being traversed. Acceptable products: Wieland, Nelson, 3M, Thomas and Betts.

7. Location of outlets

- 7.1 The location of apparatus and outlets shown on the drawings is approximate. The exact location shall be satisfactory and conform to instructions and requirements of this specification and satisfy the conditions at the moment of installation. Consult with the Engineer as required.
- 7.2 Do not install outlets back to back in the same wall; leave a 150 mm (6") space between boxes.
- 7.3 The Engineer may request the relocation of outlets, without cost or credit, providing that the request be made prior to the installation, inside a 3.05 m (10') radius of the original location and that the installation is similar to the original type.
- 7.4 Make necessary adjustments when interior finish is completed.
- 7.5 When outlets are shown on exterior walls use flexible polyethylene vapour barriers lberville model VB.1, 2, 3 and/or 54 to keep the wall integrity. The installation shall be according to the manufacturer's recommendation.

8. Electrical schematics

- 8.1 Supply Engineer's drawing showing the schematic electrical distribution, framed and Plexiglass covered at the following locations:
- 8.1.1 Main electrical room.

9. Coordination of protection devices

9.1 Insure that circuit protection devices, such as overloads relays and fuses are in agreement with required capacities and adjusted to values as specified.

10. Load balancing

- Distribute the loads in order to balance the phase current of the circuits as closely as possible and note all required modifications to the original layout. Confirm the results to the Engineer in writing. Phase currents, under normal conditions, of distribution, lighting and service panels shall be measured at the moment of acceptation of the work.
- 10.2 Read the phase voltages under load and adjust the transformer taps so that the obtained voltage is within 2% of the required equipment nominal value.
- When loads or panels are to be connected to an existing panel on distribution, measure the current on the existing panel or distribution supply feeder when all of the existing installations are in normal service. Verify that the space capacity required for the new loads to be connected is available. If the spare capacity required is unavailable, inform the Engineer in writing and obtain its instructions before the execution of the work.
- 10.4 At the achievement of the work, submit a report showing all normal load currents, taken on phases and neutral of distribution panels, dry type transformers and motor control centers. Indicate the date and hour of each reading with the circuit voltage at that time.

11. Insulation test

- With a 500 V megger, test the insulation value of circuits, supply cables and equipment rated at 350 V or less.
- 11.2 With a 1,000 V megger, test the insulation value of supply circuit cables and equipment rated between 350 V and 600 V.
- 11.3 Test the resistance to ground value before applying voltage.
- 11.4 Verify that the values are within the acceptable limits set by the applicable Electrical Code, otherwise, apply corrective measures.

12. Separate neutrals

- 12.1 All new circuits include the hot wire (black wire) and separate neutral (white wire) from the outlet or equipment to the respective terminal strips in electrical panels.
- All new isolated circuits include the hot wire (black wire), separate neutral (white wire) and separate isolated ground (green wire in EMT conduit; red wire in "BX" cable including green tape on both ends and at all junction and outlet boxes) from the outlet or equipment to the respective terminal strips in electrical panels.

13. Areas protected by sprinklers

- 13.1 Except otherwise noted, the building is protected by an automatic fire extinguishing system (wet sprinklers).
- All electrical equipment having openings for ventilation, bus duct connection, etc., shall be designed for installation in sprinkler protected rooms. This applies, among others, to panels, transformers, switchboard, automatic transfer switchers, etc.
- The construction and installation of equipment shall prevent the water from sprinkler system to penetrate into the equipment and touch live parts or components.
- Insure that water coming from sprinkler system which could remain on top equipment cannot enter inside the panel box by openings for penetration of conduits, cables, bus ducts, etc. use watertight connectors. Seal all penetrations on top of electrical apparatus.

14. Marking against electric shocks and arcs

- 14.1 Contractor shall supply and install appropriate warning marking on equipment subject to require inspections, adjustments, repairs or maintenance under live conditions, according to the article 2-206 of the applicable Electrical Code. Marking shall be installed on following equipment, among others:
 - starters, disconnect switches, breakers and splitter troughs;
 - Distribution and utilization panels;
 - Equipment power panels and control panels.

15. Voltage drop in branch circuit

15.1 A voltage drop greater than 2 % in branch circuit wiring for receptacle or equipment, shall be considered unacceptable and will have to be corrected by the electrical contractor at is own expense.

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1. Equipment

- 1.1 Manufacturer's nameplates
- 1.1.1 Provide metal nameplate on each piece of equipment, mechanically fastened with raised or recessed letters.
- 1.1.2 Provide Underwriters' Laboratories and/or CSA registration plates, as required by respective agency.
- 1.1.3 Manufacturers nameplate to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.
- 1.1.4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.
- 1.2 System nameplates
- 1.2.1 Provide laminated plastic plates with white face and black center of minimum size $90 \times 40 \times 2.5 \text{ mm}$ (3.5" x 1.5" x 0.1") nominal thickness, engraved with 6 mm ($\frac{1}{4}$ ") high lettering. Use 25 mm (1") lettering for major equipment.
- 1.2.2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.
- 1.2.3 Identify equipment type and number (e.g. Pump no. 2) and service or areas or zone of building served (e.g. South Zone Chilled Water Primary).
- 1.2.4 Submit list of nameplates for review prior to engraving.

2. Piping

- Comply with standard detail drawings "Identification of Piping Systems".
- 2.2 Identify medium in piping with manufactured markers showing name and service including temperature, pressure and directional flow arrows.
- 2.3 Apply primary colors and secondary color bands on finished piping surfaces, in exposed areas only, to indicate type and degree of hazard.

2.4 Colours used

Primary Classification		ssification Secondary Classification		Legend and Type and Direction Arrows	
Yellow	505-101	Orange	508-102	Black	512-101
Green	503-107	Purple	511-101	White	513-101
Blue	202-101	Black	512-101		
Red	509-102	Yellow	505-101		
		White	513-101		

2.5 Conform to the above schedule for painted piping. 2.6 Manufactured pipe markers and color bands. 2.6.1 Plastic coated cloth material with protective over coating and waterproof contact adhesive undercoating, suitable for continuous operating temperature of 150 C (300 F) and intermittent temperature of 200 °C (400 °F). Apply to prepared surfaces. 2.6.2 50 mm (2") wide tape single wrap around pipe or pipe covering with ends overlapping one pipe diameter but not less than 25 mm (1") for color bands. 2.6.3 Block capital letters 50 mm (2") high for pipes of 75 mm (3") nominal and larger OD (including insulation) and not less than 20 mm (3/4") high for smaller diameters. 2.6.4 Direction arrows 150 mm (6") long by 50 mm (2") wide for piping of 75 mm (3") nominal or larger OD including insulation and 100 mm (4") long by 20 mm (3/4") wide for smaller diameters. Use double headed arrows where direction of flow is reversible. 2.6.5 Black pipe marker letters and direction arrows, white on red background for fire protection pipe markers. Acceptable products: SMS, WH Brady (tapes, bands, markers, tags), CFB Design. 2.6.6 2.7 Where colors differ submit legends with color classifications to Engineer for approval before ordering material. 2.8 Location 2.8.1 Locate markers and classifying colours on piping systems so they can be seen from floor or platform. 2.8.2 Piping runs at least once in each room. 2.8.3 Maximum 15 m (50') between identifications in open areas. 2.8.4 Both sides where piping passes through walls, partitions and floors. 2.8.5 At point of entry and leaving, where piping is concealed in pipe chase or other confined space, and at each access opening. 2.8.6 At start and end points of runs and at each piece of equipment. 2.8.7 At major manual and automatic valves immediately upstream of valves. 2.8.8 Identify branch, equipment or building served after valve.

2.9 Table: Pipe and valve identification

Pipe Marker Legend	Valve Tag Legend	Primary colour	Secondary colour
Cold water	C.W.	Green	None
Dom hot water supply	D.H.W.S.	Green	None
Dom hot water recirc	D.H.W.R.	Green	None
Heating water supply	H.W.S.	Yellow	Black
Heating water return	H.W.R.	Yellow	Black
Make-up water	M.U.W.	Yellow	Black
Boiler feed water	B.F.W.	Yellow	Black
Storm sewer	S.S.	Green	None
San sewer	SAN. S.	Green	None
Refrigerant liquid R410A	REF.L. (R410A)	Yellow	Black
Refrigerant gas R410A	R.E.F.G. (R410A)	Yellow	Black
Engine exhaust	E.E.	Yellow	Black
Fuel oil	F.P.	Yellow	Orange
Natural gas	N.G.	Yellow	Orange
Fire protection water	F.P.W.	Red	White
Sprinkler water	S.W.	Red	White
Vent (plumbing)	V.P.	Green	None
Vent (nat. gas)	V.	Yellow	Black

3. Ductwork

- 3.1 Use 50 mm (2") high black-stenciled letters with directional flow arrow.
- 3.2 Maintain maximum 15 m (50') distance between markings.
- 3.3 Identify ducts each side of dividing walls or partitions and beside each access door.
- 3.4 Stencil over final finish only.

4. Valves and Controllers

- 4.1 Provide brass tags with 13 mm (½") stamped code lettering and numbers filled with black paint, secured with brass chains or "S" hooks for valves and operating controllers (except at plumbing fixtures and radiators) except at plain sight of equipment they serve.
- 4.2 Provide Engineer with, six (6) identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.
- 4.3 Install where directed one (1) copy of flow diagram and valve schedule mounted in glazed frame. Provide one (1) copy in each operating and maintenance instruction manual.
- 4.4 Consecutively number valves in systems.

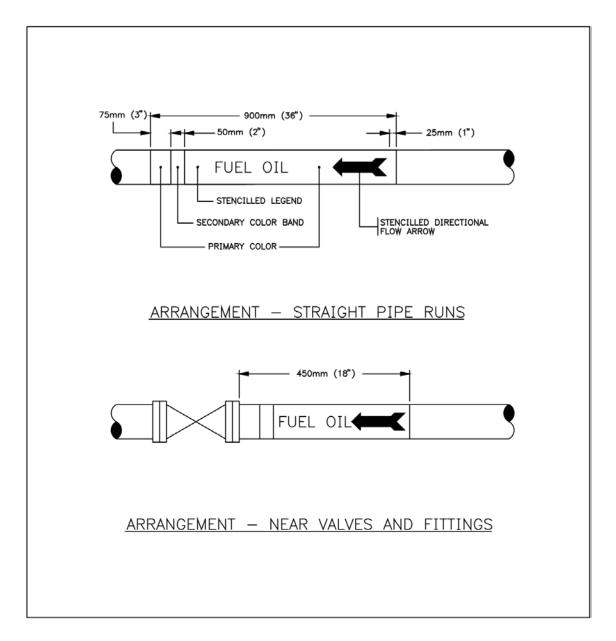
5. Ceilings

5.1 Supply self-adhesive vinyl disc, 12 mm (½") diameter and affix them on ceiling metallic "T" or access doors.

5.2 Color codes

SERVICE	COLOUR CODE	EQUIPMENT
Plumbing	Blue	Stop valves
Fire protection	Red	Zone valves
Heating	Yellow	Stop valves Balancing valves Control valves
Cooling	Black	Stop valves Balancing valves Control valves
Ventilation	Green	Terminal boxes Motorized dampers

Identification of Piping Systems System Using Stencils



END OF SECTION

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APPENDIX

Water Flow Test

PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Performance documents

1.2.1 The current fire protection documents (drawings and specifications) are to be used as "performance" documents. This document is presented as additional design criteria. The contractor is responsible to provide a complete set of drawings issued with the identification "Issued for Construction" stamped and signed by a Professional Engineer, member in good standing of the Professional Engineers Ontario.

1.3 Summary

1.3.1 Content of this Section

- .1 Materials, equipment's and installation methods associated with piping network and hose connection.
- .2 Materials, equipment's and installation methods associated with wet pipe sprinkler system serving heated areas.
- .3 Materials, equipment's and installation methods associated with dry pipe sprinkler system.

1.4 Reference Standards

- 1.4.1 Unless otherwise specified, execute work as per the following standards and regulations:
 - .1 Provincial, regulations, related to construction and fire, and as approved by the Provincial Fire Marshall.
 - .2 Standards: FCC403M-1982 Automatic Sprinkler System and FCC 410-M1979, Fire Alarm Systems.
 - .3 National Fire Protection Association Standards:
 - NFPA 13 Installation of Sprinkler Systems;
 - NFPA 14 Standpipe and Hose Systems.
 - 4 To NFPA 13 guide, published by the Insurer's Advisory Organization, No IAO-G13.

1.5 Design Criteria

- 1.5.1 Light Hazard Occupancy: existing building & addition
 - .1 Nominal flow 0.068 l/s / m² (0.1gpm/sq.ft.) at 50 kPa (7 PSI) minimum service pressure, considering the coverage area.
 - .2 Coverage area, approximately 139 m² (1500 sq.ft.).
- 1.5.2 Ordinary hazard occupancy, group 1: Mechanical room & general storage
 - .1 Nominal flow 0.1 l/s / m² (0.15 gpm/sq.ft.) at 50 kPa (7 PSI) minimum service pressure, considering the coverage area.
 - .2 Coverage area, approximately 139 m² (1500 sq.ft.).

- 1.5.3 Hose allowance as per NFPA 13 requirement. An engineer must seal calculations.
- 1.5.4 Allow for a minimum reserve of 5 PSI to take into account fluctuation from the source.

1.6 Water Supply

- 1.6.1 A 6" NPS connection to the building is already installed and capped at the wall in the basement see drawing for exact location.
- 1.6.2 The water flow test shall be conducted no more than 12 months prior to working plan submittal unless otherwise approved by the authority having jurisdiction. In annexe see water test done in 2012.
- 1.6.3 Submit hydraulic calculations signed by an engineer as well as dynamic tests on the water system. The plans associated with hydraulic calculations must be signed and sealed by an engineer.

1.7 Contractor Construction Drawings and Calculations

- 1.7.1 Before beginning work, contractor shall submit a complete set of drawings issued with the identification "Issued for Construction" stamped and signed by a Professional Engineer, member in good standing of the Professional Engineer Ontario.
 - 1 The drawings identified above shall be submitted for the Engineer inspection, in accordance with General Requirements of Section 20 05 00 and of Authority having jurisdiction.
- 1.7.2 Construction drawings shall clearly indicate:
 - .1 Name of Owner.
 - .2 Location, including street address.
 - .3 Point of compass.
 - .4 Ceiling construction.
 - .5 Full height cross section.
 - .6 Location of firewalls.
 - .7 Occupancy of each area or room.
 - .8 Location and size of blind spaces and closets.
 - .9 Any questionable small enclosures in which no sprinklers are not to be installed.
 - .10 Size of city main in street, pressure and whether dead-ended or circulating; if dead-ended, direction and distance to nearest circulating main, with city main test results.
 - .11 Other sources of water supply, with available pressure or elevation.
 - .12 Make, type and orifice size of sprinklers.
 - .13 Temperature rating and location of high temperature sprinklers.
 - .14 Number of sprinklers on each riser and on each zone by floors, and total area protected by each one on each floor.
 - .15 Number of sprinklers on each riser and total per floor.
 - .16 Make, type, model and size of alarm check valve.

- .17 Trade name, type, model and dimensions of pre-action valves (dry and double interlock).
- .18 Kind and location of alarm bells.
- .19 Total number of automatic sprinkler heads of each dry, wet and pre-action automatic extinguishing system.
- .20 Approximate capacity of each dry-type system, in litres (gallons).
- .21 Cutting lengths of pipe or centre-to-centre dimensions.
- .22 Crosses, riser nipples and size.
- .23 Type of hangers, inserts and sleeves.
- .24 All control valves, checks, drain pipes and test pipes.
- .25 Small hand hose and hose equipment.
- .26 When drawings include underground pipes, mention the pipe class and diameter, type of valves, meters and pits for valves, and depth of top of pipe below grade.
- .27 Arrangements for network drainage.
- .28 When the installation is an extension from an existing network without external supply, a sufficient part of the existing system must be shown on drawings, to indicate the total number of sprinkler to be supplied and to make all conditions clear.
- .29 Name and address of contractor.
- 1.7.3 Over and above that called for above, show the following in to the hydraulically designed calculations:
 - .1 Hydraulic reference points to be designated by letter or number and to correspond to the comparable reference points shown in the hydraulic calculation sheets.
 - .2 Description of sprinklers used.
 - .3 System design criteria: minimum rate of water flow, design area of water application for both inside hose and outside hydrants.
 - .4 Actual calculated requirements: total quantity of water and pressure required at a common reference point for each system.
 - .5 Elevation data including relative elevation of sprinkler junction points and supply of reference points.
- 1.7.4 The results of hydraulic calculations must be submitted on a printed form including a summary, a detailed work description and a graphic. The results of hydraulic calculations must be stamped and signed by a Professional Engineer, member in good standing of the Professional Engineer Ontario
- 1.7.5 Submit calculations of hydraulically designed systems on form sheets, including summary sheet, detailed work sheets and graph sheet.
- 1.7.6 On summary sheet, clearly indicate:
 - .1 Date.
 - .2 Location.
 - .3 Description of hazard.

- .4 Name and address of contractor or designer.
- .5 Name of approving agency.
- .6 System design requirements, including design area of water application, minimum rate of water application (density) and area per sprinkler.
- .7 Total water requirements as calculated including allowance for inside hose and outside hydrants.
- .8 Water supply information.
- 1.7.7 On detailed work sheets or computer printout sheets, clearly indicate:
 - .1 Sheet number.
 - .2 Sprinkler description and discharge constant (K).
 - .3 Hydraulic reference points.
 - .4 Flows in I/s (USgpm).
 - .5 Pipes size.
 - .6 Pipe lengths, centre to centre of fittings.
 - .7 Equivalent pipe lengths for fitting and devices.
 - .8 Friction loss in kPa/m (PSI/ft) of pipe.
 - .9 Total friction loss between reference points.
 - .10 Elevation head in kPa (PSI) at each reference point.
 - 11 Required pressure in kPa (PSI) at each reference point.
 - .12 Velocity pressure and normal pressure if included in calculations.
 - .13 Notes to indicate starting points, reference to other sheets or to clarify data shown.
- 1.7.8 Graph paper of semi-logarithmic type to contain water supply curves and systems requirements plus inside and outside hose requirements so as to present a graphic summary of complete hydraulic calculation.
- 1.8 Maintenance Materials (Sprinkler Heads)
- 1.8.1 Provide lockable metal cabinet containing spare sprinkler heads of each type and melting point temperature. Including sprinkler wrenches and keys for emergency repair work, as per NFPA 13.
- 1.8.2 Special key designed for automatic sprinklers.
- 1.8.3 Automatic sprinkler spare parts stock shall include the following sprinklers:
 - .1 For networks not exceeding 300 water sprinklers: 6 heads.
 - .2 For networks having 300 to 1000 water sprinklers: 12 heads.
 - .3 For networks having over 1000 water sprinklers: 24 heads.

1.9 Dimensions and Layout

- 1.9.1 Follow the layout as shown on drawings for the location of sprinkler heads, piping and all accessories.
- 1.9.2 In no case, shall pipe sizes be less than those shown on drawings.
- 1.9.3 Follow the symmetry regarding the layout of sprinkler heads vs ceiling tiles and accessories.

PART 2 - PRODUCTS

2.1 Piping and Fittings

2.1.1 Piping

- .1 Wet System: black steel according to ASTM A53, for a minimum operating pressure of 1200 kPa (175 PSI) and maximum of 2070 kPa (300 PSI).
- .2 Dry systems: galvanized steel according to ASTM A795 (including galvanized inner pipe wall) for minimum operating pressure of 1200 kPa (175 PSI) and maximum of 2070 kPa (300 PSI).
- .3 To weld (not permitted for galvanized steels pipe) or to groove by rolling
 - Up to NPS 50 mm (2"); schedule 40;
 - NPS 65 mm (2½") and greater; schedule 10.
- .4 To be threaded or to groove by cutting
 - All sizes, schedule 40.
- .5 Pipes with a corrosion resistance ratio (CCR) below 1 must not be used.

2.1.2 Fittings:

- .1 Fittings for pressure 1200 kPa (175 PSI)
 - Threaded cast iron: class 125, ANSI B16.4.
 - Flanged cast iron: class 125, ANSI B16.1.
 - Threaded malleable iron: class 150, ANSI B16.3.
 - Steel to be welded: ASTM-A-234.
 - Flanged, for class 300 piping and fittings ANSI B16.5.
 - Couplings and fittings for grooved piping.
 - Acceptable products: Victaulic, Gruvlock or equal.
- .2 Fittings for pressure 2070 kPa (300 PSI)
 - Threaded cast iron: class 250, ANSI B16.4.
 - Threaded malleable iron: class 300, ANSI B16.3.
 - Steel to be welded: ASTM A-234.
 - Flanged for piping and fittings: class 300 ANSI B16.5.
 - Couplings for grooved piping (rolled or machined).
 - Acceptable products: Grinnell, Victaulic.
- 2.1.3 Flange bolts: square or hexagonal head bolts, heavy-duty hexagonal nuts, ASTM A307.
- 2.1.4 Flange gaskets: 1.6 mm (1/16") regular or red rubber woven reinforced; ANSI B16.20 1973 and ANSI B16.21-1978.
- 2.1.5 Gaskets for grooved piping.

2.1.6 Pipe hangers and supports

- .1 Support from structural members. Where structural support does not exist suspend hangers from steel channels or angles. Provide and install supplementary structural members. Obtain approval before using vertical expansion shields. Do not suspend from metal deck. Conform to equipment manufacturer recommendations.
- .2 Acceptable products: Anvil 260 et 261, UL et FM.

2.2 Valves

- 2.2.1 Valves: of one manufacturer for fire protection: ULC listed; bearing manufacturer's name, trademark and FM identification figure number and pressure rating.
- 2.2.2 Unless otherwise specified or indicated design for 1.2 MPa (175 PSI) working water pressure.
- 2.2.3 Valves over NPS 50 mm (2") nominal shall have rising stems and be repackable under pressure. Supply hand wheel made of malleable cast iron. Valves not exceeding NPS 50 mm (2") diameter can be provided with or without rising stems.
- 2.2.4 UL and FM approved butterfly valves with gear mechanism can be used.
- 2.2.5 Acceptable products: Jenkins, Crane, Grinnell, Keystone.
- 2.2.6 Valves on fire lines and standpipes: Provide with contacts and devices necessary for operation of supervisory system specified under "Fire Detection and Alarm System", division 16.
 - .1 For valves NPS 15 to 65 mm (½" to 2½"), use Potter OSYS-U A-1 with N.O. SPDT contact.
 - .2 For valves NPS 75 (3") and over, use Potter OSYS-U with N.O. SPDT contact.
 - .3 For butterfly valves use Potter PCVS with N.O. SPDT contact.

2.3 Gate Valves

- 2.3.1 Valves 50 mm (2") and under: bronze to ASTM B61-80 double disc screwed ends, exterior stem and yoke, or standard.
- 2.3.2 Valves 65 mm (2½" and over: Underwriters' Laboratories pattern, iron body, bronze mounted, with OS & Y, double disc or wedge, flanged ends.

2.4 Globe Valves

- 2.4.1 Valves 50 mm (2") and under: bronze to ASTM B61-80 screwed ends, composition disc replaceable without removing valve from line.
- 2.4.2 Valves 65 mm (2½") and over: iron body, bronze mounted, OS&Y, flanged ends bolted bonnet and yoke, bronze seat, solid bronze disc, seat and disc replaceable without removing valve from line.

2.5 Butterfly Valves

2.5.1 UL approved, iron body, bronze disc, replaceable soft gasket and seat, union grooved or flanged ends.

2.6 Check Valves

2.6.1 NPS 50 mm (2") and under bronze to ASTM B61-80, for horizontal or vertical mounting, composite and replaceable disc, screwed caps and ends.

2.6.2 NPS 65 mm (2½") and over, iron body, bronze mounted UL listed, replaceable seat and disc without removing valve from line, flanged caps and ends. For horizontal or vertical mounting.

2.7 Pressure Reducing Valve

- 2.7.1 Combined check valve stop valve and pressure reducing valve, operated automatically by inner hydraulic controls; outlet pressure controlled under all flow and no flow situation, ULC approved.
- 2.7.2 Acceptable product: Elkhart, model UR.

2.8 Automatic Sprinkler Heads

- 2.8.1 Standard upright sprinkler head.
- 2.8.2 Standard pendant sprinkler head.
- 2.8.3 Sidewall sprinkler head.
- 2.8.4 Ceiling sprinkler head, semi-recessed type when there is no otherwise indication on the drawings and specification.
- 2.8.5 Bronze finish sprinkler head to be installed in: mechanical room, electrical room or exposed ceiling.
- 2.8.6 Dry pendant sprinkler head with observation rod, to be installed in freeze, risk areas: roof space in the existing building.
- 2.8.7 High temperature sprinkler head as required.
- 2.8.8 Automatic sprinklers in elevator machine rooms or at the tops of hoist ways shall be of ordinary- or intermediate-temperature rating.
- 2.8.9 Sprinklers in an unventilated, concealed space, under an uninsulated roof, or in an unventilated attic shall be of the intermediate-temperature classification.
- 2.8.10 Sprinklers shall be listed and bear certification marking of nationally recognized testing agency.
- 2.8.11 For light hazard occupancies, sprinklers shall be of the quick response type.
- 2.8.12 Provide minimum 12 mm (½") nominal diameter discharge orifice. Smaller orifice sprinkler usage must be approved by authorities having jurisdiction.

2.9 Wet-Type Systems

- 2.9.1 Complete system to include:
 - .1 Flow switches (Vane-type).
 - .2 Indicating-type valves.
 - .3 Pressure gauges.
 - .4 Piping and fittings.
 - .5 Valves.
 - .6 Hangers.
 - .7 Floor and ceiling escutcheon plates.

- 2.9.2 As per NFPA 13, a wet pipe system shall be provided with a listed relief valve not less than 1/2 in. (12 mm) in size and set to operate at 175 psi (12.1 bar) or 10 psi (0.7 bar) in excess of the maximum system pressure, whichever is greater, unless auxiliary air reservoirs are installed to absorb pressure increases.
- 2.9.3 As per NFPA 13 2016, a single air vent located near a high point in the system shall be provided on each wet pipe system utilizing metallic pipe, note this is not mandatory for project required for the edition before 2016 of NFPA 13.

2.10 Dry-Type Systems

- 2.10.1 Complete dry pipe sprinkler system must include:
 - .1 Dry pipe alarm valve.
 - .2 Sprinkler accelerator.
 - .3 Water supply control valve.
 - .4 Electric air compressor.
 - .5 Automatic device to maintain air pressure.
 - .6 Water and air pressure gauges.
 - .7 Piping and fittings.
 - .8 Valves.
 - .9 Hangers.
 - .10 Floor and ceiling escutcheons plates.
- Valves on water supply and close-off valves of fire alarm system shall be of the indicating type. Alarm check shall be in conformity with standard ANSI/NFPA 13, approved by the ULC for use in a fire protection system, equipped with quick opening device and ancillaries such as drainage valves, check valves water priming device, alarm fittings, water and air pressure gauges, and hardware accessories.
- 2.10.3 Alarm check: to mount as indicated.
- 2.10.4 Installation to include hydraulic alarm devices of the main alarm valve; provide a pneumatic low-pressure default alarm transmitter, to be wired to central guard station.
- 2.10.5 For system size of more than 500 gal (1900 L) but not more than 750 gal (2850 L), a quick opening device shall be installed.
- 2.10.6 Air compressor: electric (120 V, 60 Hz) to rebuild normal pressure within 30 minutes or less, low differential pressure operated.
- 2.10.7 Air pressure to be maintained 100 to 130 kPa (15 19 PSI) above normal operating pressure of valve.
 - .1 Acceptable products: Viking D-1 or approved equal.
- 2.10.8 For each compressor provide a dryer able to provide a dew point of -40°C (-40°F).
 - .1 Acceptable products: Viking 01285A or approved equal.

2.11 Pumper Connection

- 2.11.1 Provide the indicated Siamese connection: to mount as indicated, to supply main fire protection piping, fire hoses on standpipe system and sprinkler system.
- 2.11.2 Provide connection with two NPS 65 mm (2½") female hose connections fitted with caps and chains. Thread connection to suit Fire Department.
- 2.11.3 Piping from connection shall be NPS 100 mm (4") minimum.
- 2.11.4 Include horizontal check valve and automatic drip discharging to nearest floor drain.
- 2.11.5 Identify pumper connection with bilingual sign having raised letters at least 25 mm (1") in size cast on plate or fitting reading. Identification to be as follows: COLONNE D'INCENDIE SPRINKLERS.
- 2.11.6 Acceptable product: CFH or approved equal.

2.12 Test valve and draining

- 2.12.1 Including multi-tap test port and viewfinder for testing and drainage network.
- 2.12.2 Designed for an operating pressure of 2068 kPa (300 PSI).
- 2.12.3 Approval ULC et FM.

2.13 Flow indicator

- 2.13.1 Flow indicator for each area and accessories required. Neoprene gasket, adjustable delay from 0 to 90 seconds, 450 PSI, FM approved.
 - Potter VSR-SF for pipe from 1" to 2" diameter:
 - Potter VSR-F for pipe from 2" to 8" diameter.

2.14 Finish

2.14.1 Valves, nozzles, connections a rack and spanner to chromed finish

PART 3 - EXECUTION

3.1 Inspection

3.1.1 It is prohibited to recess, paint or conceal piping, accessories or work prior to their inspection or approval by the authority having jurisdiction or by an authorized representative.

3.2 Installation

- 3.2.1 Install systems in accordance with prescriptions.
- 3.2.2 Allow for expansion and contraction when installing pipe hangers.
- 3.2.3 Discharge drains to safe location outside building allowing at least 1.2 m (48") past drain valve, in interior of building to visible point of free discharge at catch basin, open building drains or sumps.
- 3.2.4 Install signs required by local Fire Department.
- 3.2.5 Secure outdoor signs with stainless steel bolts.
- 3.2.6 Where multiple drains are connected to a header, each to be provided with sight flow indicator.
- 3.2.7 Install alarm valves and electric gong as indicated.
- 3.2.8 Install indicating type valves inside the building when water line supplies only fire protection systems.
- 3.2.9 Install indicating type valve on fire protection connections immediately after service connection when water main supplies building service and fire protection.
- 3.2.10 Install horizontal valves with stems upright where space allows.
- 3.2.11 Install sprinkler heads with the deflectors of sprinklers be aligned parallel to ceilings, roofs, or the incline of stairs when the slope exceeding 2 in 12.
- 3.2.12 Install all control valves so they are accessible to authorized persons during emergency situations. Permanent ladders, stairs built on the risers, manual chain pulleys or other allowed way, must be installed by this Section where necessary.
- 3.2.13 All piping for dry pipe and pre-action sprinkler systems shall be installed with a pitch in accordance with NFPA 13.
- 3.2.14 For dry pipe systems, the trip test connection or manifold shall be located on the end of the most distant sprinkler pipe in the upper story and shall be equipped with an accessible shutoff valve and a plug not less than 1 in. (25 mm), of which at least one shall be brass.
- 3.2.15 For standard pendent and upright spray sprinklers, the clearance between the deflector and the top of storage shall be 18 in. (457 mm) or greater.
- 3.2.16 Install sprinkler heads of intermediate- and high-temperature ratings around Unit Heaters as required by NFPA 13 8.3.2.5. See piping plans for the exact position of Unit Heaters. Note that it is important to identify High-Temperature and Intermediate-Temperature Zones at Unit Heaters on site when the final locations of Unit Heaters are confirmed.
- 3.2.17 In areas immediately above equipment that produces large amounts of heat and high temperatures, or where maximum ceiling temperatures exceed 100°F (38°C), sprinklers with temperature ratings in accordance with the maximum ceiling temperatures of Table 6.2.5.1 of NFPA 13 shall be used.

- 3.2.18 When a sprinkler head is installed above an obstruction larger then 1.2 m (48") in width, install a sprinkler head under the obstruction.
- 3.2.19 When shown on drawings as "relocated", install new sprinkler heads.

Wire and Plate Guards 3.3

3.3.1 As indicated, install red wire guards to protect sprinkler heads located in mechanical and electrical rooms, near fans, in parking or, because of their location, prone to mechanical deterioration (either upright or pendent. Upright or pendent automatic sprinklers, subject to mechanical deteriorations, shall be protected with approved wire guards.

3.4 **Principle of Operation - Dry Type Systems**

- 3.4.1 A pressure drop downstream of the alarm valve permits the main valve to open and water to flow.
- 3.4.2 A warning or pre alarm signal is sent to the Fire alarm panel if a low-pressure condition is sensed on compressed air feed.
- 3.4.3 An alarm signal is sent to the Fire alarm panel when water flows upon main valve opening.

3.5 Drainage

- 3.5.1 Drainage, where required, to floor drains or open drains to allow testing and drainage of networks. Auxiliary drains located in areas subject to freezing shall be accessible.
- 3.5.2 All piping for dry pipe and pre-action sprinkler systems shall be installed with a pitch in accordance with NFPA 13.
- 3.5.3 Auxiliary drain should be installed in areas where a change in direction of piping prevents drainage of the piping network using the main drain valve. Where the capacity of isolated trapped sections of system piping is more than 20 L (5 gal), the auxiliary drain shall consist of two 25 mm (1 in.) valves and one 50 mm x 300 mm (2 in. x 12 in.) condensate nipple or equivalent, or a device listed for such service.
- 3.5.4 A sign shall be provided at the dry pipe or pre-action valve indicating the number of low point drains and the location of each individual drain.

3.6 Hydraulic testing

- 3.6.1 Pressure and flow testing of the city waterworks system need to be done following the NFPA 291-2010 Recommended Practice for Fire Flow Testing and Making of Hydrants Standard. Testing needs to follow the best practice guide 3-0 Hydraulics of Fire Protection System, March 2010, of the FM Global Property.
- 3.6.2 Results must be presented on the appropriate form and graph. The following information must be shown:
 - Static pressure before and after the test (residual pressure);
 - Flows measured:
 - Position of fire hydrants on which the tests were conducted.

3.7 Sign for network calculated hydraulically

The contractor shall install a sign, as required by NFPA 13 to indicate the characteristics of the 3.7.1 hydraulically calculated network. The required information will be provided to the contractor so he can complete the sign.

3.8 Hydrostatic testing

3.8.1 The sprinkler system must be submitted, for two (2) hours, at a hydrostatic pressure gauge test of 1 400 kPa (200 lbs/po. ca.) or a pressure of 350 kPa (50 lbs/po. ca.) above static pressure of operation if it exceeds 1 050 kPa (150 lbs/po. ca.).

END OF SECTION

APPENDIX

Water Flow Test

Hydrant Flow Test



Test Date: August 28, 2012 Site: 2720 Richmond Road

Time:

10:30

Hydrant ID: R1 H022 & F1 H021 on Maplewood

Tested by: Terry Ethier & City of Ottawa

Prepared by: Terry Ethier

Main Size: 8"

			Pito	ot
Static:	46 PSI @	0 GPM	Orifice	PSI
Residual:	46 PSI @	408 GPM	1x 1-3/4"	21
	44 PSI @	584 GPM	1x 2.5"	12
	44 PSI @	1006 GPM	2x 2.5"	11 & 7

Note: See attached Drawing for main layout.

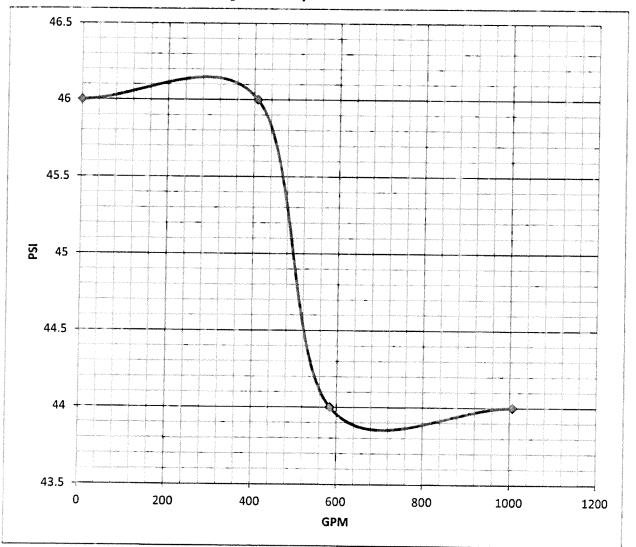


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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

1.2.1 Content of this Section

.1 Materials, equipment's and installation methods associated with portable fire extinguishers and accessories.

1.3 Reference Standards

- 1.3.1 Unless otherwise specified, execute work as per the following standards and regulations:
 - .1 Provincial regulations, related to construction and fire, and as approved by the Provincial Fire Marshall.
 - .2 Standards: FCC403M-1982 Automatic Sprinkler System and FCC 410-M1979, Fire Alarm Systems.
 - .3 National Fire Protection Association Standards:
 - NFPA 10 Portable Fire Extinguishers.

1.4 Shop Drawings

1.4.1 Before beginning work, submit shop drawings for inspection, in accordance with General Requirements of Section 20 05 00 and of Authority having jurisdiction.

1.5 Dimensions and Layout

- 1.5.1 Follow the layout as shown on drawings for the location of sprinkler heads, piping and all accessories.
- 1.5.2 In no case, shall pipe sizes be less than those shown on drawings.
- 1.5.3 Follow the symmetry regarding the layout of sprinkler heads vs ceiling tiles and accessories.

1.6 Permits

1.6.1 Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Multipurpose Dry Chemical Extinguisher

2.1.1 Type Ex-1 and Ex-2

- .1 Dry chemical extinguisher: permanent pressure type ammonium phosphate; equipped with hose and nozzle and stop valves bearing ULC label, for class A, B & C fires; installed on wall bracket or in cabinet as indicated, and with 10 pounds capacity.
- .2 Acceptable Products: CFH or approved equal.

2.1.2 Type Ex-3

.1 Wet chemical extinguisher: Stored pressure design, polished stainless steel cylinders, equipped with hose and nozzle and stop valves bearing ULC label, for class K fires; installed on wall bracket or in cabinet as indicated. Capacity of 6 litres.

2.2 Support Bracket for Extinguishers

2.2.1 Support bracket for extinguishers: as per extinguishers manufacturer recommendations.

2.3 Cabinet for Extinguishers

- 2.3.1 Cabinet for extinguishers, recessed ,semi recessed, surface mounted, as indicated.
- 2.3.2 Casing made of 304 stainless steel, 18 gauge.
- 2.3.3 Door and frame constructed of 316 stainless steel, 14 gauge. Door with rounded edge and piano hinge. The frame edges must be 12 mm ($\frac{1}{2}$ ") folded to the wall.
- 2.3.4 Door with a window covering 70 % of the area, 4.8 mm (3/16") thick with approved latch.

PART 3 - EXECUTION

3.1 Inspection

- 3.1.1 It is prohibited to recess, paint or conceal piping, accessories or work prior to their inspection or approval by the authority having jurisdiction or by an authorized representative.
- 3.2 Installation
- 3.2.1 Install systems in accordance with prescriptions.
- 3.2.2 Install signs required by local Fire Department.

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Content of this Section
 - .1 Materials, insulation equipment's and accessories and related installation methods.

1.3 Standard References

- 1.3.1 Thermal insulation shall be in accordance with CGSB and ASTM standards.
- 1.3.2 Materials shall be homologated by CAN/ULC S-102 for flame spread, smoke development and combustible material contribution.

1.4 Shop Drawings

- 1.4.1 Submit shop drawings in accordance with Section 20 05 00.
- 1.4.2 Submit manufacturer's catalogue literature related to installation, fabrication for pipe, conduits, fittings, valves and jointing recommendations.

1.5 Samples Submittals

- 1.5.1 Submit samples in accordance with Section 20 05 00.
- 1.5.2 Submit for examination: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm (½") plywood board. Affix typewritten label beneath sample indicating service.

1.6 Definitions

- 1.6.1 "CONCEALED" insulated mechanical services and equipment in trenches, chases, furred spaces, pipe shafts or hung ceilings. Services and equipment in tunnels, boiler rooms and mechanical rooms are not considered to be concealed.
- 1.6.2 "EXPOSED" "not concealed" as defined previously.
- 1.6.3 Service temperature
 - .1 Inside building heated at 20 °C (70 °F): temperature of handled fluid.
 - .2 Outside building insulation envelope:
 - For hot fluids 18.3°C (65°F) and over, use:
 - service temperature (°C) = handled fluid temperature (°C) + 45°C (service temperature (°F) = (handled fluid temperature (°F) + 80°F)).
 - For cold fluids 17.8°C (64°F) and under, use:
 - 1.5 the insulation required for a fluid inside the building.

PART 2 - PRODUCTS

2.1 Insulation Type P-1: Service Temperature between 5°C and 200°C (40°F and 400°F)

2.1.1 Insulation system for piping, valves and fittings at a service temperature between 23°C and 200°C (73°F and 400°F).

2.1.2 Material

- .1 Rigid fiberglass sleeving for piping according to ASTM C547 with all purpose jacket according to CGSB 51-GP-52Ma.
 - Maximum thermal conductivity (k) (ASTM C553): 0.042 W/m at 93°C (0.31 BTU inch/hrsq.ft. °F at 200°F).
- .2 Acceptable products:
 - Johns Manville, Micro-Lok FKS;
 - Knauf, Earthwool 100 Pipe Insulation FSK;
 - Manson, Alley-K FSK;
 - Owens Corning, Isolant Fiberglas for pipe FSK.

2.1.3 Insulation thickness

.1 For service temperatures between 5°C and 13°C (40°F and 55°F), all fluids except domestic cold water:

Pipe nominal diameter	Insulation nominal thickness		
All diameters	38 mm (1.5")		

.2 Domestic cold:

Pipe nominal diameter	Insulation nominal thickness
All diameters	13 mm (½")

For service temperature between 38 °C and 60°C (100 °F and 140 °F)

Pipe nominal diameter	Insulation nominal thickness
To NPS 38 mm (1½")	25 mm (1")
NPS 50 mm and over (2" and over)	38 mm (1½")

.3 For service temperature between 61 °C and 95 °C (141 °F and 200 °F)

Pipe nominal diameter	Insulation nominal thickness
To NPS 38 mm (1½")	38 mm (1½")
Over NPS 50 mm (2")	50 mm (2")

2.2 Insulation Type P-3: For Roof Drains

2.2.1 Description: used to insulate underside of roof drains.

2.2.2 Materials

- .1 Fiberglass blanket according to ASTM C1290 and ASTM C553 with reinforced aluminum vapor barrier according to ASTM C1136. Minimum thermal resistance RSI = 0.88 (R5) to 24°C (75°F).
- .2 Acceptable products:
 - Certainteed, Soft Touch FSK:
 - Johns Manville, Microlite Standard duct wrap FSK;
 - Knauf, Duct Wrap FSK;
 - Manson, Alley-Wrap FSK;
 - Owens Corning, SoftR Duct Wrap FSK.

2.2.3 Insulation thickness

Pipe nominal diameter	Insulation nominal thickness
All diameters	38 mm (1.5")

2.3 Insulation Type P-4: Service Temperature Between –40°C and 95°C (-40°F to 195°F)

- 2.3.1 Description: Insulation for pipes, valves and fittings:
 - .1 Service temperature between -40°C and 95°C (-40°F and 195°F).

2.3.2 Materials

- .1 Flexible elastomeric unicellular sheet and pipe covering according to CAN/ULC S102, maximum thermal conductivity (k) 0.0365W/m °C at 24°C (0.27 BTU inch/hr °F sq.ft. at 75°F), maximum flame spread rating: 25; maximum smoke density rating: 50.
- .2 Acceptable products:
 - Armacell, Armaflex AP;
 - IMCOA, Imcolock.

.3 Insulation thickness

• Service Temperature below 5°C (40°F), all services except domestic cold water.

Pipe nominal diameter	True insulation thickness	Nominal insulation thickness
NPS 25 mm (1") & less	27 mm (1.06")	2 x 19 mm (¾")
NPS 32 mm (11/4") & over	41 mm (1.61")	1 x 12 mm (½") and 2 x 19 mm (¾")

Service temperature: 5 to 13°C (40 to 55°F); all services except domestic cold water

Pipe nominal diameter	True insulation thickness	Nominal insulation thickness
NPS 25 mm (1") & less	14 mm (.55")	1 x 19 mm (¾")
NPS 32 mm to NPS 50 mm (11/4" to 2")	21 mm (.8")	2 x 12 mm (½")
NPS 65 mm (2½") & over	27 mm (1.06")	1 x 12 mm (½") and 1 x 19 mm (¾")

Domestic cold water

Pipe nominal diameter	True insulation thickness	Nominal insulation thickness
NPS 50 mm (2") & less	7 mm (.28")	1 x 9 mm (%")
NPS 65 mm (2½") & over	12 mm (.5")	1 x 12 mm (½")

 All services at temperature between 50°C and 95°C (121 to 195°F) including domestic hot water and recirculated water

Pipe nominal diameter	True insulation thickness	Nominal insulation thickness
NPS 50 mm (2") & less	27 mm (1.06")	2 x 19 mm (¾")
NPS 65 mm (2½") & more	41 mm (1.61")	1 x 12 mm (½") and 2 x 19 mm (¾")

2.4 Insulation Type D-1: Flexible Fiberglass with Vapor Barrier, Round Ducts

2.4.1 Used with insulation type D-1 for ducts air round or oval.

2.4.2 Materials

- .1 Fiberglass blanket for air ducts according to ASTM C1290 and ASTM C553, (type I), factor k (maximum = 0.04 W/m. (0.3 BTU in./hr sq.ft.°F) at 24°C (75°F), with a protective cover, such as a vapor barrier FSK according to ASTM C1136.
- .2 Acceptable products:
 - Certainteed, Soft Touch FSK;
 - Johns Manville, Microlite Standard duct wrap FSK;
 - Knauf, Duct Wrap FSK;
 - Manson, Alley-Wrap FSK;
 - Owens Corning, SoftR Duct Wrap FSK.

2.4.3 Insulation thickness

Nominal insulation thickness	Service temperature
2 x 25 mm (2 x 1") overlapped joints	-40 to -18C (-40 to 0°F)

2.5 Insulation Type D-2: Rigid Fiberglass with Vapor Barrier Rectangular Ducts

2.5.1 Used with insulation type D-2 rectangular air ducts.

2.5.2 Materials

- .1 Rigid fiberglass panel for air ducts, density 48 kg/m³ (3 lbs/cu.ft.) according to ASTM C612, and FSK vapor barrier according to ASTM C1136, maximum K factor: 0.034 W/m °C (0.24 BTU in/hr sq.ft.°F) at 24°C (75°F).
- .2 Acceptable products:
 - Certainteed, CertaPro CB300 FSK;
 - Johns Manville, Spin-Glas serie 1000 FSK;
 - Knauf, Insulation board FSK;
 - Manson, AK Board FSK;
 - Owens Corning, Isolant Fiberglas serie 700 FSK.

2.5.3 Insulation thickness

Nominal insulation thickness	Service temperature
2 x 25 mm (2 x 1") overlapped joints	-40°C to -22°C (-40°F to -8°F)

2.6 Insulation Type E-1: For hot and cold Surfaces Service Temperature between -40°C and 200°C (-40°F to 450°F)

2.6.1 Insulation for hot surfaces, curved and plane: Hot or cold water storage tanks, heat exchangers, flash tanks, aerator, hot water tank, condensate water tank.

2.6.2 Material

.1 Fiberglass board for air ducts, density 48 kg/m³ (3 lbs/cu.ft.), to standard ASTM C612, with FSK type vapor barrier to standard ASTM C1136, maximum k factor: 0.034 W/m °C (0.24 BTU in/hr sq.ft. °F) at 24°C (75°F).

.2 Acceptable products:

- Certainteed, CertaPro CB300 FSK;
- Johns Manville, Spin-Glas serie 1000 FSK;
- Knauf, Insulation board FSK;
- Manson, AK Board FSK;
- Owens Corning, SoftR Duct Wrap FSK.

.3 Insulation thickness

Nominal insulation thickness	Service temperature
25 mm (1")	1°C to 59°C (33 to 140°F)
50 mm (2")	60°C to 119°C (141°F to 250°F)

2.7 Insulation Type E-4: For Pumps: Temperature between -40°C to 230°C (-40°F to 450°F)

2.7.1 Used to insulate irregular surfaces.

2.7.2 Materials

.1 Fiberglass board for air ducts, density 48 kg/m³ (3 lbs/cu.ft.), to standard ASTM C612, with FSK type vapor barrier to standard ASTM C1136, maximum k factor: 0.034 W/m °C (0.24 BTU in/hr sq.ft. °F) at 24°C (75°F).

.2 Acceptable products:

- Certainteed, CertaPro CB300 FSK;
- Johns Manville, Spin-Glas serie 1000 FSK;
- Knauf, Insulation board FSK;
- Manson, AK Board FSK;
- Owens Corning, Isolant Fiberglas serie 700 FSK.

2.7.3 Insulation thickness

Nominal insulation thickness	Service temperature
50 mm (2")	60°C to 120°C (141°F to 250°F)

2.8 Insulation Type E-7: For Exhaust Pipes and Chimneys; Service Temperature 450°C to 650°C (850°F to 1,200°F)

- 2.8.1 Used on hot surfaces of boilers, internal combustion engines using fuel.
- 2.8.2 Materials
 - .1 Hydrated calcium silicate rigid insulation.
 - .2 Mineral wool insulating material according to ASTM C547 or ASTM C612.
 - .3 Acceptable products:
 - Johns Manville (silicate de calcium), Thermo-12 Or;
 - Roxul (laine de roche), Techton 1200, RHT 120.

2.8.3 Insulation thickness

Nominal insulation thickness	Service temperature	
100 mm (4")	450°C to 650°C (850°F to 1,200°F)	

2.9 Adhesives, Tapes and Fasteners

- 2.9.1 For insulation types P-1 and P-3.
 - .1 Fire resistant insulation for jacket.
 - Acceptable products: Bakor 120-09, Foster 30-36.
 - .2 Fire resistant insulation adhesive: to glue insulation to metal surfaces.
 - Acceptable products: Bakor 230-38 (Blue), Duro Dyne "SAR" (red); Foster 85-11.
 - .3 Fire resistant insulation adhesive for vapor barrier strips or all-purpose jackets (ASJ or AP).
 - Acceptable products: Bakor 230-39 (colorless); Foster 85-20.
 - .4 Fire resistant insulation and vapor barrier adhesive to bond fiberglass on fiberglass or elastomeric layers in multi-layer installations.
 - Acceptable products: Bakor 230-06 or approved equal.
 - .5 Adhesive for polyethylene film
 - Acceptable products: Bakor 230-32 or approved equal.
 - .6 Locking clips on main ducts strips, hot service.
 - .7 Self-adhesive tape 75 mm (3") wide to cover joints for all purpose (ASJ or AP) jackets, hot or cold.
- 2.9.2 For insulation type P-4
 - .1 Fire resistant insulation and vapor barrier adhesive.
 - Acceptable products: Bakor 230-21 or Armstrong 520.

2.9.3 For ductwork

- .1 Tape: self-adhesive, 100 mm (4"), wide rated lower than 25 for flame spread and lower than 50 for smoke development.
 - Acceptable products: FSK Venture Tape or approved equal.
- .2 Contact adhesive: quick-setting, non-flammable fire resistant adhesive to bond fiberglass to ducts. Flame spread 15, smoke development 0.
 - Acceptable products: Duro Dyne "SAR" (red); Bakor 230-38 (blue); Foster 85-11.
- .3 Use weld pins on bottom of duct if duct is over 635 mm (25") wide.

2.9.4 For vapor barrier

- .1 Lap seal adhesive: Quick-setting adhesive for joints and lap sealing of vapor barriers. Flame spread 10, smoke development 0.
- .2 Acceptable products: Bakor 230-21 or approved equal.

2.9.5 For canvas

- .1 Fire resistant adhesive for cementing canvas cloth to duct insulation.
- .2 Acceptable products: Bakor 120-09; Foster 30-36.

2.9.6 Pins

- .1 Weld pins 4 mm (0.15") diameter, with 35 mm (1.4") diameter head for installation through the insulation. Length to suit thickness of insulation.
- .2 Acceptable products: Duro Dyne, Clip-Pin or approved equal.
- .3 Weld pins 2 mm (0.08") for installation prior to applying insulation. Length to suit thickness of insulation. Nylon retain clips 32 mm (1.25") square.
- .4 Acceptable products: Duro Dyne spotter pins with spotter clips or stop clips as required or approved equal.

2.9.7 For tanks, equipment and others.

- .1 Galvanized steel sheeting 19X0, 40 mm (1.5").
- .2 Weld pins 2 mm (0.08") to installation prior to applying insulation. Length to suit thickness of insulation. Nylon retain clips 32 mm (1.25") square.
 - Acceptable products: Duro Dyne spotter pins with spotter clips or stop clips as required or approved equal.
- .3 Galvanized, hexagonal weave mesh 25 mm (1").
- .4 Aluminum Kraft paper.
- .5 Aluminum sheet 0.40 mm (0.016") thick.

2.10 Jackets

2.10.1 Canvas Jackets

- .1 Apply in exposed areas: compact, firm ULC listed heavy tight weaved, cotton fabric at 220 g/m² (6.5 oz/sq.yd.).
- .2 On concealed valves and fittings use ULC listed plain weaved, cotton fabric at 120 g/m², (3.5 oz/sq.yd.).
- 3 Acceptable products: S. Fattal Thermocanvas or approved equal.

2.10.2 Self-adhering jacket

- .1 Rubberized asphalt membrane covered with an aluminum vapor barrier for exterior installation, overlapping joints.
- .2 Installation on the insulation of ventilation ducts, refrigerant piping, chilled water and equipment's.
- 3 Installation based upon manufacturer recommendations.
- .4 Acceptable products: Alumaguard 60 (Polyguard products) or approved equal.

2.10.3 Elastomeric insulation paint.

- .1 Apply in exposed areas.
- .2 Vinyl based paint.
 - Acceptable product: Armaflex or approved equal.

PART 3 - EXECUTION

3.1 General

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- 3.1.1 Apply insulation after required tests have been completed and approved by Engineer. Insulation and surfaces shall be clean and dry when installed and during application of any finish. Clean the insulation surface before applying coating or covering.
- 3.1.2 Work shall be performed by insulation journeymen.
- 3.1.3 Apply insulation and coverings on hot piping duct or equipment while surface is between 50°C and 60°C (120°F and 140°F).
- 3.1.4 Vapor barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, and without interruption at sleeves, pipe and fittings.
- 3.1.5 Install insulation with smooth and even surfaces.
- 3.1.6 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
- 3.1.7 Use multi-layers, overlapping joints when insulation thickness exceeds 50 mm (2").

3.2 Insulation Installation

3.2.1 Works for this section include but are not limited to the thermal insulation of the following elements:

Ele	ements	Insulation	type
Pip	oing, valves and fittings for:		
•	Domestic cold water	P-2	P-4
•	Domestic hot water and recirculation hot water 60°C (140°F)	P-1	P-4
•	Heating water	P-1	
•	Condensate	P-1	
•	Refrigerant suction	P-4	P-1
•	Refrigerant hot gas discharge and liquid lines	P-4	P-1
•	Rain water piping in roof space and over a distance of 3 m (10') in	P-1	P-4
	heated space		
•	Rain water leader	P-1	P-4
•	Underside of roof drain body	P-3	
•	Sanitary vents over a distance of 3 m (10') starting outside	P-1	P-4
•	Cooling coils drip pan drain	P-1	P-4
•	Horizontal sanitary drains from WC and urinals, provided with flush	P-1	P-4
	valve		
•	Sump Pump discharge	P-1	P-4
•	Traps and drains where there is risk of condensation on the piping	P-1	P-4

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Ductwork		Insulati	on type
•	From fresh air intake to heating coil	D-2	
•	Air supply in roof spring and on a distance of 3m (10') in heated space	D-1	D-2
•	Exhaust in roof space and on a distance of 3 m (10') in heated space	D-1	D-2
•	Exhaust on a 3 m (10') distance starting from an exterior wall	D-1	D-2

Equipment		Insulation type
•	Internal combustion Engine and boiler chimney	E-7
•	Domestic hot water tank	E-1
•	Heating pump	E-4

3.3 Piping Insulation

- 3.3.1 Preformed insulation: sectional insulation up to NPS 375 (15"), sectional or curved segmented above equal to or above NPS 450 (18").
- 3.3.2 Multi-layered insulation: use staggered butt joint construction.
- 3.3.3 Vertical pipes over NPS 75 (3"): use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter locate on 4.5 m (15') centers and at each valve and flange.
- 3.3.4 Expansion joints: install every 6.5 m (20') or as indicated. Terminate single layer and each layer of multiple layers in straight cut. Leave space of 25 mm (1") between terminations. Pack void tightly with glass wool. Protect joints with aluminum sleeves.
- 3.3.5 Use factory installed, easily disassembled insulation, for valves, fittings and process equipment requiring periodic maintenance.
- 3.3.6 Terminate insulation at each end of unions and flanges on hot lines, and at other points where indicated, with insulation cement, to CGSB 51-GP-6M, trowel led on bevel.
- 3.3.7 Gouge out insulation for proper fit where there is interference between weld bead 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, supports, hangers, and clamp guides and seal with insulating cement.
- 3.3.8 For piping with mechanical fasteners, stop insulation at connection level. Cover flanges with one (1) or more additional layer(s) of insulation overlapping 150 mm (6") on both sides of joint. This or these additional layers shall be of the same thickness, as the piping insulation and shall not contain any deformation.
- Fix insulation with straps every 900 mm (36") at least, with at least three (3) straps per straight run for piping NPS 250 mm (10") dia. and over.
- 3.3.10 All cold piping supports shall be installed on the outer side of insulation. At rack support, use a "Foam glass" piece between pipe and saddle.

Finish

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3.3.11

.1 For exposed elements, finish with a canvas set, with the insulation cement and apply one additional coating of the insulation cement.

3.3.12 Insulation not required for

- .1 Exposed piping of radiators and convectors at floor level.
- .2 Valves, unions and flanges on systems at temperature between 15 and 45 °C (60 and 115 °F).
- .3 Chrome plated piping, valves, unions, flanges and valve bonnets on domestic hot and cold water services.
- 4 Rainwater and sanitary drainage pipes unless indicated otherwise.

3.4 Air Duct Insulation

3.4.1 General

- .1 Make seams on top side of ducts
- .2 Glue and seal vapor barrier with vapor tight adhesive.
- 3 With multilayered insulation, stagger joints horizontally and longitudinally.

3.4.2 Mechanical fasteners

- .1 On rectangular ducts, cover partially (50%) of the insulation surface with adhesive and install on each side at least two (2) rows of weld pins every 200 mm (8").
- .2 On round ducts, cover completely the insulation surface with adhesive and seal seams with auto adhesive tape.
- 3.4.3 On acoustically insulated ducts, reduce thickness of thermal insulation by an amount equal to the acoustical insulation thickness.
- 3.4.4 Final thermal insulation not to be less than 25 mm (1").

3.4.5 Finish

.1 For exposed elements, install angles to prevent insulation crushing. Finish with canvas net with the insulating cement and apply one additional coating of insulation cement.

3.5 Equipment

3.5.1 Type E-1

- .1 Curved surfaces: miter cut insulation to fit shape of equipment. Keep in place with straps 457 mm (18") center. Seal all joints with insulation cement.
- .2 Plane and irregular surfaces: cut insulation to fit shape of equipment. Fill spaces with low-density insulation. Pack the low-density insulation. Pack on welded pins every 305 mm (12") and maintain with plates.
- Install a galvanized weave, fixed to pin plates. Lace by twisting wire ends. Cover with 2 coatings, 13 mm (½") thick each of insulating cement.

.4 Install a vapor barrier at each layer of insulation. Use aluminum Kraft paper bonded to a insulation or cement, as the case with an adhesive vapor barrier coating. Overlap joints of 76 mm (3") and seal with the same adhesive.

.5 Finish

- Finish with a canvas set with the insulating cement and apply one additional coating of insulation cement;
- Finish with an aluminum jacket.

3.5.2 Type E-4

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- .1 Cut insulation to fit equipment shape. Set in place with fast acting fireproof adhesive. Fill cavities with low-density fiberglass, seal joints with insulating cement.
- .2 Install a galvanized weave, fixed to pin plates. Lace by twisting wire ends. Cover with two (2) coatings, 13 mm (½") thick each of insulating cement.
- .3 Install a vapor barrier after each insulation cement layer. Use aluminum Kraft paper glued to either insulation or cement with vapor barrier adhesive. Overlap joints by 75 mm (3") and seal with same adhesive.

.4 Finish

 Finish with a canvas set with the insulating cement and apply one additional coating of insulation cement;

3.5.3 Type E-7

.1 Chimneys

• Weld gauge 10 steel pins every 610 mm (24") center, following a vertical and horizontal line. Sink insulation on pins. Make tight joints, especially for service temperature above 232 °C (450 °F) and use two (2) layers of insulation. Cover insulation with gauge 20 galvanized steel meshes with 25 mm (1") hexagonal weaves. Overlap joints by at least 15 mm (0.6"). Lace wire ends with gauge 16 galvanized annealed steel wires. Fasten insulation and mesh with 64 mm (2.5") round or square fasteners. Insulation must fit lining perfectly. Do not compress insulation when fixing fasteners.

.2 Finish

Inside and outside building. Fix aluminum sheet 0.80 mm (1/32") thick to insulation;

3.6 Fireproof Insulation Glues and Cements

- 3.6.1 Apply fireproof coating on canvas.
- 3.6.2 Coat piping, ductwork and visible elements in finished rooms with a layer of diluted insulation glue according to manufacturer recommendations.
 - .1 All elastomeric foam must be painted when visible and outside.

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Content of this Section
 - .1 Materials, equipment's, accessories and methods of installation related to plumbing system.
 - .2 Materials, equipment's, accessories and methods of installation related to domestic water network.
 - .3 Materials, equipment's, accessories and methods of installation related to drainage and vent network.
 - .4 Materials, equipment's, accessories and methods of installation related to special devices for plumbing systems.

1.3 Shop Drawings

1.3.1 Supply shop drawings according to Section 20 05 00.

1.4 Maintenance instructions

1.4.1 Supply necessary instructions for maintenance to be incorporated in maintenance manual specified in Section 20 05 00.

1.5 Reference Codes

- 1.5.1 Unless otherwise specified, execute works according to:
 - Plumbing Code.

1.6 Permit

1.6.1 Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Pipe and fittings for storm and sanitary drains, sewers and vents

- 2.1.1 Above ground building drainage.
 - .1 DWV copper tubing to ASTM B.306, DWV fittings to CSA B158.1, soldered joints, tin/antimony 50/50 to ASTM B32.
 - .2 Cast iron and fittings with factory applied corrosion resistant coating inside and outside, to CSA B70-M91 Jointing done with stainless steel clamp and neoprene gasket to CSA B70-M91 or cement base cold caulking (PC4) to CGGB F77-GP up to NPS 250 (10"). For NPS 300 (12") and 380 (15"), use hub and spigot type joints with compression neoprene gaskets.

2.1.2 Underground

- .1 PVC/DWV DR35 pipes and fittings conforming to NQ 3624-130, NQ 3624-135 et CSA B182.2 standards.
- .2 Cast iron and fittings, hub and spigot, with factory applied corrosion resistant coating inside and outside, to CSA B70-M91. Joints: compression type with neoprene gasket molten lead to CSA B70-M91.
- .3 ABS/DWV pipes fittings conforming to CSA B181.1, with a diameter/thickness ratio not exceeding 28, adhesive solvent conforming to BNQ 3751-150-82.

2.1.3 Sump pump discharge

- .1 DWV copper for DN75 (3") and less to ASTM B306, DWV fittings to CSA B158.1, soldered joints tin/antimony 50/50 to ASTM B32.
- .2 Grade 304, gauge 105 stainless steel tubes and fittings, 3 mm (0.125") thickness, to ASTM A-240, welded with argon.

2.2 Domestic water supply piping

- 2.2.1 Supply piping for cold water, hot water, domestic water recirculation, to be buried or installed above ground, inside a building.
 - .1 Hard drawn copper tube type "L" above ground. Copper tubes type "K" for buried services, to ASTM B42, B43 and B88.
 - .2 Flanged fittings in brass or bronze, to ANSI B16-24.
 - .3 Screwed fittings in brass or bronze, to ANSI B16-15.
 - .4 Welded cast bronze fittings, to ANSI B16-18 or forged copper to ANSI B16-22.
 - .5 Gaskets: 1.6 mm (1/16") thick, preformed synthetic rubber, full face, to ANSI/AWWA C111/A21.11.
 - .6 Bolts: hexagonal head, nuts and washers, to ASTM A307.
 - .7 Solder: Soft "Tin-antimony-copper-silver" to ASTM B-32.
 - Acceptable Products: Handy Sol from Handy & Harman or Aquasol approved equal.

- 2.2.2 Main water pipe to be buried, outside the building from 1 m (3') inside the building.
 - .1 NPS100 (4") and over: ductile cast iron to ANSI A21.51.
 - Ductile cast iron fittings to CSA B131.9 with single pressure rubber fittings to ASTM A21.11.
 - Cast iron flanges to ANSI 21.10 with rubber gaskets to ANSI 21.11 and hex bolts, nuts and gaskets to ASTM A-307.
 - .2 Up to NPS 75 (3"), copper, type K, to ASTM B-68-10.
 - Compression type couplings good for a pressure of 1 MPa (150 PSI).
- 2.2.3 Supply piping for trap primer connecting to the floor drains, to be installed within the slab or buried under: Uponor, Whirsbo-Hepex Plastic pipe, to CSA B.137.9 with pressed brass fitting.

2.3 Pipe hangers and supports

- 2.3.1 Support from structural members. Where structural support does not exist suspend hangers from steel channels or angles. Provide and install supplementary structural members. Obtain approval before using vertical expansion shields. Use minimum two shields for each hanger. Do not suspend from metal deck. Conform to equipment manufacturer recommendations.
- 2.3.2 Use hangers adaptable for all pipe sizes.
 - .1 Use roller type hangers where specified.
 - Acceptable products: Myatt, Anvil, Apex.
 - .2 Piping with service fluid temperature higher than 95°C (200°F); Anvil 181 and 271.
 - .3 Copper pipes: domestic water, drains vents and others: Anvil CT-65, CT-121.
 - .4 Fire protection: Anvil 260 and 261, UL and FM.
 - .5 All other services: Anvil 65 up to 50 mm (2"), 60 for 65 mm (2½") and over and vertical runs: 261.
 - .6 Use roller type hangers with bracing in the following cases: hangers cannot be supported from top of structural steel work.
 - .7 Minimum hanger rod length: 150 mm (6") for all piping.
 - .8 Hangers rods shall be made of mild steel, with mechanical threading, length of threads shall be sufficient to allow adjustment of pipe levels.
- 2.3.3 Pipe racks shall be fabricated from I, U, H structural steel or angle iron and prefabricated galvanized steel channels. Welds shall be continuous and free of cavities. Racks attached to structural elements with Philipps Red Head anchors or approved equal (painting: refer to the article treating this subject).
- 2.3.4 Pipes racks spacing shall suit pipe of smaller diameter.
- 2.3.5 Use rod diameters and spacing for pipe supports as shown in table except for the following:
 - .1 Support sanitary plumbing piping in accordance with plumbing code municipal or provincial or as specified.
 - .2 Support NPS 12 mm (½") gas pipe every 1.8 m (6').
 - .3 Support NPS 12 mm (1/2") copper pipe every 1.5 m (5').

.4 Support plastic and glass piping in accordance with manufacturer's recommendations.

Pipe size (Nominal Diameter)		Rod diameter		Maximum spacing	
				Steel	Copper
NPS 20, 25	(3/4", 1")	10 mm (¾")	2.1 m	(7')	1.8 m (6')
NPS 32	(11/4")	10 mm (¾")	2.1 m	(7')	1.8 m (6')
NPS 40	(11/2")	10 mm (¾")	2.7 m	(9')	2.4 m (8')
NPS 50	(2")	10 mm (¾")	3 m	(10')	2.7 m (9')
NPS 65, 75	(2½",3")	10 mm (3/8")	3.6 m	(12')	3 m (10')
NPS 100	(4")	16 mm (⁵%")	4.2 m	(14')	3.6 m (12')
NPS 125	(5")	16 mm (5%")	4.8 m	(16')	
NPS 150	(6")	22 mm (¾")	5.1 m	(17')	
NPS 200	(8")	22 mm (¾")	5.7 m	(19')	
NPS 250	(10")	22 mm (¾")	6.6 m	(22')	
NPS 300	(12")	22 mm (¾")	6.9 m	(23')	

- 2.3.6 Place support within 300 mm (12") of each horizontal elbow.
- 2.3.7 Hangers shall be 3 pieces minimum standard: i.e. anchor, rod, pipe collars and hangers.
- 2.3.8 For piping having an operating fluid temperature of 18°C (64°F) or less, except cold domestic water, install saddles or hangers on top of insulation over prefabricated insulation shields for each saddle and/or support.
- 2.3.9 Install saddles on insulated piping.
- 2.3.10 Acceptable products: Anvil: saddles 160 to 165, insulation shields 167, Myatt or Apex.
- 2.3.11 Offset hanger pipe and structural attachments in such a manner that rod is vertical when piping is at its service temperature.
- 2.3.12 Set hanger levels to distribute the weight load evenly.
- 2.3.13 Before proceeding with fabrication or installation, submit, for verification, the shop drawings for all types of proposed supports.

- 2.3.14 On a roof, use prefabricated supports with aluminum disk, stainless steel clamps and polystyrene pad.
 - .1 Acceptable products: Portable Pipe Hangers series PP et SS, Advanced Support Products inc. series SS1000.

2.4 Valves

- 2.4.1 Provide all valves from same manufacturer.
- 2.4.2 Unless otherwise specified or noted, valves to be ANSI Class 200, 1400 kPa, or Class 125/200 860/1400 kPa non shock, screwed or soldered ends, zinc handle. In equipment rooms and boiler rooms, provide OS&Y and globe valves NPS 65 mm (2½") and over.
 - .1 Acceptable product: for NPS 50 mm (2") and under:
 - plug valve:
 - Crane 9202 or 9222, Toyo 5044A or 5049A, Milwaukee BA-100, Nibco T585-70 or S-585-70, Anvil F171N, Kitz # 68 or 69, Jenkins 901GJ or 902J.
 - · gate valve:
 - Crane 428 or 1334, Toyo 293, Milwaukee 148 or 1169, Nibco T-111 or S-111, Kitz # 24 or 44, Jenkins 810J.
 - globe valve straight-through flow:
 - Crane 7 or 1310, Toyo 221 or 212, Milwaukee 590-T or 1502, Nibco T235-Y or S-211-Y, Kitz # 09 or 12, Jenkins 106BJ.
 - angle globe valve:
 - Crane 17, Toyo 260, Milwaukee 595-T, Nibco T-335Y, Toyo # 260 or Kitz # 38, Jenkins 108BJ.
 - check valve:
 - Crane 37 or 1342, Toyo 236 or 237, Milwaukee 509 or 1509, Nibco T413-Y or S-413-Y, Kitz # 22 or 23. Jenkins 4092J.
- 2.4.3 Acceptable products: DN 65 mm (2½") plus.
 - Gate wedge:
 - Crane 465 I/2, Toyo 421A, Milwaukee F-2885-M, Nibco F-617-0, Toyo # 421JA, Kitz # 72, Jenkins 454J.
 - Globe:
 - Crane 351, Toyo 400A, Milwaukee F-2981-M, Nibco F-718-B, Kitz # 76, Jenkins 2342J.
 - · Check:
 - Crane 373, Toyo 435A, Milwaukee F-2974-M, Nibco F-918-B, Kitz # 78, Jenkins 587J.
 - Butterfly:
 - Keystone F-12-CBJ-2, Toyo 918 BESL, Crane 44-BXZ-L, Grinnell L-1281-3, Centerline # L200L-E, Jenkins 2232EL.

- .1 Drain valves: ball valve with threaded end, cap and chain, NPS 20 mm (¾"); Toyo 5046, DAHL 50.430.
- .2 Provide gate valves at each piece of plumbing equipment and at each branch line take-off, and globe valves where balancing is required.

2.5 Cock and outlets

- 2.5.1 Frost proof outlets
 - .1 Refer to drawings.
- 2.5.2 Hose bib (for indoor installation)
 - .1 Refer to drawings.

2.6 Water hammer arrestors (shock absorbers)

- 2.6.1 Provide arrestors on branch supplies to each fixture or group of fixtures and where indicated.
- 2.6.2 Conform to ASSE-1010 « Plumbing and Drainage Institute », stainless steel construction. Water-hammer arrestors dimension must be conforming to ASSE-1010.
- 2.6.3 Acceptable product: Jay. R. Smith-5000 or ZURN Z-1700.

2.7 Backflow preventers

- 2.7.1 Reduced pressure principle backflow preventer to CSA B.64.4.
 - .1 NPS 12 mm (½") to NPS 50 mm (2"): bronze body with stainless steel flange bolts and rubber seats. Maximum pressure 1200 kPa (175 PSI).
 - Acceptable product: Watts No. 909 LF, Wilkins 975-L, up to 60°C (140°F), Wilkins 975 XL-L and Watts 909 HWLF up to 98°C (210°F), Hersey FRP II, Conbraco 4A-200-T2 up to 82°C (180°F).
 - .2 NPS 65 mm (2½") up to NPS 250 mm (10"): cast iron body with internal epoxy covered water conduits and internal parts and flange bolts made in brass and stainless steel, rubber seats. Maximum pressure 1035 kPa (150 PSI), maximum temperature 43°C (110°F).
 - Acceptable products: Watts No. 909 LF, Wilkins No. 975-L, Hersey 6 CM, Conbraco 4A-200-02 up to 60°C (140°F).

- 2.7.2 Double check valve assembly backflow preventer to CSA B.64.5.
 - .1 NPS 19 mm (¾") to NPS 50 mm (2"): bronze body, stainless steel trim, rubber discs and water tight seats and ball test valves. Maximum pressure 1200 kPa (175 PSI).
 - Acceptable products: Wilkins 950-L, Watts No. 709 up to 60°C (140°F), Wilkins No. 950-XL-L and Watts No. 709 HW up to 80°C (175°F), Hersey FDC, Conbraco 4S-100-T2 up to 82°C (180°F).
 - .2 NPS 65 mm (2½") to NPS 254 mm (10"): cast iron body construction, epoxy covered water conduits and brass internal parts with stainless steel flange bolts and rubber seats. Maximum pressure 1028 kPa (150 PSI), maximum temperature 43°C (110°F).
 - Acceptable products: Wilkins No. 950-L, Watts No. 709 LF, Conbraco 4A-100-02 up to 60°C (140°F).
- 2.7.3 Supply and install a stop valve on either side of each backflow preventer specified above.
- 2.7.4 Backflow preventer for fire protection standpipe.
 - .1 Combination of two check valves installed between two gate valves. ULC and FM approved, NPS 75 mm (3") to NPS 200 mm (8").
 - .2 Swing check valve, bolted cover, special FM composite disc, bronze body, flanged ends.
 - Acceptable products: Conbraco DC4S (valves included), Wilkins 350 OSYFG (valves included).
 - .3 Bolted bonnet gate valves, rising stem, OS&Y, bronze internal parts, solid wedge, wheel operated.
 - Acceptable product: Crane 460, Nibco F619.

2.8 Back water valves (BWV)

- 2.8.1 Drainage back water valves.
 - .1 Provide where indicated complete with gas tight and watertight flapper.
 - .2 Acceptable product: ZURN Z-1090-1, Jay R. Smith 7012, Watts.

2.9 Vacuum breakers

- 2.9.1 Anti siphon atmospheric vacuum breaker to CSA B64.1.1.
 - .1 NPS 6 mm (¼") to NPS 75 mm (3"): bronze body, silicone disc. Maximum pressure 860 kPa (125 PSI), maximum temperature 71°C (160°F).
 - .2 Acceptable products: Cambridge 76096, Wilkins 305 and Watts 288A, Conbraco 38-200 (¼" to 34"), Combraco 38-100 (1" to 2").
- 2.9.2 Anti siphon pressure type vacuum breaker to CSA B64.1.2.
 - .1 NPS 6 mm (½") to NPS 75 mm (3"), bronze body with silicone rubber disc and stainless steel spring. Maximum pressure 1028 kPa (150 PSI), maximum temperature 71°C (160°F).
 - .2 Acceptable product: Wilkins series 720-A, Watts 800, Conbraco 4V-500.

- 2.9.3 Hose connection vacuum breaker to CSA B64.2.
 - .1 NPS 19 mm (¾"), bronze construction rubber seal and disc, chrome plated finish maximum pressure 860 kPa (125 PSI).
 - .2 Acceptable products: Watts 8-A, vandal proof, Watts NF-8, frost proof, Conbraco 38-300, Conbraco 38-300.

2.10 Pressure reducing control valve

- 2.10.1 Pressure reducing valve, self-operating, bronze body, screwed union fittings, body to withstand a maximum pressure of 2965 kPa (400 PSI). Stainless steel trim, single seat, balanced disc, integral strainer.
 - .1 Adjusting band from 205 to 615 kPa (30 to 90 PSI).
 - 2 Acceptable products: Irgured, model 1130 from Gunzen Hauser, Watts or equivalent.
- 2.10.2 Pressure reducing valve to be external pilot operated, flangeless stainless steel body, flexible diaphragm with integral pilot.
 - Adjusting band from 135 to 620 kPa (20 to 90 PSI);
 - Flow working range: 1000:1;
 - Acceptable products: Roll Seal Valve Co., model 110 PR, Muesco Inc, model 115, Masoneilan or equivalent.

2.11 Thermometers

2.11.1 General

- .1 Place direct reading thermometers so that readings can be taken from the floor or from platform if applicable.
- .2 If it not possible to place thermometers so that readings can be taken easily, use remote reading thermometers.
- .3 Lamicoid nameplates used for thermometer identification shall be placed as close to the thermometer as possible.
- .4 Materials used to satisfy system requirements.
- 2.11.2 Industrial, with aluminum casing, adjustable reading angle, liquid type with 228 mm (9") scale to ONGC 14.4M88. Appropriate standard scale to measured temperatures with 1°C increments (1°F) the scale to be numbered every ten degrees, except for ranges beyond 150°C (300°F).
 - Acceptable products: Winters, Ashcroft, Trerice, Taylor-Weiss.
- 2.11.3 All thermometers to be supplied with wells. The depth of the wells shall permit an insertion of at least 50 mm (2") in liquids and 100 mm (4") in gases. Threads to be 20 mm ($\frac{3}{4}$ ").
- 2.11.4 When insulation is used, wells shall be supplied with extension collars cleaning the insulation thickness.
- 2.11.5 Scales to cover twice the system temperature range.
- 2.11.6 Thermometers indications are given in imperial and metric system.

2.12 Manometers

2.12.1 General

- .1 Place direct reading manometers so that readings can be taken from the floor or from the platform if applicable.
- .2 If it is not possible to place manometers so that readings can be taken easily, install them at 1.5 m (5') from the floor and connect them with 6 mm (1/4") piping and bronze stopcock.
- .3 Lamicoid nameplates used for manometer identification shall be placed as close to the manometer as possible.
- .4 Materials used to satisfy system requirements.
- 2.12.2 With 115 mm (4½") dials conforming to ONGC 91-GP-1, 5% accuracy and conforming to ANSI grade 2A unless otherwise noted.
 - Acceptable products: Winters, Ashcroft, Trerice, Marshalltown.
- 2.12.3 Each gauge shall be chosen to indicate twice the system operating pressure.
- 2.12.4 Provide a bronze stopcock.
- 2.12.5 When insulation is used on piping, provide extension to clear the insulation.
- 2.12.6 Thermometer and manometer scales to be in English and metric units.

2.13 Water meters

- 2.13.1 City Water meter with bypass and lockable valve of size to comply with local water authority.
- 2.13.2 Owner water meter inside building with main shut off gate valve on either side of meter. Provide downstream of meter check valve and drain valve. Drain valve to be sized half of main entrance diameter.
 - Acceptable products: Hersey model 400/500 NPS 15 mm (5%") to NPS 50 (2"); model MVR, NPS18 (34") to NPS 150 (6"); model MHR NPS 200 (8") and 250 (10").

2.14 Air vents

- 2.14.1 Automatic float type air vents where indicated and at high points, with stop valve and test valve NPS 6 mm (¼") 1030 kPa (150 PSI) at 18°C (65°F). Pipe the vent to nearest floor drain or to nearest service sink.
 - .1 Acceptable products: Armstrong No. AV-13, NPS 12 mm (½") or NPS 19 mm (¾").

2.15 Strainers

- 2.15.1 Minimum service rating of 860 kPa (125 PSI) gauge pressure or 1½ times system pressure whichever is greater.
- 2.15.2 Strainers: Cast iron body.
- 2.15.3 Type: cleanable Y pattern.
- 2.15.4 Screens: removable and made from ss, with 1.1 mm (0.045") diameter holes 36 holes per cm² (230 per sq.in.).

- 2.15.5 NPS 50 mm (2") nominal and under, screwed with brass cap.
 - Acceptable products: Armstrong F1SC, Conbraco TCG (¼" to 3").
- 2.15.6 NPS 65 mm (2½") and over flanged with bolted cap. Threaded screwed off center opening; blow down valve same diameter as threaded opening.
 - Acceptable products: Armstrong AIFL, Conbraco FC1 Class 125, Conbraco FC2 Class 250.

2.16 Grease Interceptor

- 2.16.1 Steel construction with cast iron or aluminum non-slipcover, lock and lift ring with draw stud attached to the body. Interceptor with removable baffles, clean out for P trap access, removable sediment bucket, flow regulator with vent installed on drainage inlet. All internal parts shall have an acid resistant coating, rubber or epoxy.
- 2.16.2 Acceptable products:
 - Refer to drawings;
 - Les Intercepteurs G.R. Inc.

2.17 Trap primer

- 2.17.1 Diaphragm operated primer with 13 mm (½") NPT connection, automatically activated when the pressure drop. Operating range of 138 to 552 kPa (20 to 80 psig) for a maximum of four (4) drain traps. To be installed on a cold fresh water line of 38 mm (1½") or less.
 - Acceptable products: PPP, model PO-500 or approved equivalent.
- 2.17.2 Distribution unit with male main connection of 13 mm (½") NPT. PVC body, for 1 to 4 drain traps.
 - Acceptable products: PPP, model DU or approved equivalent.

2.18 Deep seal trap

- 2.18.1 Cast iron construction with bronze clean out.
- 2.18.2 Acceptable products: Jay R. Smith 7220, 7221, 7222, Zurn Z-1000, Watts.
- 2.19 Floor drains
- 2.19.1 Refer do drawings
- 2.20 Roof drains
- 2.20.1 Refer to drawings
- 2.21 Clean-outs
- 2.21.1 Refer to drawings.
- 2.22 Submersible waste water pumps
- 2.22.1 Refer to drawings.

PART 3 - EXECUTION

3.1 Piping Installation

3.1.1 General

- .1 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.
- .2 Install groups of piping parallel to each other on trapeze hangers; spaced to permit application of insulation, identification, and service access.
- .3 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
- .4 Where pipe sizes differ from connections sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
- .5 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.
- .6 Ream ends of pipes and tubes before installation.
- .7 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
- .8 Use non-corrosive lubricant or Teflon tape applied to male thread.
- .9 Grooved pipe ends: cut square, seating surface clean and free from indent and score marks.
- .10 Install swing or swivel joints to connect risers to mains. Use coupling in risers from one floor outlet to next.
- .11 Install flanges or unions to permit removal of equipment without disturbing piping systems.
- .12 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.

3.1.2 Expansion and contraction

- .1 Install expansion joints and compensators, flexible connections, pipe loops and offsets as indicated.
- .2 Support piping to prevent any stress or strain.
- .3 Install guides for expansion joints to manufacturer instructions, otherwise, for minimum 3 m (10') on each side of expansion joint for sizes to 75 mm (3") nominal, minimum 4.8 m (16') on each side for larger pipe sizes.
- .4 Provide steel anchors welded to steel piping, clamped to non-ferrous fastened to building structure or embedded in concrete pier. Coordinate with Engineer where fastenings are to be made.
- .5 Anchor horizontal runs of brass and copper pipe to wall or floor construction. Coordinate locations with Engineer. Obtain approval for all anchor types.

3.1.3 Sanitary and storm drainage

- .1 Run piping to main sewers with uniform grade. Trap and vent fixtures as required.
- .2 Where inverts are not given, pipes shall have uniform grade of 1:100.
- .3 Plug or cap pipes and fittings to keep out debris during construction.
- .4 Jointing of pipe: compatible with type of pipe used.
 - Acceptable product: Garlock, John Crane Compound, Master Metallic Compound, Loctite.

3.1.4 Interior buried piping:

- .1 Lay piping on compacted bedding of clean coarse sand compacted, and free from clay, snow or ice, organic matter or stones.
- .2 Do not lay pipes in water when conditions are unsuitable.
- 3 Run buried drains minimum 200 mm (8") clear below bottom of concrete slab.

3.1.5 Water Piping

- .1 Run water piping from service connections to fixtures, equipment, outlets.
- .2 Connect pressure gauge graduated from 0 to a gauge pressure of 1100 kPa (0 to 150 psig) on water service main on building side of water meter. Install gauge cock between service main and gauge. Stem mount gauge shall have 115 mm (4.5") dial to CGSB91-GP-I, type A, grade A.
- .3 Provide washroom groups and branch take-offs from mains with isolating gate valves. Install stop valve on each fixture supply.
- .4 Where two or more recirculating hot water branch lines are connected to main recirculating line, provide lock shield globe valve and check valve in each branch line for balancing water flow and for prevention of back flow in one branch. Adjust balancing valves to provide recirculation through each circuit. Turn over lock shield valve key to Engineer after balancing at interim takeover.
- .5 Provide hose bibs faucet for complete drainage, at low points of systems or part of systems.
- .6 Flushing and cleaning procedure for piping systems
 - Flush and clean out after pressure tests
 - Fill with solution of water and non-foaming, phosphate-free detergent.
 - Flush and drain. Clean strainers.
 - · Refill water system with clean water
 - Remove moisture from interior surfaces of fuel oil systems using dry compressed air on nitrogen before filling with oil.
- .7 Clean potable water piping as requested by authority having jurisdiction.
 - Clean domestic water piping adequately before putting it into service.
 - Clean piping with normal potable water flowing until water is clean at every outlet.

- 3.1.6 Polyvinyl Chloride: join piping and fittings with threaded couplings to IPS dimensions.
 - .1 Install hangers at following distance:

	NPS 12mm (½")	NPS 20mm (¾")	NPS 25mm (1")	NPS 40mm (1½")	NPS 50mm (2")	NPS 65mm (2½")
16°C (60°F)	1.5 m (60")	1.7 m (66")	1.8 m (72")	2 m (78")	2.1 m (82")	2.3 m (90")
38°C (100°F)	1.4 m (54")	1.4 m (59")	1.5 m (60")	1.7 m (66")	1.8 m (72")	2 m (78")
60°C (140°F)	0.8 m (30")	0.8 m (30")	0.9 m (36")	1.1 m (42")	1.1 m (42")	1.2 m (48")

- .2 Install laboratory drains and all connections as indicated. Drain and vent shall resist to acids, pesticides and isotopes.
- .3 Do not use P traps on fixtures; group fixtures drain pipes to a single point; at Y main connection or on riser, use U siphon vented on both sides.

3.1.7 Buried Piping

- .1 Use acid resistant extra heavy (14%) silicium cast iron piping; joints to be made with molten lead and braid. Use Hub and spigot couplings.
- .2 Glass piping shall be covered with a flexible blanket to prevent damage caused by light collisions.
- 3.1.8 Visible piping installed under floor or in crawl space: use same pipe as above floor, standard weight.
- 3.1.9 Above ground piping, behind laboratory benches and in service trenches: use boro-silicate glass piping tempered and annealed, resistant, with all assorted couplings. Join pipes with sleeves, compression clamps, and gaskets allowing 2 to 4 degrees alignment or joint pipes with nylon-grooved sleeves, as per manufacturer's product selection.

3.2 Specialties Installation

3.2.1 Cleanouts

- .1 Install accessible cleanouts at traps, where required by codes and where prescribed.
- .2 Unless serviceable from below floor in basement, bring cleanouts up to finished floor or wall.
- .3 Building drain cleanout and stack and stack base cleanouts: NPS 100 mm (4") and under equals line size, NPS 125 mm (5") and over = NPS 100 mm (4").
- .4 For above ground, interior piping, located under street level, and for clean-outs at foot of storm and sanitary columns, install a retaining rod with angles at clean-outs or "Barret" type clean-outs.
- 3.2.2 Install backwater valves in pits or with access to top for servicing.
- 3.2.3 Floor drains: provide with trap primers connected to nearest cold water flush valve, or as shown to manual primer.
- 3.2.4 Water meter: installation to comply with local water authority requirements. The installer must be accredited for this task as per local water authority requirements.

- 3.2.5 Testing: ensure that insulated piping and equipment installed in concealed spaces is tested and inspected prior to permanent concealment. Give 48 h notice to Engineer in writing.
- 3.2.6 Non-freeze wall hydrant: above finished grade unless otherwise noted and with inside shut-off valve.

3.2.7 Equipment Drainage

- .1 Install drain valves at low points.
- .2 Extend equipment drain piping to discharge into floor or hub drain. If required, split the drainage piping towards many floor drains to prevent overflow.
- .3 Install drain piping from drain pan of air handling units, full size of outlet connection and equipment with trap seal equal to fan total pressure, plus 25 mm (1"), unless otherwise instructed by Engineer. This drain shall be indirect type and flows towards a floor drain.

3.3 Pumps Installation

- 3.3.1 Secure base mounted pump assembly bedplate to concrete base provided.
- 3.3.2 Secure frame and cover plates of sump pumps of various types onto pit frames provided.
- 3.3.3 Align pump and motor assembly after grouting base mounted units, and after mounting of cover plate of sump type vertical pumps.

3.4 Testing

- 3.4.1 Test water piping hydrostatically at a pressure 1½ times system pressure or at 860 kPa (125 psig), whichever is greater.
- 3.4.2 Pressurize piping for 4 hours makes sure that the piping is free of leaks, unless otherwise stated.
- 3.4.3 Test drainage and vent piping as requested by codes. Test system with water only unless written Engineer permission is obtained.
- 3.4.4 For subsoil drainage piping, test flow after backfill and compaction and produce a written report.

3.5 Commissioning

3.5.1 Equipment: make tests to demonstrate capabilities and general operating characteristics of equipment, as instructed by Engineer.

3.6 Clean-Up

3.6.1 Leave systems operating with work areas clean to satisfaction of Engineer.

3.7 Connections to municipal networks

3.7.1 Connections to municipal services including cutting, excavation, backfilling, pavement and sidewalk coating.

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Content of this Section
 - .1 Materials, equipments, accessories and methods of installation related to water heaters (electrical, steam, gaz, etc) and accumulation systems.
 - .2 Materials, equipments, accessories and methods of installation related to domestic water treatment systems.
 - .3 Materials, equipment's, accessories and methods of installation related to water softener systems.

1.3 Shop Drawings

1.3.1 Supply shop drawings according to Section 20 05 00.

1.4 Maintenance instructions

1.4.1 Supply necessary instructions for maintenance to be incorporated in maintenance manual specified in Section 20 05 00.

1.5 Reference Codes

- 1.5.1 Unless otherwise specified, execute works according to:
 - Plumbing Code.

1.6 Permit

1.6.1 Obtain all necessary permits and approvals by competent authorities.

Page 2

PART 2 - PRODUCTS

- 2.1 Gaz fired hot water heater with tank
- 2.1.1 Refer to drawings.

PART 3 - EXECUTION

3.1 Installation of heating equipment

- 3.1.1 Connect equipment to hot and cold water piping and connect safety valve outlet to floor drain.
- 3.1.2 Electric equipment: Work is described at Division 26.
- 3.1.3 Hot water Heater: Install as per manufacturer instructions to hot and cold water and piping.
- 3.1.4 Control valve: install water control valves in supply pipe to tank, equipment, water-heaters, according to manufacturer instructions.

3.2 Commissioning

3.2.1 Equipment: make tests to demonstrate capabilities and general operating characteristics of equipment, as instructed by Engineer.

3.3 Clean-Up

3.3.1 Leave systems operating with work areas clean to satisfaction of Engineer.

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

1.2.1 Contents of this Section

- .1 Materials, equipment's, accessories and methods of installation related to sinks, tubs and plumbing fixtures.
- .2 Materials, equipment's, accessories and methods of installation related to special apparatus in plumbing networks.
- .3 Materials, equipment's, accessories and methods of installation related to restroom sanitary equipment (sink, WC, urinal) and its plumbing fixtures.
- .4 Materials, equipment's, accessories and methods of installation related to bathroom bathing equipment (bath, shower stall) and its plumbing fixtures.
- .5 Materials, equipment's, accessories and methods of installation related to regular drinking fountains and to refrigerated fountains/water chillers, and their plumbing fixtures.
- .6 Materials, equipment's, accessories and methods of installation related to emergency equipment (eyewash and shower stations) and its plumbing fixtures.

1.3 Shop Drawings

1.3.1 Supply shop drawings according to Section 20 05 00.

1.4 Maintenance Data

- 1.4.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00.
- 1.4.2 Supply in a framed glass, instructions and blow out view for water treatment systems.

1.5 Fixtures and fittings

1.5.1 If architectural and mechanical drawings are contradictory as to the number and location of plumbing fixtures and their location, architectural drawings prevail.

1.6 Reference Codes

- 1.6.1 Unless otherwise specified, execute works according to:
 - · Plumbing Code.

1.7 Permits

1.7.1 Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Plumbing fixtures and trim

- 2.1.1 Plumbing fixtures shall be the products of one manufacturer and of be of the same colour in any one washroom or location.
- 2.1.2 Unless otherwise indicated, plumbing faucets and accessories and trim shall be the products of one manufacturer.
- 2.1.3 Materials
 - .1 Vitreous china to CSA B45.1.
 - .2 Unless otherwise stated stainless steel fixtures to CSA B45.4, Class II, type 302 or 304; Class I; type 316 for all laboratories, photo labs use without exception.
 - .3 Plumbing fittings to CSA B125.
 - .4 Exposed plumbing brass and metal work shall be heavy triple chromium plated.
 - .5 Unless otherwise stated all fixtures shall be white.
- 2.1.4 Water conservation type fixtures
 - .1 "Water saver type" water closets are identified following the number with a suffix (1.6 GPF), that is the volume per cycle in gallons. "Water saver type" or "low consumption type" urinals are identified following the number with a suffix (0.5 GPF).
 - .2 Flush valves must be adjusted to capacities indicated.
- 2.2 Water closets
- 2.2.1 Refer to drawings
- 2.3 Urinals
- 2.3.1 Refer to drawings
- 2.4 Lavatories
- 2.4.1 Refer to drawings
- 2.5 Showers
- 2.5.1 Refer to drawings
- 2.6 Sinks
- 2.6.1 Refer to drawings
- 2.7 Refrigerated drinking fountains
- 2.7.1 Refer to drawings

PART 3 - EXECUTION

3.1 Fixture Installation

- 3.1.1 Connect fixtures complete with supplies and drains separately trapped, supported level and square. Each fixture must have lock shield valves on supplies as specified. Hot water faucets shall be on left. Mixing faucets; opposite action and thermostatic control mixing valves to have check valves on supplies. Fixtures to have supplies from wall.
- 3.1.2 Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers and escutcheons.
- 3.1.3 Provide supports, required to set fixtures level and square. Mount fixtures so that 90 kg (200 lb) mass will not loosen or distort mounting. Fasten fixtures on walls or partitions with 12 mm (½") nominal carriage bolts passing through wall to 3 mm (½") thick steel plates or recessed where required on other side of wall unless chair carriers are specified.
- 3.1.4 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.
- 3.1.5 Connect and mount if not already mounted, kitchen and laboratory equipment supplied by other Sections previously specified.
- 3.1.6 Provide water hammer arrestors for each fixture or group of fixtures.
- 3.1.7 Where future fixtures are shown to be "roughed in" on drawings, plug or cap outlet branches for same, gas tight and watertight. Cap openings in walls with stainless steel cover plates, secured with knock-off head screws.
- 3.1.8 Provide on each piping branch and on each plumbing fixture a stop valve and a balancing valve where balancing is required.
- 3.1.9 Fit up each kitchen sink with a dishwasher connection for future use on the domestic hot water line, complete with isolation valve and drainage upstream of the sink P-Trap.

3.2 Mounting Heights

- 3.2.1 Fixture mounting heights measured from floor shall be in accordance with following paragraphs and be validated prior to installed with architects:
 - .1 Water Closet
 - Standard: 460 mm (15") to top of bowl rim;
 - For physically handicapped: 457 mm (18") to top of seat.
 - .2 Urinal
 - Standard: 550 mm (22") to top of bowl rim.
 - .3 Lavatory
 - Standard: 775 (30") to top of basin rim;
 - For physically handicapped: 865 mm (34") to top of basin rim.
 - .4 Drinking Fountain
 - Standard: 1 m (39") to top of basin rim;
 - For physically handicapped: 900 mm (36") to top of basin rim;
 - For elementary school: 750 mm (30") to top of basin rim.

.5 Shower rosettes from receptor top to center line of bent arm (adjust pipe to head selected).

Men: 1830 mm (72");
Women: 1730 mm (68");
High School (boys): 1780 mm (70");
High School (girls): 1730 mm (68");
Elementary Schools (boys): 1625 mm (69");
Elementary Schools (girls): 1575 mm (62");

3.3 Commissioning

3.3.1 Equipment: make tests to demonstrate capabilities and general operating characteristics of equipment, as instructed by Engineer.

3.4 Clean-Up

3.4.1 Leave systems operating with work areas clean to satisfaction of Engineer.

END OF SECTION

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PART 1 - GENERAL

1.1 Summary

- 1.1.1 The following section is aimed at operations, maintenance, methods and requirements concerning testing, adjusting and balancing (TAB) of HVAC systems.
- 1.1.2 TAB operations are testing, adjusting and balancing operations destined to ensure that the various systems function in accordance to the contractual requirements stated.

1.2 Qualifications of personnel in charge of TAB operations

- 1.2.1 Within 90 days following the awarding of the contract, submit the list of persons who will be in charge of executing the testing, adjusting and balancing operations.
- 1.2.2 Submit documentation which demonstrates the competence and experience of the personnel.
- 1.2.3 The testing, adjusting and balancing operations must be executed according to the standard which controls the qualifications of the company and of the personnel in charge of it.
 - .1 Associated Air Balance Council, (AABC), National Standards for Total System Balance, MN-1.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- 1.2.4 TAB operations must be carried out according to the suggested recommendations and practices of the retained standard.
- 1.2.5 In order to satisfy the contractual requirements, conform to the provisions of the retained standard which are aimed at TAB operations and use the verification lists and forms offered.
- 1.2.6 Conform to the provisions of the retained standard in regards to TAB operations including company and personnel (those in charge of the work) qualifications, and calibration of measurement equipment.
- 1.2.7 Conform to manufacturer recommendations for the calibration of measurement equipment when they are more rigorous than those stated in the relative TAB operations standard.
- 1.2.8 The provisions of the retained standard concerning quality assurance, notably the warranties related to performance, are an integral part of the contract.
 - .1 In the case of systems or components which are not covered by the retained standard concerning TAB operations, use the methods established by the specialist in charge of the work.
 - .2 When new methods and requirements which are applicable to the contractual requirements and which have been published or enforced by the policy-maker (AABC, NEDD, or TABB), the requirements and recommendations defined are mandatory.

1.3 Goal of TAB operations

- 1.3.1 Carry out systems testing to verify whether they function reliably and appropriately, to determine the true operating points and to evaluate the qualitative and quantitative performances of equipment, systems and related command/regulation apparatus, at nominal load, at medium or light load, this load being real or simulated.
- 1.3.2 Adjust the equipment and systems such that they respond to the performance requirements prescribed and that they can interact with related systems in the prescribed way, within normal and emergency loading and operating conditions.

1.3.3 Balance equipment and systems such that the flow corresponds to the load over the entire range of operation.

1.4 Exceptions

1.4.1 The testing, adjusting and balancing of equipment and systems subject to standards or specific codes must be executed to the satisfaction of the proper authority.

1.5 Coordination

- 1.5.1 Schedule time, within the construction work calendar, for trial operations and for the adjustment and balancing of systems (including fixes and reworks) which need to be done before the work is handed over.
- 1.5.2 Test-drive, adjust and balance each distinct system then repeat for each system with respect to related systems, in the case of systems with control mechanisms.

1.6 Review of terms in contractual documents related to TAB operations

- 1.6.1 Review contractual documents before the start of construction work and confirm in writing to the Engineer that the provisions regarding testing, adjusting and balancing of equipment and systems, as well as all other aspects relating to their conception and installation are appropriate and will ensure the success of these operations.
- 1.6.2 Review standards and other prescribed reference documents and inform the Engineer in writing of the proposed methods in the contractual documents which differ from those described in the standards or reference documents.
- 1.6.3 During construction work, coordinate the location as well as the installation or layout of the devices, equipment and accessories and of the openings and test port fittings necessary to execute TAB operations.

1.7 Equipment and systems start-up

- 1.7.1 Unless indicated otherwise, follow the equipment and systems' manufacturers recommended startup procedures.
- 1.7.2 Follow any particular start-up procedure specified elsewhere.

1.8 Operation of equipment and systems during TAB activities

1.8.1 Run equipment and systems for the required period for the execution of TAB activities and for the verification of TAB reports by the Engineer.

1.9 Beginning of TAB operations

- 1.9.1 Advise the Engineer 14 days before proceeding to testing, adjusting and balancing operations.
- 1.9.2 Only proceed with TAB operations when the building is, for the most part, serviceable:
 - .1 The construction of ceilings and the installation of doors, windows and other elements which can have an influence on the results of the TAB operations are completed;
 - .2 The installation of weather-tight products, caulks and weather strips is completed;
 - .3 Trials for pressure, weather-tightness and others prescribed in Section 23 are completed;
 - .4 The material necessary for the execution of TAB operations is installed and ready to run;

- .5 The mechanical installations and the electrical and related command/regulation systems, which can impact the results of the TAB operations, are running and the following items with regards to proper operation are verified:
 - Thermal protection of electrical equipment against overloads;
 - Aeraulic networks:
 - filters are in place and clean;
 - air ducts are clean;
 - ducts, shafts and plenums are air-tight, within the specified limits;
 - · fans are rotating in the proper direction;
 - · volumetric dampers and fire-protection shutters are in place and open;
 - coil fins are clean and straightened;
 - · inspection doors and panels are installed and closed;
 - exhaust openings are installed and volumetric dampers are open.
 - Hydronic networks:
 - pipes are rinsed, filled and vented;
 - pumps are rotating in the proper direction;
 - filters are in place and baskets are clean;
 - · isolating and balancing valves are in place and open;
 - balancing valves are installed and calibrated to the manufacturer's specifications;
 - · liquids treatment systems are in good operating condition.

1.10 Difference between adjustment and theoretical values

- 1.10.1 Carry out testing, adjusting and balancing of systems until the differences are no larger than the following values:
 - .1 HVAC systems: plus 10%, minus 10 %.
 - .2 Hydronics systems: more or less 10 %.

1.11 Difference between measured and real values

1.11.1 Measured values must correspond to more or less 2% of real values.

1.12 Measurement instruments

- 1.12.1 Before starting TAB operations, submit the list of instruments that will be used to the Engineer and include their serial numbers.
- 1.12.2 Calibrate the instruments in compliance with the requirements of the standard or reference document, whichever is most rigorous, in regards to HVAC systems or to those submitted to TAB operations.
- 1.12.3 Calibrate instruments within the three (3) months preceding the start of TAB operations. Submit a calibration attestation to the Engineer.

1.13 Documents/samples to submit

- 1.13.1 Before proceeding with TAB operations, submit the following:
 - .1 The proposed method to test, adjust and balance the systems if it differs from the method described in the standard or reference document retained.

1.14 Preliminary report

- 1.14.1 Before officially submitting the TAB report to the Engineer, submit, for verification and approbation purposes, a preliminary report in which the following must be indicated:
 - .1 The details concerning the instruments used.
 - .2 The details concerning the TAB method employed.
 - .3 The calculation methods used.
 - .4 Recapitulation.

1.15 TAB report

- 1.15.1 The presentation of the report must comply with the requirements of the standard or reference document retained regarding TAB operations.
- 1.15.2 The results expressed in the report must be in SI units. The report must contain the following:
 - .1 The drawings to keep in the project's folder.
 - .2 The schematic diagrams of the targeted systems.
- 1.15.3 Submit to the Engineer, for verification and approbation purposes, six (6) copies of the TAB report, in English, presented in D-ring binders containing tab separators.

1.16 Data verification

- 1.16.1 The recorded measurements are likely to be checked by the Engineer.
- 1.16.2 Anticipate sufficient personnel and instruments for the verification of, at most, 5 % of recorded measurements.
- 1.16.3 The Engineer will determine the number of verifications to conduct as well as the measurement locations.
- 1.16.4 Rerun testing, adjusting and balancing operations until the results are to the satisfaction of the Engineer, and assume the fees for such tasks.

1.17 Controls

- 1.17.1 Once the TAB operations are completed to the Engineer's satisfaction, reinstall the protective guards on the driving mechanism or transmission device, close the inspection doors and traps, return the control devices to their operating positions and verify whether the sensors are fixed at the required set points.
- 1.17.2 Permanently mark the balanced damper positions; these must not be erased or covered in any way.

1.18 End of TAB operations

1.18.1 The testing, adjusting and balancing operations of the systems will only be considered as complete when the final report will have been approved by the Engineer.

1.19 Aeraulic systems

- 1.19.1 TAB operations must be executed in compliance with the most rigorous requirements stated in either the present section or in the standards and relevant reference documents from the AABC, NEBB and SMACNA.
- 1.19.2 Proceed with testing, adjusting and balancing of systems, equipment, elements, and command/regulation devices specified in Division 23.

- 1.19.3 The persons in charge of executing TAB operations must be entitled to provide the specified services, according to the standards of the AABC or NEBB.
- 1.19.4 Testing, adjusting and balancing operations on the systems must be done under the direction of a supervisor recognized by the AABC or NEBB.
- 1.19.5 The surveys to be done will address the following, according to the systems, equipment, elements or command/regulation devices targeted: air speed, static pressure, flow, head loss, temperature (dry bulb, wet bulb, dew point), air duct cross-section, rotation speed, demand set-up, pressure.
- 1.19.6 Depending on the situation, measurement locations, in the case of equipment, will be situated in the following locations:
 - .1 At the entrance and exit of dampers, filters, heating and cooling air coils, humidifiers, fans and any other equipment which can modify conditions.
 - .2 At the controllers and at the apparatus and devices controlled.
- 1.19.7 Depending on the situation, measurement locations, in the case of systems, will be situated in the following locations: primary and secondary air ducts, supply ducts of terminal elements (grilles, damper or diffuser grilles).
- 1.20 Other requirements concerning TAB operations
- 1.20.1 General requirements applicable to work described in the present article.
 - .1 Qualification of personnel in charge of TAB operations: according to the provisions stated in the article about aeraulic systems.
 - .2 Quality assurance: according to the provisions stated in the article about aeraulic systems.
- 1.20.2 Kitchen hoods and exhaust systems
 - .1 Perform a smoke test (smoke generation or water vapour) to demonstrate to the Engineer proper capture and containment performance of the installed commercial kitchen exhaust systems.

PART 2 - PRODUCTS

2.1 Not applicable

PART 3 - EXECUTION

3.1 Not applicable

END OF SECTION

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Section 23 20 00

PART 1 - GENERAL

1.1 **General Requirements**

1.1.1 Section 20 05 00 - "General Requirements Concerning Common Work Results" applies.

1.2 Summary

1.2.1 Content of this Section

- Piping distribution network for hot water, steam and condensate return installed in the building and facilities and central heating:
 - pipes, devices and faucet accessories and pipe fittings, manufacturing materials and installation related methods;
 - pumps and installation related methods:
 - materials, equipment, components and chemicals necessary for the establishment of a comprehensive HVAC water treatment facility.

1.3 Shop drawings

1.3.1 Submit shop drawings in accordance with Section 20 05 00.

1.4 Maintenance instructions

- 1.4.1 Submit in English, necessary instructions for maintenance. Incorporated such to the instruction manual mentioned in Section 20 05 00.
- 1.4.2 Supply instructions and blow out view for water treatment systems in a frame with glass.

1.5 **Permits**

1.5.1 Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Valves - General

2.1.1 Conform to: Bronze MSS-SP-80 Cast Iron MSS-SP-70

.1 Materials:

- Bronze: ASTM-B-61 and B-62;
- Cast Bronze: ASTM-B-584;
- Silicone Bronze: ASTM-B-371;
- Copper: ASTM-B-16;
- Stainless steel: ASTM B-371 type 304;
- Stainless steel: ASTM A-276 type 316;
- Cast Iron: ASTM A-126, class B;
- Obturator Buna "N", TFE, EPDM.

2.1.2 Balancing valve

.1 All valves (butterfly, ball valve, plug valve) used for balancing, must be supplied with dial indicator, pointer and memory stop.

2.1.3 Plug valve

- .1 To 125 mm (5") NPS supply with wrench type handle. Supply a wormgear operator with indicator and flywheel for 150 mm (6") NPS and over. Valves shall be of the lubricated type.
- .2 Factory tested to ANSI B16-1 and B16-3.

2.1.4 Butterfly valve

- .1 Supplied with locking lever handle with 8 positions notched plate, to NPS 150 (6"), and supplied with worm gear, permanently lubricated, dial indicator and fly wheel, for NPS 200 (8") and over. Body shall be lug type.
 - Acceptable products: Keystone F-401 and F-427, Crane, Grinnell series 1 000, Victaulic, Gruylock.

2.1.5 Ball valve

- .1 Supplied with command lever, vinyl covered.
- .2 Standard orifice size
- .3 Extended stem for insulation thickness.
- .4 With dial indicator and positioning notches for balancing.

2.1.6 Chain pulley

.1 Valves located 2.1 m (7') above floor to be provided with a chain pulley. Extend chains to 1.5 m (5') approximately above floor level, and attach them in order to maintain practical traffic in corridors and other areas.

2.1.7 Floor Stand

- .1 Where indicated, supply valves with floor stand, open/closed, indicator and fly wheel stem extension.
 - Acceptable products: Keystone F-422, Crane 1182.

2.1.8 Drain Valves

Drain valves: ball valve or gate valve, bronze body with hose thread, with cap and chain.

System pipe diameter	Valve size
To NPS 32 mm (1.25")	20 mm (¾")
38 mm to 65 mm (1.5" to 2.5")	25 mm (1")
75 mm (3") and over	50 mm (2")

.1 Acceptable products: Toyo 5046, Nibco T113HC.

2.2 "Y" Strainer

- 2.2.1 Body: cast iron, bronze or carbon steel.
- 2.2.2 Strainer in stainless steel 304, nominal diameter perforations:
 - Steam: 1.143 mm (0.045") for all diameters;
 - Water, up to NPS 100 mm (4"): 1.6 mm (1/16");
 - Water, above NPS 125 mm (5"): 3.2 mm (1/8").
- 2.2.3 Strainer over DN 40 mm (1.5") in diameter: supply nipple and drain valve for steam service, drain valve with hose fitting for liquid service.
- 2.2.4 Connection: threaded sockets for DN 50 mm (2") and less, flanged for larger diameters.
- 2.2.5 Strainer to withstand higher of following pressures: effective steam gauge pressure of 860 kPa (class 125) or 1½ times effective service pressure.

NPS 10 to 50 mm (%" to 2")	Cast iron Threaded ends Pressure 1723 kPa (250 psig)	ASTM A-278 C1.30
NPS 50 to 250 mm (2" to 10")	Cast iron flanged Pressure 860 kPa (125 psig)	ASTM A-278 C1.30
NPS 65 to 150 mm (2" to 8")	Cast iron Pressure 1723 kPa (250 psig)	ASTM A-278 C1.30
NPS 65 to 150 mm (2½" to 6")	Carbon steel flanged Pressure 1035 kPa (150 psig)	ASTM A-216 Grade WCB
NPS 12 to 150 mm (½" to 6")	Carbon steel flanged Pressure 2070 kPa (300 psig)	ASTM A-216 Grade WCB

- 2.2.6 Pressure drop, with clean strainer, not over 21 kPa (3 psi), at nominal network flow.
- 2.2.7 Acceptable products: Armstrong, Crane, Victaulic 730, Gruvlok 7260, Conbraco.

2.3 Water Hammer Arresters

- 2.3.1 Size to PDI-WH201.
- 2.3.2 Acceptable products: Jay R. Smith 5000, Zurn 1700.

2.4 Gaskets

2.4.1 Unless otherwise indicated, 1.5 mm (1/16"), conform with standard ANSI/AWWA C111/A221.11, with compound appropriate for service to cover full face for flat face flanges and raised face flanges; for water service: red rubber 1.5 mm (1/16") thick, to cover full face of joint.

2.5 Thermometers

2.5.1 General

- .1 Place direct reading thermometers so that readings can be taken from the floor or from platform if applicable.
- .2 If it not possible to place thermometers so that readings can be taken easily, use remote reading thermometers.
- .3 Lamicoid nameplates used for thermometer identification shall be placed as close to the thermometer as possible.
- .4 Materials used to satisfy system requirements.
- 2.5.2 Industrial type, with aluminum casing, adjustable reading angle, liquid type with 228 mm (9") scale to CGSB 14-4M88. Appropriate standard scale to measured temperatures with 1°C increments (1°F) the scale to be numbered every ten degrees, except for ranges beyond 150°C (300°F).
 - Acceptable products: Winters, Ashcroft, Trerice, Taylor-Weiss.
- 2.5.3 All thermometers to be supplied with wells. The depth of the wells shall permit an insertion of at least 50 mm (2") in liquids and 100 mm (4") in gases. Threads to be 20 mm ($\frac{3}{4}$ ").
- 2.5.4 When insulation is used, wells shall be supplied with extension collars clearing the insulation thickness.
- 2.5.5 Scales to cover twice the system temperature range.
- 2.5.6 Thermometer scales to be in English and metric units.

2.6 Manometers

2.6.1 General

- .1 Place direct reading manometers so that readings can be taken from the floor or from the platform, if applicable.
- .2 If it is not possible to place manometers so that readings can be taken easily, install them at 1.5 m (5') from the floor and connect them with 6 mm (1/4") piping and bronze stopcock.

- .3 Lamicoid nameplates used for manometer identification shall be placed as close to the manometer as possible.
- .4 Materials used to satisfy system requirements.
- 2.6.2 With 115 mm (4½") dials conforming to ONGC 91-GP-1, 0.5% accuracy and conforming to ANSI grade 2A unless otherwise noted, with bronze stop cock.
 - Acceptable products: Marshalltown, Ashcroft, Trerice.
- 2.6.3 Each gauge shall be chosen to indicate twice the system operating pressure.
- 2.6.4 Provide a pigtail for steam service, a pulsation damper if required.
- 2.6.5 When insulation is used on piping, provide extension to clear the insulation.
- 2.6.6 Manometer scales to be in English and metric units.

2.7 Pipe Hangers and Supports

- 2.7.1 Support from structural members. Where structural support does not exist suspend hangers from steel channels or angles. Provide and install supplementary structural members. Obtain approval before using vertical expansion shields. Use minimum two shields for each hanger. Do not suspend from metal deck. Conform to equipment manufacturer's recommendations.
- 2.7.2 Use hangers adaptable for all pipe sizes. Use roller type hangers where specified.

Acceptable products: Myatt, Anvil, Apex.

- .1 Piping with service fluid temperature higher than 95°C (200°F); Anvil 181 and 271.
- .2 Copper pipes: domestic water, drains vents and others: Anvil CT-65, CT-121.
- .3 All other services: Anvil 65 up to 50 mm (2"), Anvil 260 for 65 mm (2½") and over and vertical runs: Anvil 261.
- .4 Use roller type hangers with bracing in the following cases: hangers cannot be supported from top of structural steel work.
- .5 Minimum hanger rod length: 150 mm (6") for all piping.
- .6 Hangers rods shall be made of mild steel, with mechanical threading, length of threads shall be sufficient to allow adjustment of pipe levels.
- 2.7.3 Pipe racks shall be fabricated from I, U, H structural steel or angle iron and prefabricated galvanized steel channels. Welds shall be continuous and free of cavities. Racks attached to structural elements with Philipps Red Head anchors or approved equal (painting: refer to the article treating this subject).
- 2.7.4 Pipe racks spacing shall suit pipe of smaller diameter.
- 2.7.5 Use rod diameters and spacing for pipe supports as shown in table except for the following:
 - .1 Support sanitary plumbing piping in accordance with plumbing code municipal or provincial or as specified.
 - .2 Support NPS 12 mm (½") gas pipe every 1.8 m (6').
 - .3 Support NPS 12 mm (½") copper pipe every 1.5 m (5').

.4 Support plastic and glass piping in accordance with manufacturer's recommendations.

Pipe size (Nominal Diameter)		Rod Diameter	Maximum Steel	Spacing Copper
NPS 20, 25	(3/4", 1")	10 mm (%")	2.1 m (7')	1.8 m (6')
NPS 32	(11/4")	10 mm (¾")	2.1 m (7')	1.8 m (6')
NPS 40	(11/2")	10 mm (3/8")	2.7 m (9')	2.4 m (8')
NPS 50	(2")	10 mm (¾")	3 m (10')	2.7 m (9')
NPS 65, 75	(2½",3")	10 mm (3/8")	3.6 m (12')	3 m (10')
NPS 100	(4")	16 mm (5%")	4.2 m (14')	3.6 m (12')
NPS 125	(5")	16 mm (5%")	4.8 m (16')	, ,
NPS 150	(6")	22 mm (⁷ / ₈ ")	5.1 m (17')	
NPS 200	(8")	22 mm (⁷ / ₈ ")	5.7 m (19')	
NPS 250	(Ì0 ["])	22 mm (¾")	6.6 m (22')	
NPS 300	(12")	22 mm (¾")	6.9 m (23')	

- 2.7.6 Place support within 300 mm (12") of each horizontal elbow.
- 2.7.7 Hangers shall be 3-piece minimum standard: i.e. anchor, rod, pipe collars and hangers.
- 2.7.8 For piping having an operating fluid temperature of 18°C (64°F) or less, except cold domestic water, install saddles or hangers on top of insulation over prefabricated insulation shields for each saddle and/or support.
 - .1 Acceptable products: Anvil No 167, Myatt or Apex.
- 2.7.9 Where medium temperature piping is at or above 110°C (231°F), install collars and supports over the thermal insulation, by using prefabricated pads in order to protect the thermal insulation.
 - .1 Acceptable products: Anvil: saddles 160 to 165, Myatt or Apex.
- 2.7.10 Offset hanger pipe and structural attachments in such a manner that rod is vertical when piping is at its service temperature.
- 2.7.11 Set hanger levels to distribute the weight load evenly.
- 2.7.12 Before proceeding with fabrication or installation, submit, for verification, the shop drawings for all types of proposed supports.
- 2.7.13 On a roof, using prefabricated supports with high density polypropylene base with protection against ultraviolet light.
 - .1 Acceptable products: Portable Pipe Hangers serie PP and SS, Advanced Support Products inc. serie SS1000.

2.8 Expansion Tank

- 2.8.1 Cylindrical, vertical or horizontal, steel construction with liquid or flexible membrane under pressure.
- 2.8.2 Butyl membrane and interior polypropylene lining, sealed to tank wall.
- 2.8.3 Service pressure 800 kPa (125 psig) bearing ASME seal of approval.
- 2.8.4 Service temperature: 115°C (240°F) maximum.
- 2.8.5 Pre-charge: Tank to be pressurized prior to installation at minimum service pressure.
- 2.8.6 Acceptable products: Refer to drawings.

2.9 Manual Air Vent Valves

- 2.9.1 Operated by screwdriver and accessible from the top or side of the radiators or convectors envelope.
- 2.9.2 Acceptable products: Dole no 9 or 9B, Taco 417 Coint Vent, Maid O'Mist.

2.10 Automatic Vents

- 2.10.1 For unit heaters, fan-coils and coils
 - .1 Chrome plated bronze body, copper seat, synthetic rubber disc with removable seat, working pressure 590 kPa (100 psi).
 - .2 Acceptable products: Armstrong AV-13 NPS 20 mm (¾") Braukman, Maid-O-Mist.
- 2.10.2 To be installed in mechanical rooms, boiler room and on all locations on piping systems.
 - .1 Float type vent, industrial use, cast iron body, NPS 19 mm (3/4").
 - .2 Float: stainless steel, Buna "N" seat, stainless steel.
 - .3 To withstand 1725 kPa (250 psig) service pressure.
 - .4 Acceptable product: Armstrong 21-AR or approved equal.
 - .5 Each vent with a stop valve, a 6 mm ($\frac{1}{4}$ ") test valve, vent piped to nearest floor drain.
- 2.10.3 To be installed on risers.
 - .1 Cast iron body float type airvent with NPS 19 mm (3/4).
 - .2 Stainless steel float and needle valve and Buna "N" seat.
 - .3 Maximum design working pressure: 2070 kPA (300 psig) at 93°C (200°F).
 - .4 Acceptable products: Armstrong 1-AV, or approved equal.

2.11 Make-up Water Regulator

- 2.11.1 Complete assembly: stop valves, strainer, pressure regulating valve, pressure gauges and relief valve.
 - .1 Membrane type pressure reducing valve, bronze body, stainless or nickel/chrome seat, pressure gauge connection. Maximum inlet pressure 242/1585 kPa (35/230 psi).
 - .2 Acceptable products: Armstrong GD-24, Gunzenhauzer (Methot Inc.) 1130, Conbraco Serie 36.

- 2.11.2 Relief valve, cast bronze body, internal parts in brass with spring and lever. Maximum pressure 1110 kPa (160 psi) at 120°C (250°F).
 - .1 Acceptable products: Kunkle No 137-B NPS 19 mm (¾"), Conbraco.
 - .2 Strainers, gauges and valves, as described elsewhere in the specifications.

2.12 Collectors and Headers

- 2.12.1 Made of pipes, fittings and accessories to specifications, appropriate for intended service.
 - .1 Full-flanged ends.
 - .2 Welded inlets and outlets with weldolet or threadolet, and welded flange with threaded sockets or unions.
 - .3 Install flanges at a minimum height determined by insulation thickness.
 - .4 Supply inlets and outlets with stop valves installed 1220 mm (4') above finished floor.
 - .5 Hydrostatic test: twice the operating pressure.
- 2.12.2 Supply shop drawing to Engineer for approval.
- 2.13 Heating Water to 120°C (250°F), 1035 kPa (150 psi)
- 2.13.1 See specifications sheets P23-6 and P23-6a for materials to be used at the end of this Section.
- 2.14 Vertical, In-Line Centrifugal Pumps
- 2.14.1 Refer to drawings.

2.15 Pump Suction Diffuser

- 2.15.1 General: Angle pattern fitting, with built-in strainer, with minimal pressure loss, made to be installed on pump suction, with a minimal pipe length.
- 2.15.2 Body: for a maximum working pressure of 1200 kPa (175 psi); cast iron, flanged or grooved connection, on pump and network side.
- 2.15.3 Straightening vane in steel on closed circuits and in stainless steel on open circuits. Stainless steel strainer with 4.76 mm (3/16") maximum openings.
- 2.15.4 Start-up strainer, of 16 mesh bronze, installed over permanent strainer. This strainer shall be removed after one month of continuous pump operation by the present Section.
- 2.15.5 Acceptable products: Suction Guide, Armstrong Darling; B&G Suction Diffuser, ITT Bell & Gosset.

2.16 Pump Combined Valve

- 2.16.1 General: Angle valve used as check valve, balance valve and shutoff valve, made to be installed at pump discharge with a minimal pipe length.
- 2.16.2 Body: for a maximum working pressure of 1200 kPa (175 psi); cast iron, flanged or grooved connection, on pump and network side.
- 2.16.3 Bronze or plastic material seat, replaceable bronze disc with EPDM seat insert, stainless steel stem and spring.

- 2.16.4 Openings for pressure gauges, graduations on valve to determine flow.
- Acceptable products: Flo-trex, Armstrong Darling, Triple Duty, ITT Bell & Gosset.

2.17 Chemical Water Treatment

2.17.1 General points

.1 The mechanical contractor shall also provide all piping, valves and connections necessary for the proper chemical treatment systems.

2.17.2 Corrosion coupon racks

- Provide one (1) corrosion coupon racks preassembled in the factory according to ASTM standards, including:
 - one (1) flow regulator (250°F) and (450 lb/po²), ductile cast iron body, spring and stainless steel cartridge;
 - four (4) steel coupons with nylon supports;
 - two (2) copper coupons with nylon supports;
 - · All support piping including: unions, tees, elbows and two isolation valves.
- .1 Acceptable product: Magnor SCC, Dow or approved equivalent

2.17.3 Pot-feeder

- .1 Provide one (1) pot-feeder.
- .2 Capacity of 9 liters (2,4 Usg), operating pressure of 1 035 kPa (150 psi) and including:
 - one (1) inlet valve of 15 mm (½") for chemical products;
 - one (1) funnel of 100 mm (4") diameter;
 - one (1) drain valve of 15 mm (½");
 - one (1) vent valve of 6 mm (¼");
 - two (2) connecting outputs of 15 mm (½").
- .3 All valves are made of bronze.
- .4 Acceptable product: Magnor, modèle 201-H, Dow or approved equivalent.

2.17.4 Test kits

- .1 The test cabinet is made of steel and coated with acid-resistant enamel paint, complete with a key lock and a fluorescent lamp inside.
- .2 It contains test tubes and all accessories and reagents necessary for analyses of P and M alkalinity chlorides, sulphites, total hardness, low concentration molybdates (0-10 ppm), high concentration molybdates (0-20 ppm), pH.
- 2.17.5 For each circuit, provide a complete laboratory analysis of mixture. Analysis should include at least: pH, % of antifreeze, freezing point.

PART 3 - EXECUTION

3.1 Installation

- 3.1.1 Upon equipment arrival on site inspect and store at requested level and make secure.
- 3.1.2 Install according to piping layout. Provide for pipe movement during normal operation. Pipe drains and blow off connections to nearest drain.
- 3.1.3 Maintain proper clearance around equipment to permit performance of service maintenance. Check final location with Engineer if different from that indicated prior to installation.
- 3.1.4 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.
- 3.1.5 Refer to manufacturer's installation drawings.
- 3.1.6 Check that all openings for apertures and operating weight conform to shop drawings.
- 3.1.7 Piping: meet Provincial and local codes for assembly.
 - .1 Connect water equipment as per manufacturer's installation literature and as instructed.
 - .2 Provide flexible connections, vibration and expansion connectors on equipment noted.
 - .3 Route piping in orderly manner and maintain proper grades. Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls.
 - .4 Slope water piping 1:700 upward, in direction of flow and drain at low points.
 - .5 On closed systems, equip low points with 20 mm (¾") drain valves and hose nipples. Provide, at high points on lines and on equipment connections, collecting chambers and high capacity float operated automatic air vents.
 - .6 Slope low-pressure steam piping 1:250 in direction of flow and condensate return piping 1:160. Reverse slope runouts as indicated. Provide drip trap assembly as low points and points where condensate may back up in front of control valves. Where condensate lines form trap, provide vent loop over the trapped Section.
 - .7 Make reductions in water and steam pipe sizes with eccentric reducing fittings installed to provide drainage and venting.
 - .8 Provide drainage and vent piping with 1:25 slope except when originating from a flashtank or deaerator.
 - .9 Connect deaerator to pump suction vertically, allow for expansion, install vent piping at 45° maximum angle from vertical direction.
 - .10 Provide clearance for installation of insulation and for access to strainers, valves, air vents, drains, cleanouts, unions, expansion joints, flex connectors, and trap assemblies.
 - .11 Ream pipes and tubes. Clean scale and dirt, inside and outside, before and after assembly.
 - .12 The use of main sized saddle type branch connections or directly connecting branch lines to mains in steel piping will be permitted for low pressure systems, if main is at least one pipe size larger than the branch up to 150 mm (6") mains and if main is at least two pipe sizes larger than branch for 200 mm (8") and larger mains. For high pressure systems follow ANSI B31.1-1977, submit calculations. Do not project branch pipes inside main pipe.

- .13 Make connections to equipment and branch mains with unions, pipe couplings, or flanges.
- .14 Flushing and cleaning procedure for piping systems.
 - Flush and clean out after pressure tests;
 - Fill with solution of water and non-foaming, phosphate-free detergent;
 - Flush and drain. Remove and clean strainers:
 - · Refill water system and clean water;
 - · With dry compressed air, dry interior surfaces of oil piping before filling.

.15 Welding

- Welding works shall meet ANSI B31.1 minimal requirements;
- Welders shall be registered to the "Canadian Welding Bureau" (CWB) for material and anticipated usage.

3.1.8 Valves

- .1 Install valves with stems upright or horizontal unless approved otherwise.
- .2 Install globe or angle valves with solid plug for throttling service and control device or meter bypass.
- .3 Provide spring loaded and swing check valves on discharge of condensate pumps and water booster pumps.
- .4 On gas piping use lubricated plug valves.
- .5 Install butterfly valves where indicated.
- .6 Install on oil piping, as indicated, vacuum breakers and fusible link operated valves.
- 3.1.9 Calibrate controlling apparatus after installation.

3.1.10 "Y" Strainer

- .1 Install "Y" strainer on horizontal and downslope runs.
- .2 Leave proper clearance to remove strainer.
- .3 Install "Y" strainer on all pumps, steam traps, control valves inlets and where indicated.
- 3.1.11 Install and test as per pressure vessel code.

3.2 Pumps

- 3.2.1 Base mounted type: provide templates for anchor bolt placement. Furnish anchor bolts. Place level and shim unit. Grout, align and check rotation. Align coupling. Prior to start-up, check oil level and lubricate.
- 3.2.2 In line pumps: support at flanges or near unions on outlets of unit. Check motor bearing lubrication points. Check rotation and flow direction arrows.
- 3.2.3 Vertical pump sitting on tank: check pump suction location with respect to walls and floor of pit or tank. Check suction strainer and clean. Check rotation, tighten glands finger tight, check lubricator level and top. Pipe as shown on drawings.

- 3.2.4 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- 3.2.5 Pipe threaded outlet drain to drain.
- 3.2.6 Install volute drain valve in an accessible location.

3.3 Water Treatment

3.3.1 Test methods

- .1 Three 3 inspection visits shall be done during the contract period, beginning immediately after the cleaning and start-up of installation. Such visits to be performed by a chemical Engineer, representing the supplier of chemicals. Visits to include the verification of treatment quality, methods and tests frequency, and possible trouble shooting with Owner operating personnel. Should modifications to original treatment instructions be required, submit such in typed-form memo. Provide standard forms, in sufficient quantities, for written data gathering, per day, per chemical used. Supplier representative shall modify instructions until the system is stabilized (first six weeks), and shall visit to maintain and minimize system destabilization. The chemical Engineer shall only perform tests during his visit, and interpret their results.
- .2 The chemical Engineer shall only perform tests during his visit.

	SPECIFICATIONS SHEET FOR MATERIALS TO BE USED					
SERVICE	P23-6 Heating water to 120°C (250°F), 1035 kPa (150 psi)					
FLUIDS		er, ethylene or propylene glycol (with poling water at maximum operating p t is accepted.				
Items	Nominal Dimensions	Description	Standards	Acceptable Products		
Pipes	To NPS 50 mm (2")	Schedule 40 carbon steel, electric resistance welded	ASTM A-53 Grade "B" Type "E"			
	NPS 65 mm (2½") to NPS 250 (10")	Black carbon steel, schedule 40, beveled ends, electric resistance welding.	ASTM A-53 Grade "B" Type "E"			
	NPS 300 (12") to NPS 600 (24")	Black carbon steel, standard series, beveled ends, electric resistance welding.	ASTM A-53 Grade "B" Type "E"			
Fittings	To NPS 50 mm (2")	Class 150, malleable iron, threaded	ANSI B16.3	Anvil,		
	NPS 65 to 600 mm (2½" to 24")	Welding seamless carbon steel, bevelled ends, standard wall	ANSI A-234 Grade "WPB"	Anvil,		
			ANSI B16.9			
Couplings	To NPS 50 mm (2")	Threaded				
	NPS 65 mm (2½") and over	Welded		[
Sleeves	NPS 10 to 50 mm (3/8" to 2")	Class 300, malleable iron threaded	ANSI B16.3			
Nipples	To NPS 50 mm (2")	Seamless carbon steel, standard wall	ASTM A-106			
Unions	To NPS 50 mm (2")	Class 150, malleable iron, threaded with brass to iron coupling	ASTM A-47 ANSI B2.1			

	SPECIFI	CATIONS SHEET FOR MATERIALS	S TO BE USED		
SERVICE	P23-6 Heating water to 120°C (250°F), 1035 kPa (150 psi)				
FLUIDS	Use on hot water, ethylene or propylene glycol (with proper packing), chilled water, from tower or cooling water at maximum operating pressure of 120°C (250°F). No mechanical joint is accepted.				
Items	Nominal Dimensions	Description	Standards	Acceptable Products	
Dielectric unions and flanges	All diameters	To use when there is contact between two dissimilar metals		Watts serie 3000 up to 82°C (180°F) for unions, Gruvlok 7089 & Victaulic type 47 up to 110°C (230°F)	
Flanges	To NPS 50 mm (2")	Class 150, forged steel, raised face, threaded	ASTM A-105 ASTM A-181 ANSI B36.10		
	NPS 65 (2½") and over	Class 150, forged steel, raised face welding neck	ASTM A-105 ASTM A-181		
	Use flat face flanges only on equipment supplied with flat face flanges.				
Orifice flanges	NPS 25 to 500 mm (1" to 24")	Class 150, forged steel, raised face, welding neck with tightening bolts, gaskets and threaded [grooved with gasket]	ASTM A-105 ASTM 1-181		
Bolts and nuts		Alloy steel hexagonal nuts	ASTM A-193-GrB7 ASTM A-194-GrZH		
Gaskets		Red rubber, reinforced with bronze mesh, narrow weave	SAE-ASTM-R.70 5	John Crane 666	
Joints		Threaded with Teflon tape		Reco-Seal no. 5, Loctite "PST"	
Gate valves	NPS 12 to 50 mm (½" to 2")	Class 150, threaded ends, bronze body, solid wedge disc, rising stem		Crane 431, Toyo 298, Milwaukee 1150, Nibco T-131, Grinnell 3060, Kitz 42	

SPECIFICATIONS SHEET FOR MATERIALS TO BE USED						
SERVICE	P23-6 Heating water to 120°C (250°F), 1035 kPa (150 psi)					
FLUIDS	from tower or co	Use on hot water, ethylene or propylene glycol (with proper packing), chilled water, water from tower or cooling water at maximum operating pressure of 120°C (250°F). No mechanical joint is accepted.				
Items	Nominal Dimensions	Description	Standards	Acceptable Products		
	NPS 12 to 50 mm (½" to 2")	Class 150, threaded ends, bronze body, solid wedge disc, non-rising stem		Crane 437C, Toyo 204-A, Milwaukee 1140, Nibco T-133, Kitz 46		
Butterfly valves	NPS 50 to 300mm (2" to 12")	Class 175 for 1205 kPa (175 psig) service pressure, cast iron body, bronze-aluminium wedge, 304 stainless steel stem EPDM seat, support legs 50 mm (2") high		Keystone F-222-CBJ-2, Victaulic 300, Crane 44-BXZ-L, Grinnell LC-1281, Gruvlok 7721, Centerline L200L-E, Toyo 918, BESL, Kitz 85E, Milwaukee ML-223 or ML-323-E, Centerline		
	NPS 350 to 500 mm (14" to 20")	Class 150 for 1050 kPa (150 psig) service pressure, cast iron body, bronze disc, EPDM seat, acoustic legs, 50 mm (2") high neck		Keystone F-222-CBJ-2, Grinnell LC-1282, Victaulic 709, Centerline G200L-E Crane 44-BXZ		
	NPS 600 to 1200 mm (24" to 36")	Class 150 for 1050 kPa (150 psig) service pressure, cast iron body, flanged, ductile iron disc, with nickel edge, stainless steel stem EPDM seat		Keystone F-104 H-CRP-2, Grinnell FC9622-0-XT		
Ball valves	NPS 12 to 50 mm (½" to 2")	Class 150, screwed ends, bronze body, bronze balls, chrome finish, silicon bronze stem, reinforced TFE seat	ASTM B-584 ASTM B-371	Crane serie 9210, Nibco serie T-560- BR, Kitz serie 10K (bronze)		

	SPECIFICATIONS SHEET FOR MATERIALS TO BE USED				
SERVICE	P23-6 Heating water to 120°C (250°F), 1035 kPa (150 psi)				
FLUIDS		er, ethylene or propylene glycol (with ooling water at maximum operating p it is accepted.			
Items	Nominal Dimensions	Description	Standards	Acceptable Products	
Globe valves	NPS 12 to 50 mm (½" to 2")	Class 150, screwed ends, bronze body, plastic disc for maximum temperature 185°C (365°F)		Crame 7-TF. Toyo 221, Milwaukee 590, Nibco F235-Y, Kitz 09	
	NPT 65 to 300 mm (2½"to 12")	Class 150, iron body, bronze disc, trim and seat ring, bolted bonnet, rising stem		Crane 21-E, Milwaukee F-2983, Nibco F-768-B	
Seing check valves	NPS 12 to 50 mm (½" to 2")	Class 200, bronze body and disc, threaded ends removable swing disc, screw-in cap		Crane 137, Toyo 238, Milwaukee 510-T, Nibco T-453-B, Kitz 29	
	NPS 65 to 300 mm (2½" to 12")	Class 250, iron body, flanged, swing check, replaceable and rectifiable desk and seat, bolted bonnet		Crane 39-E, Milwaukee F-2970, Nibco F-968-B	
Swing check valve	NPS 50 to 300 mm (2" to 12")	Class 150, cast iron body, disc, Buna-N seat, stainless steel accessories	ANSI 150	Keystone 831, Nibco W960, Victaulic 716, 715, 711, Centerline R-1*644*D1X	
Lubricated plug valve	NPS 12 to 50 mm (½" to 2")	Class 150, cast iron body, with threaded sleeves	ASTM A-126	Keystone Ball Centric 541, Huber Resun D-125	
	NPS 75 to 125 mm (3" to 5")	Class 175, cast iron flanged, flullflow disc, operating lever	ASTM A-150	Keystone Ball Centric F-580, Huber Resun D-150	

SPECIFICATIONS SHEET FOR MATERIALS TO BE USED				
SERVICE P23-6 Heating water to 120°C (250°F), 1035 kPa (150 psi)				
FLUIDS	Use on hot water, ethylene or propylene glycol (with proper packing), chilled water, water from tower or cooling water at maximum operating pressure of 120°C (250°F). No mechanical joint is accepted.			
Items	Nominal Dimensions	Description	Standards	Acceptable Products
	NPS 150 to 300 mm (6" to 12")	Class 150, cast iron flanged, wormgear and wheel	ASTM A-126	Keystone f-583, Huber Resun D-151
N.B.:		All these plug valves shall be delivered to the site lubricated with lubricant suitable for the service intended and clearly identified, or with EPDM covered disc.		

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Contents of this Section
 - .1 Materials, equipment, accessories and methods of installation related to piping systems for refrigerant including pipe, fittings, equipment and fitting accessories and manufacturing materials.
 - .2 Contractor is responsible to confirm the refrigerant network sizing prior to the installation and when modifications are made to the piping network.

1.3 Shop Drawings

1.3.1 Supply shop drawings according to Section 20 05 00.

1.4 Maintenance instructions

1.4.1 Supply necessary instructions for maintenance to be incorporated in maintenance manual specified in Section 20 05 00.

1.5 Permit

1.5.1 Obtain all necessary permits and approvals by competent authorities and from the manufacturer of the variable refrigerant system.

PART 2 - PRODUCTS

2.1 Refrigerant Piping

Components	Nominal Sizes	Description	Standards
Pipes	12 to 50 mm (½ to 2")	Hard ACR copper tubing, type K or L	ASTM B88-83
Fittings	12 to 50 mm	Brazed or flanged copper or bronze	
Stop valves	22 mm and less (%" and less)	Forged brass body and bonnet, packless diaphragm valve	
Stop valves	25 mm and over (1" and over)	Angle body, self aligning, heavy nylon disk butterfly valve	
Check valves	22 mm and less (%" and less)	Guided piston with brass body in flare connection	
Check valves	25 mm and over (1"and over)	Guided piston spring operated bolted bonnet sweat connection	

PART 3 - EXECUTION

3.1 Manufacturer's instructions

3.1.1 Compliance: comply with the requirements, recommendations and manufacturer's written specifications, including technical bulletins, instructions for handling, storage, installation and indications of spec sheets.

3.2 General

3.2.1 Install piping in accordance with CSA B52 and ASME B31.5, 1/RA/1, with document published by SPE.

3.3 Brazing method

- 3.3.1 Distribute an inert gas within the piping during brazing.
- 3.3.2 Remove the internal parts of valves, solenoid coils of the solenoid valves, lens and glass tubes.
- 3.3.3 Protect sensitive elements such as expansion valves from heat during brazing

3.4 Installation of the pipe

3.4.1 General

- .1 Install copper tubes using a bending process, but avoid wrinkles or reducing their diameter.
- .2 Validate the sizing and the accessories required for refrigeration piping with supplier units. Include the additional refrigeration load if required.
- .3 The Contractor shall submit the refrigerant diagram approved by the manufacturer before starting work. This diagram should include all necessary accessories.

3.4.2 Hot gas lines

- .1 Install the hot gas lines following a downward slope (1:240) in the direction of flow to prevent any return oil to the compressor during operation.
- .2 Provide and install automatic valves (traps) at the bottom of all risers over 2400 mm high and at intervals of 7600 mm.
- .3 Provide inverted deep float traps at the top of the risers.
- .4 Install double columns in the case of compressors power control.
 - column of larger diameter: install traps in areas previously prescribed;
 - column of smaller diameter: dimensioned for a rate of 5.1 m³/s at minimum load to be connected upstream of the trap mounted on the column of larger diameter.

3.5 Hydrostatic testing and tightness

- 3.5.1 Close all valves on the equipment that was loaded at the factory and on all other apparatus that do not have to be tested under pressure.
- Perform the tests according to CSA B52 prior to expansion to 2 MPa and 1 MPa respectively on the high pressure side and on the low pressure side.

3.5.3 Method: raise the pressure to 35 kPa with the refrigerant gas on the high and low pressure side; add nitrogen if necessary until the required test pressure is reached. Search for leaks using an electronic detector or a halide lamp. If necessary, repair leaks and resume testing.

END OF SECTION

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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

1.2.1 Content of this Section

- .1 Materials, equipment, accessories and methods of installation related to ventilation duct.
- .2 Materials, equipment, accessories and methods of installation related to soundproofing insulation.
- .3 Materials, equipment, accessories and methods of installation related to ventilation duct accessories such as access doors, flexible sleeves, sensors and diffuser connections.
- .4 Materials, equipment, accessories and methods of installation related to air balancing
- .5 Materials, equipment, accessories and methods of installation related to fire and smoke dampers.
- .6 Materials, equipment, accessories and methods of installation related to flexible ducts.
- .7 Materials, equipment, accessories and methods of installation related to fans
- .8 Materials, equipment, accessories and methods of installation related to exhaust system.
- .9 Materials, equipment, accessories and methods of installation related to variable and constant air box, fan powered boxes, bypass box.
- .10 Materials, equipment, accessories and methods of installation related to louvers.
- .11 Materials, equipment, accessories and methods of installation related to domestic kitchen exhaust systems.

1.3 Shop Drawings

- 1.3.1 The following shop drawings shall be submitted regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 Prepare for approval, detailed shop drawings of the installation at a minimum scale of 1:50 (1/4"-1") for all the building.

1.4 Maintenance Data

1.4.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00.

1.5 Manufactured Items

- 1.5.1 Catalogue, listed or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency, signifying adherence to codes and standards in force.
- 1.5.2 Grilles, registers and diffusers shall be product of one manufacturer, i.e. grilles and registers by one, diffusers by one, or same.

1.6.1

1.6	Permits
1.5.6	Sound attenuators shall be product of one manufacturer for generic type.
1.5.5	Terminal units shall be product of one manufacturer for generic type.
1.5.4	Supply factory fabricated flexible ducts.
1.5.3	Supply factory fabricated spiral ducts, fittings and special elements.

Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Ventilation Ducts, Metal Construction (Supply, Return and Exhaust)

2.1.1 General

- .1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible, Third Edition.
- .2 SMACNA, HVAC Duct Air Leakage Test Manual.
- .3 ASTM A480/A480, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .4 ASTM A653/A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .5 ASTM A924/A924 Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
- .6 ASTM A1011/A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- .7 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .8 ANSI/NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

2.1.2 Classification

.1 Refer to mechanical table for pressure classification of ducts.

2.1.3 Seal Class

.1 Seal Class must be determined according to data in the table below:

Pressure (Pa)	Seal class (SMACNA)
501 – 2 500	А
0 - 500	В

- .2 Seal class (refer to SMACNA for more details)
 - Class A: Sealing of longitudinal joints, transverse joints, connection and all applicable penetrations, provided by means of a sealing product combine with a sealing tape;
 - Class B : Sealing of longitudinal joints, transverse joints and connection, provided by means of a sealing product, a sealing tape or a combination of these materials.

2.1.4 Leakage classes

- .1 According to specification of HVAC Duct Leakage Test Manual from SMACNA.
- .2 Leakage Class must be determine according to data in the table below:

Type of conduit	Leakage Class B Positive or negative	Leakage Class A Positive or negative	
Rectangular	12	6	
Circular or oval	6	3	

2.1.5 Duct sealer

- .1 Sealing product for ductworks, water base sealer made with acrylic vinyl, ULC approved, non-flammable (wet state), fire retardant (dry state), meets NFPA 90A and 90B, service temperature of -7°C to 93°C.
 - Acceptable products: Duro Dyne WBS2 or approved equivalent;
 - Reddish brown colour.

2.1.6 Sealing tape

- .1 Sealing tape: Poly/Vinyl treated open-Weave fiberglass tape, 50 mm width
 - Acceptable products: Duro Dyne FT-2 or approved equivalent.
 - Color : aluminum gray.

2.1.7 Fittings

- .1 Manufactured as per SMACNA.
- .2 Radius elbow
 - Rectangular ductworks: central radius of curvature of 1.5 x width of duct;
 - Circular ductworks: four (4) pieces elbow for duct up to 225 mm diameter and five (5) pieces elbow for bigger duct: central radius of curvature of 1.5 x diameter of duct.
- .3 Square throat elbow Rectangular ductworks
 - Ductworks equal or smaller than 450 mm: Round-off back elbow without vanes;
 - Ductworks between 451 mm and 610 mm: Round-off back elbow with one central vane;
 - Ductworks bigger than 610 mm: Round-off back elbow with two vanes (one third and two third of conduit).
- .4 Transition fitting
 - Diverging elements: transition angle of less than 30° or less;
 - Converging elements: transition angle of less than 30° or less.

- .5 Flow divider: long radius elbows or as prescribed.
- .6 Deflector for obstacle: maintain the same effective area. Transition angle must be as prescribed for transition fittings.

2.1.8 Galvanized steel ductworks

- .1 G90 Galvanized steel according to ASTM A653/A653M.
- .2 Thickness, manufacturing and reinforcement according to SMACNA.
- .3 Joints: T-1, T24, T24a, T-25 and T-26 as described by SMACNA and ASHRAE. T-1 joints can only be used for ducts of 300 mm (12") and less.

2.1.9 Hanger and supports

- .1 Suspension straps: Same materials as the duct, but thichness one size higher. Suspension straps are permitted for ducts smaller or equal than 500 mm.
- .2 Form of suspension: according to SMACNA.
- .3 Angles and suspension rods: : galvanized steel angle fixed with zinc plated steel rods according to SMACNA.
- 4 Suspension's fastener
 - for mounting in concrete structures: concrete anchors, prefabricated.
 - acceptables products: Myatt, fig. 485 or equivalent.
 - for mounting on steel beams: : stirrups or steel backing plate, prefabricated.
 - acceptables products: Anvil, fig. 86 or equivalent for stirrups; Anvil, fig. 60 or equivalent for backing plates.
 - for mounting on steel beams:: prefabricated stirrups.
 - acceptables products: Anvil fig. 86 or equivalent.

2.2 Flexible Ducts

- 2.2.1 Provide between air control boxes and grilles, registers and diffusers.
- 2.2.2 Ductwork: spiral wound flexible aluminium. Duct must withstand 1.5 kPa (6" W.G.) internal pressure.
- 2.2.3 Thermally insulated ductwork: flexible glass fibre, nominal thickness of 25 mm (1"), maximum thermal conductivity of 0.04 W/m°C at 24°C (0.23 BTU-in./h-sq.ft.at 75°F) when tested to ASTM C-518 and C-177, factory applied, with vapor barrier.
- 2.2.4 Conforms to UL code, Standards for Safety Air Ducts, ULC S110-1970 and to NFPA 90A.
- 2.2.5 Acceptable products: Flexmaster T/L-VT, Boflex AL (thermally insulated).

2.3 Flexible Connections

- 2.3.1 Provide where indicated, at fans, at air handling units and at hoods, factory fabricated flexible connectors, not more than (150) mm (6") long between metal parts to be joined and installed with just sufficient slack to prevent vibration transmission. Allow 100 mm (4") movement for high pressure fans and 50 mm (2") movement for low pressure fans.
- 2.3.2 Conforms to the requirements of UL, ULC and NFPA 90A.

2.3.3 General HVAC Systems

- .1 Neoprene coated fibreglass fabric, of 1017 g./m² (30 oz./yd²) minimum density, and heat resistant up to 93°C (200°F).
- .2 Acceptable products: Duro-Dyne, Dyn-Air.

2.4 Sealers and Tapes

- 2.4.1 Low-pressure ductwork: non-flammable water base sealer made of synthetic resin emulsion in accordance with CAN-4-S-102W-1980, NFPA 90A and National Building Code.
 - Acceptable Products: Duro-Dyne "SWB".
- 2.4.2 High-pressure ducts: oil and water-resistant sealer, polymer resin type, installed with a fiberglass tape in 3 layers.
 - Acceptable products: Duro Dyne SWB et FT-2.

2.5 Duct Access Doors

2.5.1 Ducts must have doors giving access to all elements requiring regular service or inspection (for example: fire or other dampers, reheat coils, smoke detectors, humidifier manifolds, upstream of all elbows equipped with turning vanes, as well as upstream and downstream of fans). Provide them also everywhere shown on drawings and standard details as well as for cleanouts where required on specialty systems. On systems for removal of smoke and grease-laden vapors from cooking equipment also provide them every 3.6 m (12') on horizontal runs as well as on the concave side of all elbows.

2.5.2 Low-pressure ductwork.

- .1 Double-wall doors ("sandwich construction"), insulated, made of the same material as the duct but one gauge thicker and never thinner than 0.8 mm (24 gauge), with iron-angle frame and 25 mm (1") thick rigid fibreglass insulation.
- .2 Gaskets: neoprene or rubber foam.
- .3 Hardware
 - For doors measuring up to 300 x 300 mm (12" x 12"): 2 sash locks in ceiling spaces; 2 hinges and 1 sash lock on exposed ductwork or in mechanical rooms;
 - For doors measuring between 301 and 450 mm (12" and 18"): 4 sash locks in ceiling spaces, 2 hinges and 2 sash locks on exposed ductwork or in mechanical rooms;
 - For doors measuring between 451 and 1000 mm (18" and 40"): 1 piano hinge and at least 2 sash locks;
 - For doors measuring over 1000 mm (40"): 1 piano hinge and 2 handles maneuverable from the inside and the outside.

- 2.5.3 High-pressure ductwork.
 - .1 Doors not exceeding 355 mm (14"), double-walled ("sandwich construction"), insulated, made of the same material as the duct. Inside wall one gauge thicker than the duct but never thinner than 0.8 mm (24 gauge), outside wall 3.54 mm (10 gauge) thick. Iron-angle frame 25 mm (1") in door plane and of the same thickness as the duct insulation in the other plane but not smaller than 25 mm (1"). Door insulation: 25 mm (1") thick rigid fibreglass.
 - .2 Gaskets: neoprene or rubber foam.
 - .3 Hardware: 10 x 65 mm (3/8" x 21/2") hexagonal head screw welded to the center of the outside wall, 50 x 6 mm (2" x 1/4") curved flat iron bar to be attached to the screw by a butterfly nut.
- 2.5.4 Acceptable manufacturers: Airobec, Duro-Dyne, Ruskin.

2.6 Instrument Orifice

Zinc coated steel, 16 gauge, expanding neoprene plug, 25 mm (1") socket for instrument insertion, neoprene gasket and with retaining chain for plug. Maximum service pressure 275 kPa (40 psig), maximum service temperature 85°C (185°F).

2.7 Acoustic Duct Lining

- 2.7.1 Rectangular Duct, Low Velocity
 - .1 Acoustic lining in ductwork: 25 mm (1") thick flexible fiberglass duct liner, to CGSB 51.11-92, density 21.95 kg./m³ (1.37 lb/ft³), with neoprene coating on one side.
 - .2 Flame spread rating not to exceed 25 and its smoke index not to exceed 50.
 - .3 Bonding adhesive: fire resistant, ULC and NFPA approved, flame spread rating not exceeding 25 and smoke index not exceeding 50.
 - .4 Acceptable products: CTM Akousti-Liner, Knauf (M) Duct Liner, Schuller Linacoustic Standard, Fiberglass Canada.
- 2.7.2 Acoustic liner for round ducts larger than 450 mm (18") diameter, fiberglass with kerf, with acrylic polymer coating.
 - .1 Acceptable products: Schuller Spiracoustic Plus.
- 2.7.3 High velocity preformed round fiberglass duct with foil jacketing and internally coated with acrylic polymer.
 - .1 25 mm (1") thick, inside diameter from 150 to 600 mm (6" to 24"), suitable for internal pressure up to 2000 Pa (8" WC) and velocities up to 25 m/s (5000 fpm). NFPA 90A and 90B classified, total volatile organic compound in accordance with ASTM D5116.
 - 2 Acceptable products: Schuller Super Round or approved equal.

2.8 Balancing Dampers

2.8.1 Splitter Dampers

- .1 Single thickness, made of the same material as the duct, 18 gauge for heights up to 600 mm (24") and 16 gauge for heights above 600 mm (24").
- .2 Dimensions and configuration to SMACNA recommendations.
- .3 Provided with one or two operating rods with setscrew lock; two rods on ducts 600 mm (24") and over. A curved end prevents rod from entering duct.
- .4 Hinge: piano type.

2.8.2 Single Blade Dampers (butterfly)

- 1 Single thickness blade with bent edges, made of the same material as the duct, 18 gauge for widths up to 600 mm (24") and 16 gauge for widths above 600 mm (24").
- .2 Dimensions and configuration to SMACNA recommendations, except for maximum height which is to be 300 mm (12").
- .3 Provided with locking quadrant.

2.8.3 Multiple Blade Dampers

- .1 Factory manufactured of the same material as the duct.
- .2 Opposed blades of 100 mm (4") maximum height, made of 16 gauge sheet metal and built according to SMACNA recommendations.
- .3 Bushings: bronze self-oiling.
- .4 Control hardware: shaft extension with locking quadrant.
- .5 Metal angle frame provided with stoppers.

2.9 Fire Dampers

- 2.9.1 Fire dampers listed and bearing label of UL or ULC and shall meet requirements of authorities having jurisdiction.
- 2.9.2 Factory fabricated for fire rating requirement to maintain integrity of wall or partition being pierced. Fire rating to be as required by applicable codes.
- 2.9.3 In open position, damper free area shall be 100% of duct area.
- 2.9.4 Damper must close when duct temperature is 28°C (50°F) above service temperature.
- 2.9.5 Acceptable products: Controlled Air Manufacturing, Ruskin.

2.10 Louvres

- 2.10.1 Construction: all welded with exposed joints ground flush and smooth.
- 2.10.2 Material: extruded aluminium, 6063-T5 alloy.
- 2.10.3 Blade: stormproof pattern with centre watershed in blade, reinforcing embossment and maximum blade length of 3000 mm (10').

- 2.10.4 Frame, head, sill and jamb: 100 mm (4") deep one piece extruded aluminium minimum 2 mm (0.081", 12 gal.) thick with approved caulking slot, integral to unit.
- 2.10.5 Mullions: at 3000 mm (10') maximum centres,
- 2.10.6 Fastenings: all stainless steel to SAE-194-8F with nuts to SAE-194-SFB and resilient neoprene washers between aluminium and head of bolt, or between nut, ss washer and aluminium body.
- 2.10.7 Birdscreen: Aluminium mesh made of 2 mm (5/64") diameter wire, mesh spacing to be 12 mm (½") for air exhausts and 25 mm (1") for air intakes, attached in a formed U-frame on inside face of louvres.
- 2.10.8 Finish: Refer to architectural drawings.
- 2.10.9 Acceptable products: Cometal 204-45, Tamco 3000, Harvey 4-45-Al, Trolec W-445, Price JE443, Penn Airstream SA5, Ruskin ELF811.

2.11 Motorized Damper with Thermal Insulation

- 2.11.1 Extruded aluminium casing with rigid insulation inside.
- 2.11.2 Extruded aluminium (6063T5) blades, with rigid thermal insulation, gaskets (blades and sides) in rubber or silicon.
- 2.11.3 Linkage outside airflow made of aluminium and rustproof materials.
- 2.11.4 Operating range from -40°C to 100°C (-40°F to 210°F), maximum leakage rate of 21 l/s/m² (4.1 cfm/sq.ft.) for a static pressure of 1 kPa (4" w.c.).
- 2.11.5 Acceptable products: Tamco series 9000, Harvey series HARV-50BT, Trolec VAP-I-90MB.

2.12 Grilles Registers and Diffusers - General

- 2.12.1 Sizes indicated are nominal. Provide appropriate standard product nearest to nominal for capacity throw, noise level, throat and outlet velocity.
- 2.12.2 Furnish factory prime coated steel frames for setting into fire protecting membrane. At aluminium diffusers, registers and grilles, provide 1.2 mm (18 gauge) thick minimum steel collar up to fire damper or fire stop flap, for suspending from the basic structure independently of membrane pierced to maintain fire protection membrane integrity. [See detail].
- 2.12.3 Where penetrating fire partitions, provide approved steel sleeve attached to structure and secured in accord with NFPA 90A. Where penetrating firewalls provide 3.4 mm (10 gauge) thick steel sleeve with angle iron perimeter frame to NFPA 90A.

2.12.4 Frames

- .1 Steel: standard with exposed joints welded and ground flush and completely closed.
- .2 Aluminium: extruded with mechanical fasteners and completely closed corners.
- .3 Provide full perimeter sponge rubber gaskets.
- .4 Provide plaster frames as plaster stops where set into plaster or gypsum board.
- .5 Provide concealed fasteners and operators.
- 2.12.5 Acceptable product: Anemostat, E.H. Price, Titus, Nailor.

	2.13	vlaguS	Grilles	and	Register
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- 2.13.1 Refer to drawings.
- 2.14 Return and Exhaust Grilles and Registers
- 2.14.1 Refer to drawings.
- 2.15 Diffusers
- 2.15.1 Refer to drawings.
- 2.16 Linear Grilles
- 2.16.1 Refer to drawings.
- 2.17 Door Grilles
- 2.17.1 Refer to drawings.
- 2.18 Fans General
- 2.18.1 Capacity, total static-pressure, revolutions per minute, power, model and size and sound power level: as indicated.
- 2.18.2 Sound ratings: comply with AMCA (air Moving and Conditioning Association) 301. Tested to AMCA 300. Provide sound power level ratings in decibels (reference 10⁻¹² Watts) in eight octave bands. Unit shall bear AMCA certified sound rating seal.
- 2.18.3 Fans: statistically and dynamically balanced, constructed in conformity with AMCA standard 99. When not indicated, fan class shall be determined according to AMCA standard 99-2408-69 based on the rotation speed needed to accommodate a 10% rise in flow rate and a 21% rise in static pressure.
- 2.18.4 Ratings: based on tests performed in accordance with AMCA standard 210. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm (12") diameter.
- 2.18.5 Electric motors: as indicated in Section 20 05 00.
- 2.18.6 Wheels
 - .1 Welded steel construction unless otherwise indicated.
 - .2 Airfoil blades, unless otherwise specified. When indicated explicitly or implicitly by the specified model, blades are to be flat single thickness backward inclined or curved forward inclined.
 - .3 Statically and dynamically factory balanced at the specified rotation speed. Proceed to reverify in the field the dynamic balancing once the installations are complete and the systems have been tested and air balanced.

2.18.7 Housings

.1 Formed volute to be of continuously welded construction. Partially welded constructions, spot welded constructions or housing with lock seams are not acceptable. Reinforce with rigid bracing to increase structural integrity and prevent vibration. Inlet cones to be aerodynamically designed and spun providing a minimum separation of airflow. Convertible discharge up to 600 mm (24") wheels, fixed discharge for larger.

2.18.8 Bearings

.1 Heavy duty, grease lubricated, ball or spherical roller, self-aligning, pillow block design with oil retaining, dust tight seals, designed for a minimum L-10 life of 40,000 hours (200,000 hours L-50 life) when rated at the fan's maximum catalogue operating speed. Extend bearing lubrication lines and grease fittings to, and mount on, an adjacent vertical structural element for easy accessibility.

2.18.9 Shafts

.1 ASTM A-108 steel, grade 1040/1045, precision turned, ground and polished. Shaft's first critical speed to be at least 125% of the fan's maximum operating speed for each fan class. Drive end of the fan shaft to be counter sunk for tachometer readings.

2.18.10 Acceptable Product

Refer to drawings.

2.19 Kitchen Range Hood Exhaust Systems

2.19.1 Refer to drawings.

2.20 Terminal Unit

2.20.1 General

- .1 Units: VAV.
- .2 Low velocity systems of single duct type with variable volume control and housed within sound attenuating box.
- .3 Casing: 0.8 mm thick (gauge 22) galvanized steel fully insulated with minimum of 25 mm (1)" thick thermal and acoustic insulation field adjustable and inlet duct collars, with quick opening removable access panel to internals without screw or bolt fastening devices. Leakage through casing not to exceed 3% of design volume with 2 kPa (8" H₂O) upstream and 0" kPa downstream of regulator while maintaining flow regulation within 5% of setting.
- .4 Filler material for thermal and acoustic insulation and for silencer Section: inert, vermin and moisture proof, glass fibre or mineral wool of density required for acoustic performance, standard to manufacturer and protected from air flow by perforated metal liner.
- .5 Acceptable product: Refer to drawings.

2.21 Breechings and Chimneys

- 2.21.1 Type 1: chimney and breeching, prefabricated, 425°C (800°F) rated, all fuels.
 - .1 #316 stainless steel inner wall, mineral wool insulation #316 stainless steel outer wall. Rain cap. Gutter boiler connection.
 - .2 ULC certification.
- 2.21.2 Type 2: chimney, 245°C (473°F) rating maximum ULC type B (BW), gas vent only.
 - .1 Sectional prefabricated double wall chimney and breeching with mated fittings and couplings. Galvanized steel and aluminium.
 - .2 ULC certification.

- 2.21.3 Cleanouts and barometric dampers
 - .1 Bolted, gasketted type cleanouts, full size of duct, where indicated.
 - .2 Barometric dampers: 70% of full size of breeching area.
 - .3 double acting barometric damper.
- 2.21.4 Breeching expansion joint: all welded 3 mm thick (gauge 11), ss 316 as indicated.
- 2.21.5 Breeching dampers: at outlet of boilers with 80% maximum closure, 3.5 mm (10 gauge) thick with ball bearings on full length shaft or to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 Duct Installation

- 3.1.1 Install duct in accordance with SMACNA and ASHRAE standards.
- 3.1.2 Make all low, medium and high-pressure ducts airtight during fabrication and during installation.
- 3.1.3 Do not break continuity of insulation vapour barrier with hangers or rods.
- 3.1.4 Ground across flexible connection with no. 2/0 braided copper strap.
- 3.1.5 Install balancing dampers at all branch ducts and as indicated.
- 3.1.6 Anchor all risers as indicated.
- 3.1.7 Install fire dampers according to NFPA 90A. Retaining angles must be laid around the ducts, on each side of the fire barriers. The ducts must not distorted by the fire barrier system or by the installation of this system.
- 3.1.8 Apply the sealant on the outside of the joints, as recommended by the manufacturer.
- 3.1.9 Make fresh air intake ducts watertight up to end of transition. Fit drain connections on bottom with minimum 38 mm (1½") pipe to drain.
- 3.1.10 Hangers shall be steel angles with supporting rods, lock-nuts and washers to the following table:

Duct Size	Angle Iron Size	Rod Size	Spacing
Up to 305 mm	25 x 25 mm 16 ga.	6 mm	2400 mm
310 to 460 mm	25 x 25 mm 16 ga.	6 mm	2400 mm
470 to 760 mm	25 x 25 mm 16 ga.	6 mm	1800 mm
770 to 1370 mm	38 x 38 x 3 mm	10 mm	1800 mm
1380 to 1520 mm	38 x 38 x 3 mm	10 mm	1800 mm
1530 to 2130 mm	38 x 38 x 3 mm	10 mm	1200 mm
2140 to 2440 mm	38 x 38 x 3 mm	10 mm	1200 mm
2450 mm and over	38 x 38 x 3 mm	10 mm	1200 mm
Up to 12"	1" x 1" cal. 16	1/4"	8'
13" to 18"	1" x 1" cal. 16	1/4"	8'
19" to 30"	1" x 1" cal. 16	1/4"	6'
31" to 54"	1½" x 1½" x 1⁄8"	3/8"	6'
55" to 60"	1½" x 1½" x 1⁄8"	3/8"	6'
61" to 84"	1½" x 1½" x 1⁄8"	3/8"	4'
85" to 96"	1½" x 1½" x 1⁄8"	3/8"	4'
97" and over	1½" x 1½" x 1⁄8"	³ / ₈ "	4'

3.2	Flexible Ductwork
3.2.1	Locate between air control boxes and all grilles, registers and diffusers.
3.2.2	Support flexible ducts at 1.2 m (4') centres.
3.2.3	Maximum length of flexible duct connections: 2 m (6')
3.2.4	Make connections between flexible duct and terminal devices airtight with duct tape.
3.3	Watertight Ductwork
3.3.1	Following ductwork to be made watertight:
	.1 Air intakes and exhaust outlets.
3.4	Fresh Air Intakes and Exhaust Outlets
3.4.1	Install air inlets and outlets per SMACNA details.
3.4.2	Brace and strengthen air inlets and outlets to resist wind pressure. Refer to NBC for specific regional wind velocities.
3.4.3	Install bird screens as per prescriptions on all air inlets and outlets.
3.5	Instrumentation Openings
3.5.1	Install in required locations, plugs and caps to seal instrumentation orifices.
3.6	Acoustic Duct Lining
3.6.1	Acoustic lining inside of ducts.
3.6.2	Install lining according to SMACNA and manufacturer's recommendations.
3.6.3	Fasten lining to interior sheet metal surfaces with 100% coverage of a bonding adhesive and staple through 50 mm (2") square sheet metal pieces spaced on 300 mm (12") centres.
3.6.4	Protect leading and trailing edges with stapled sheet metal edging.
3.7	Balancing Dampers
3.7.1	Install dampers according to SMACNA recommendations and manufacturer's instructions.
3.8	Duct Leakage Testing
3.8.1	Make trial leak test, as instructed, to demonstrate workmanship.
3.8.2	Install no additional ductwork until trial test has been passed.
3.8.3	Leak test low-pressure ductwork at 500 Pa (2" W.G.).
3.8.4	Ductwork shall be free of audible leaks in quiet ambient. Leakage shall not exceed 1.5 $\%$ of design CFM proportioned to length under test.
3.9	Flashing
3.9.1	Provide flashings to suit installation.
3.9.2	Follow details for chimneys penetrating roofs.

3.10 Duct Accessories

- 3.10.1 Install flexible connections, sealants and tapes, duct access doors and turning vanes in accordance with manufacturers recommendations.
- 3.10.2 Ground across flexible connector with no. 2/0 braided copper strap.
- 3.10.3 For medium and high pressure supply ducts, large enough for easy access, install access doors with interior opening.

3.11 Dampers

- 3.11.1 Install fire dampers to NFPA 90A and SMACNA Standard "Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems". Locate in fire walls and partitions where indicated.
 - .1 After completion, have installation approved prior to concealment.
 - .2 For fireproof ceiling assemblies, suspend unit from structure independently of ceiling system. Submit assembly sample for approval. Maintain integrity of rated ceiling assembly as per NFPA and ULC.
- 3.11.2 In case of dimensions exceeding UL approved dimensions or 3 m (120"), install galvanized steel mullions as per UL 555 standard.

3.12 Grilles, Registers and Diffusers

- 3.12.1 Install in accordance with manufacturers instructions.
- 3.12.2 Fit frame with gasket to prevent leakage, and smudging.
- 3.12.3 Install with cadmium plated screws in countersunk holes where fastenings are visible.

3.13 Fans Installation

- 3.13.1 Install fans as indicated, complete with flexible connections and flexible electrical leads.
- 3.13.2 Install flexible connection bands between fan inlet and discharge ductwork. Ensure metal bands of connections are parallel with minimum 25 mm (1") flex between ductwork and fan during running.
- 3.13.3 Install fan-restraining snubbers as indicated. Flexible connections shall not be in tension during running.
- 3.13.4 Provide sheaves and pulleys required for final air balance.

3.14 Mixing Boxes

3.14.1 Install mixing boxes on separate supports from those for the ducting.

END OF SECTION

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PART 1 - GENERAL

1.1 General

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Contents of this Section
 - .1 Filters and related pressure gauges for various types of air handler systems and installations.

1.3 References

- 1.3.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 ANSI/NFPA 96-2008, Ventilation Control and Fire Protection of Commercial Cooking Operations.
- 1.3.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 52.1-1992, Gravimetric And Dust Spot for Testing Air-Cleaning Devices Used in Generalities Ventilation for Removing Particulate Matter (ANSI Approved).
 - .2 ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particles Size (ANSI Approved).
- 1.3.3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-115.10-M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.
 - .2 CAN/CGSB-115.14-M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.
 - .3 CAN/CGSB-115.15-M91, High Efficiency Rigid Type Air Filters for the Removal of Particulate Matter from Ventilating Systems.
 - .4 CAN/CGSB-115.18-M85, Air Filter, Extended Area Panel Type, Medium Efficiency.
- 1.3.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDSs)
- 1.3.5 Underwriters Laboratories of Canada (ULC)
 - .1 ULC-S111-2007, Standard Method of Fire Tests for Air Filter Units
 - .2 ULC-S649-2006, Exhaust Hoods and Related Controls for Commercial and Institutional Kitchens.

1.4 Shop Drawings

1.4.1 The following shop drawings shall be submitted regarding Section 20 05 00 – "General Requirements Concerning Common Work Results".

1.5 Maintenance Data

1.5.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00 – "General Requirements Concerning Common Work Results".

PART 2 - PRODUCTS

2.1 Filters - General

- 2.1.1 Provide filter media, frames, seals, gaskets per NFPA and ULC codes, and controls per CSA where applicable.
- 2.1.2 Use incombustible materials in fabrication of filter assembly.
- 2.1.3 Efficiency: ASHRAE 52.2.
- 2.1.4 Dust holding capacity: Air Filter Institute (AFI) Test.
- 2.1.5 Frames
 - .1 Prefabricated filter frames and supporting structure of galvanized steel with gasketing between frames and walls. Holding frames: 1.6 mm (gauge 16) thick ("T" Section construction).
- 2.1.6 Filters: suitable for air at 100% RH.
- 2.1.7 Acceptable manufacturers:
 - DAFCO Aerostar:
 - Camfil Farr:
 - American Air Filter.

2.2 Panel Filters

2.2.1 Renewable glass fibre media to CAN2-115.10-M80, with adhesive. Mount in permanent galvanized steel frame of 1.2 mm (gauge 18) thick minimum with 3 mm (1/8") diameter wire mesh screen at inlet and outlet, hinged at inlet.

2.3 Pleated Type Filters, MERV 8

- 2.3.1 Media: A non woven cotton or synthetic giving an efficiency MERV 8 in accordance with ASHRAE standard 52.2 2012. Media bonded to frame to prevent air leakage.
- 2.3.2 Rigid frame made of high wet-strength beverage board. Grid made of welded wire on 25 mm (1") centers with an open area of not less than 96%. Grid bonded to the media to eliminate oscillation and pull away.
- 2.3.3 Standard "CGSB-CAN-2-115-10 and ULC S111 2013 class 2.
- 2.3.4 Acceptable products:
 - DAFCO Aerostar, series 400;
 - Camfil Farr, model 30/30;
 - American Air Filter, model Perfect Pleat SCM8;
 - JAS Filtration, model PrePleat 40 LPD HC.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

3.1.1 Compliance: comply with the requirements, manufacturer's recommendations, including technical bulletins, instructions for handling, storage and installation of products, and data sheets.

3.2 Installation

3.2.1 Install filters according to manufacturer's instructions and allow the necessary clearances to allow access for maintenance or replacement.

3.3 Filter Media

- 3.3.1 Upon work's acceptance, replace all the filters in the project with new ones.
- 3.3.2 Upon receipt of the work, the filter media must be new and clean, with pressure gauge test for evidence.

3.4 Cleaning

3.4.1 Once the installation work and performance monitoring is completed, remove materials, waste, tools and equipment from the site.

END OF SECTION

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PART 1 - GENERAL

1.1 General

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Contents of this Section
 - .1 Materials, equipment and installation methods associated with chimneys, smoke flues and accessories.
 - .2 Materials, equipment and installation methods associated with boilers and accessories.

1.3 Shop drawings

1.3.1 Submit shop drawings in accordance with Section 20 05 00.

1.4 Maintenance instructions

1.4.1 Submit necessary instructions for maintenance and incorporated such to the instruction manual mentioned in Section 20 05 00.

1.5 Permits

1.5.1 Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Boilers

- 2.1.1 The boilers will be certified to ANSI Z21.13 / CSA 4.9 Gas-fired Boiler Standard and to ANSI Z21.10.3 / CSA 4.3 Gas Water Heater Standard. ASME "H" stamped boiler, designed and constructed in compliance with the ASME Boiler and Pressure Vessel Code Section IV. Maximum operating pressure 160 psi [1103 kPa]. Boiler to run on Natural Gas with modulating burner, 5:1 turndown, Direct Spark Ignition with Zero clearance to combustibles. C/W Side Wall Vent Terminal Kit.
- 2.1.2 Boilers supplied with 500ml bottle Fernox F1 Protector, 10k thermistor Outdoor and System sensors, 30PSI & 125PSI ASME Relief Valves and 30PSI & 160PSI Pressure Gauges

2.1.3 Control Features

- .1 Integral microprocessor safety control, 2 central heat inputs (high & low temperature), Domestic Hot Water Priority, Outdoor reset, Warm weather shutdown, Lead-Lag operation. Barrier Strip for field wiring terminations, 3 Pump outputs, 120/24 VAC Transformer 40VA, outdoor sensor, system sensor, Remote Touchscreen display, Alarm dry contact and EIA-485 Modbus communications for Lead-Lag.
- .2 Line Voltage Electrical: 120VAC / 60 Hz / 1 phase
- 2.1.4 Refer to reviewed shop drawing of Boiler 1 and 2 that are already supplied and on site at the end of this section. Boiler 3 must be identical to 1 and 2.

PART 3 - EXECUTION

3.1 Boilers

- 3.1.1 Follow manufacturer's instructions for the installation of boilers.
- 3.1.2 Place vibration isolators prior to making the boiler level.
- 3.1.3 Combustion air supply: make sure that the sequence of absence of flame safeties is adjusted as a function of appropriate differential air pressures inside and outside the boiler room. Comply with the Engineer's instructions.
- 3.1.4 Inspection of piping and control equipment
 - .1 Ensure that all piping has undergone tightness test, and is cleaned and drained with dry air.
 - .2 Verify the compliance of flame surveillance control with prescriptions.
 - .3 Arrange piping and controls so that burner removal does not disturb them.
 - .4 Gas piping
 - Modify shop mounted gas piping to comply with the requirements of local gas utility company.
 - Clean gas supply piping to burner. Perform nitrogen pressure test on piping downstream of utility company pressure regulator, as per code requirements.
 - Lock and seal gas valve prior to start-up test.
 - .5 Connect smoke piping and conduit. Coordinate necessary wiring work.
 - .6 Notify the Engineer prior to proceeding with fire start-up test, adjust equipment as per their recommendations.

END OF SECTION

Section 23 50 00

APPENDIX

Boilers



GRAEBECK CONSTRUCTION LTD

X-L-Air Energy Services Ltd.

141 Wescar Lane Phone: (613) 836-5002
Carp, Ontario, KOA 1L0 Fax: (613) 836-8369

SHOP DRAWING SUBMITTAL

Shop Drawing Submittal CMFO TITLE: PROJECT:

21-May-15 15001

DATE:_ JOB: 9

Page:

<u>6</u>

Attn: Albert Bertrand Senior Project Manager Graebeck Construction 160C Terence Matthews Crescent Kanata, Ontario K2M 0B2 Tel: 613-229-0864

standard Lead Time	S	10 weeks
Required Delivery Date	l	
Date Return. from Graebeck		
Date Submit. To Graebeck		
SUTATS		SUB
# noisiveЯ		0
Supplier		HYDROPLUMB
Description	BOILERS	2.1 GAS CONDENSING BOILERS & WATER HEATER
Clause	2.1	2.1
Section	23 50 00	23 50 00

RECEIVED JIR 004
By chacker at 3:09 pm, May 27, 2015

Issued By:

Kieran O'Connell



GRAEBECK CONSTRUCTION LTD

HydroPlumb Mechanical Ltd.

141 Wescar Lane Phone: (613) 831-8144 Carp, Ontario, K0A 1L0 Fax: (613) 836-8942

SHOP DRAWING SUBMITTAL

TITLE: Shop Drawing Submittal DATE: 21-May-15

PROJECT: CMFO

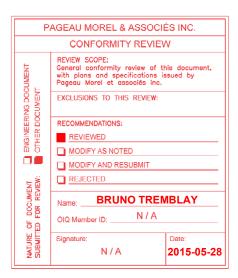
TO: Attn: Kieran O'Connell

X-L-Air Energy Services 141 Wescar Lane, Carp, ON, K0A 1L0 Tel: 613-836-5002 ex 203

JOB: 15001

PAGE: 5

Section	Clause	Description	Supplier	Revision #	STATUS	Date Submit. To X-L-Air	Date Return. from X-L-Air	Required Delivery Date	Standard Lead Time
23 50 00	2.1	BOILERS							
23 50 00	2.1	GAS CONDENSING BOILERS & WATER HEATER	MASTER	0	SUB				10 weeks



Pageau Morel et associés inc. is not liable of accuracy of dimensions, details and/or quantities.

Issued By: Chris Chi



PERFORMANCE & DRAWINGS





Trinity Lx500 K2 High Efficiency Gas Condensing Boiler & Water Heater

GRAEBECK CONSTRUCTION LTD Submittal Sheet

Section 1 - Specifications Section 2 - Dimensions Section 3 - Electrical

Project Name:	Date:	
Location:		
Engineer:		
Contractor:	Rep:	
	•	

JSPECIFICATIONS

General Specifications

- ► Product Features
 - Certified to ANSI Z21.13 / CSA 4.9 Gas-fired Boiler Standard
 - Certified to ANSI Z21.10.3 / CSA 4.3 Gas Water Heater Standard
 - ASME "H" stamped boiler, designed and constructed in compliance with the ASME Boiler and Pressure Vessel Code Section IV
 - SA-249 TP316L Stainless Steel Heat Exchanger
 - CSD-1 compliant
 - Maximum operating pressure 160 psi [1103 kPa]
 - Modulating burner, 5:1 turndown
 - Direct Spark Ignition
 - Zero clearance to combustibles
- ▶ Optional Side Wall Vent Terminal Kits NTI part # 83236, 84355, 84358
- ► Factory Supplied Items
 - 10k thermistor Outdoor and System sensors

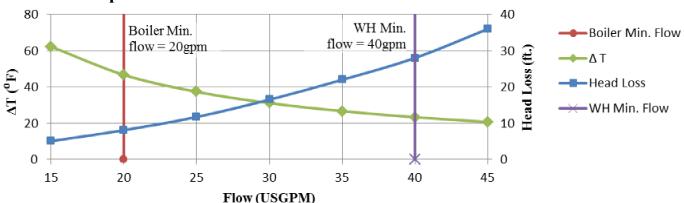
- ► Factory Supplied Items (cont'd)
 - 2 500ml bottles Fernox F1 Protector
 - Flow switch
 - 50PSI & 150PSI ASME Relief Valves
 - 60PSI & 160PSI Pressure Gauge
- ► Control Features
 - · Integral microprocessor safety control
 - 2 central heat inputs (high & low temperature)
 - Domestic Hot Water Priority
 - · Outdoor reset
 - · Warm weather shutdown
 - Time of day input
 - Lead-Lag up to 8 Lx series boilers
 - Integrated Modbus RTU for connection to BMS gateways

Water Connections NPT, in.	Gas Connection NPT, in.	Vent/Air-inlet Pipe Diameter, in.	Vent/Air-inlet Max. Length, ft.	Approx. Weight with Water, lb.
2 (Female)	³/4 (Male)	4	100	320

Heating Specifications

Input Modulation	Gross Output Capacity, MBH	Combustion	Thermal	Net I=B=R Rating,	Recovery Rate
MBH		Efficiency, %	Efficiency, %	MBH	@ 100°F Rise, USGPH
100 - 500	470	95	94	409	564

Performance Specifications















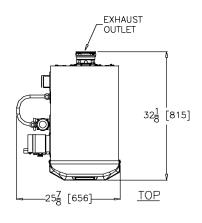
Trinity Lx500 High Efficiency Gas Condensing Boiler & Water Heater

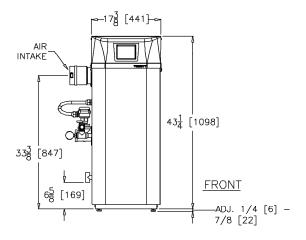
Submittal Sheet

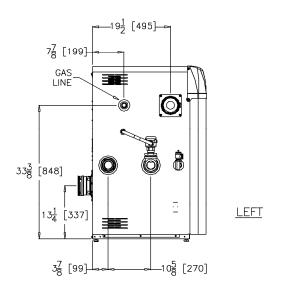
2 DIMENSIONS

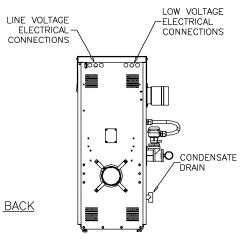
GRAEBECK CONSTRUCTION LTD

Product Dimensions – in. [mm]









Recommended Clearances - in. [mm]

Тор	Front	Left	Right	Back	Bottom
24 [610]	24 [610]	24 [610]	12 [305]	24	0













Trinity Lx500 High Efficiency Gas Condensing Boiler & Water Heater

Submittal Sheet

GRAEBECK CONSTRUCTION LTD

8



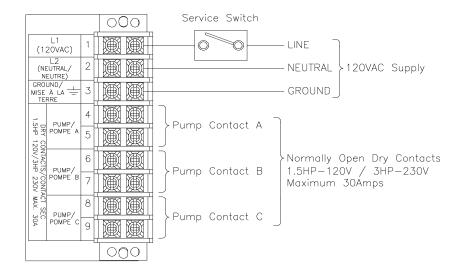
ELECTRICAL

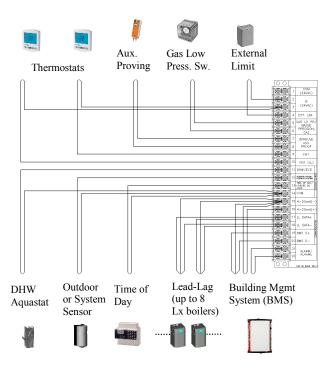
Simplified Wiring Diagrams

Line Voltage Electrical:

- ► 120VAC / 60 Hz / 1 Phase / 12 Amp
- ► Barrier Strip for field wiring terminations
- ► 3 Pump outputs
 - Indirect Domestic Hot Water (Pump A)
 - Boiler (Pump B)
 - Central Heat (Pump C)

Note: Pumps are field supplied.





Low Voltage Electrical:

- ► Barrier Strip for field wiring terminations
- ► 120/24 VAC Transformer 40VA (factory supplied)
- **▶** Inputs
 - CH1 thermostat (by others)
 - CH2 thermostat (by others)
 - Indirect DHW aquastat (by others) or DHW Tank sensor (factory option)
 - External Limit (by others)
 - Outdoor sensor (factory supplied)
 - System sensor (factory option)
 - 4-20mA external modulating control (by others)
- Outputs
 - Alarm dry contact (24VAC 0.63A max.)
- ► EIA-485 Modbus communications for Lead-Lag
- ► EIA-485 Modbus to BMS gateways (not shown).











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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Contents of this Section
 - .1 Materials, equipment, accessories and methods of installation related with refrigeration equipment such as split-type condenser and evaporator.

1.3 Shop Drawings

1.3.1 The following shop drawings shall be submitted regarding Section 20 05 00 – "General Requirements Concerning Common Work Results".

1.4 Maintenance Data

1.4.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00.

PART 2 - PRODUCTS

2.1 Modular Air-Cooled Variable Refrigerant Flow System

2.1.1 The specified mechanical system shall be a VRF (variable refrigerant flow) conditioning system. The high efficiency modular variable refrigerant system shall consist of variable speed drive scroll compressor air cooled condensing units each supplying a maximum of up to fifty (50) indoor fan coil units based on a series of modular outdoor units providing 72-360 MBH nominal cooling capacity. The variable refrigerant system shall be a two pipe configuration capable of providing cooling or heating to the building.

2.1.2 Modular VRF Air-Cooled Condensing Unit

.1 General

.1 The system shall consist of the outdoor units, indoor units, and controllers. The outdoor units shall be equipped with multiple circuit boards that interface to the control system and shall perform all functions necessary for operation. The outdoor unit shall have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be thoroughly run tested at the factory without exception.

.2 System Performance Rating

.1 The system shall consist of one (1) or two (2) modular units piped together in the field using a factory supplied twinning kit. Once connected they shall operate as one unit alternating compressor run cycles to balance total compressor operation hours.

.3 Acoustic Performance

.1 Outdoor unit shall have a sound pressure level (SPL) rating no higher than a maximum of 60 dB (A) individually or a collective maximum sound pressure rating of 65 dB (A) when combined with other modules in a system. The sound pressure rating is as measured a horizontal distance 1 m from the unit. The individual modular unit shall have a low sound operational mode where the SPL rating is no higher than 50 dB (A) or 55 dB (A) when combined in a single system with other modules (night mode operation operation).

.4 System Refrigerant Pipework

- .1 Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated as required by section 22 07 00. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection. The outdoor units shall have the ability to operate with a maximum height difference of 164 feet and can, when combined in a modular format have a total refrigerant tubing length of 3,280 feet.
- .2 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

5 Condensing Unit Cabinet Construction

.1 The casing(s) shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

- .6 Variable Speed Condenser Fan:
- .1 Each modular outdoor unit module shall be furnished with one direct drive, inverter driven, variable speed propeller type fan. The unit shall be manufactured and factory set for operating under 0 'WG external static, but capable of operation under a maximum of 0.24" W.G external static via a dipswitch setting.
- .2 The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan motor shall be mounted on isolation spring for quiet operation.
- .3 The fan shall be provided with a raised guard to prevent contact with moving parts.
- .4 The outdoor unit shall have vertical discharge airflow.
- .7 Refrigerant
- .1 R410A refrigerant shall be required for modular outdoor unit system.
- .8 Wrap Around High Efficiency Condenser Coil:
 - .1 The outdoor coil shall be of the *wrap around* configuration with nonferrous construction with lanced or corrugated plate fins on copper tubing. A minimum clearance of 1 3/8" shall be allowed between modular units to facilitate sufficient air flow across the wrap around condenser coils. The coil fins shall have a factory applied corrosion resistant blue-fin finish particularly effective in urban environments. The outdoor coil shall include four (4) circuits with two position valves for each circuit, except for the last stage. The coil shall be protected with an integral metal guard. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
- .9 Variable Speed Scroll Compressor:
- .1 The High Efficiency Modular Air-cooled outdoor units shall be provided complete with an inverter driven scroll hermetic compressors. The compressor motor shall be of DC Brushless configuration with AUTO TUNING INVERTER control to achieve optimum compressor/motor performance levels particularly during off design conditions. Non inverter-driven compressors shall not be deemed acceptable for this application. Compressors driven by induction are not allowed in this instance.
- .2 A crankcase heater(s) shall be factory mounted on the compressor(s). Each compressor shall be capable of modulation down to 19% of rated capacity.
- .3 The compressor(s) shall be equipped with an internal thermal overload. The compressor shall be mounted to avoid the transmission of vibration.
- .10 Unit Electrical Characteristics
- .1 The outdoor unit electrical power shall be 600 volts, 3 phase, 60 hertz. The outdoor unit shall be controlled by integral microprocessors.

.2 The control circuit between the indoor units and the outdoor unit shall be 30VDC completed using a 2-conductor, twisted pair non-polar shielded cable to provide total integration of the system. The inrush current to the outdoor unit shall not exceed the design full load amp FLA rating for the unit. Alternate systems with solid state or constant speed scroll compressors with significant inrush current characteristic will not be acceptable for this application.

.11 Modular Configuration

.1 The outdoor units shall consist of one or two modules each rated for the designated proportion of the total system cooling capacity. Each module is furnished with a inverter driven scroll compressor and inverter driven variable speed propeller type condenser fan. The modular outdoor unit combinations are designed so as to balance the run hours seen by each individual inverter driven scroll compressor in order to extend overall outdoor unit life cycle and reduced on going maintenance costs. The modules shall be installed in a side by side configuration without the need for intermediate oil balancing pipework.

2.1.3 Variable Refrigerant Flow Indoor Units

.1 Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger will be controlled by a linear expansion valve. This valve will be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%. Each indoor unit will require a 208 VAC power supply. Control will be via the 30 VDC data control signal from the outdoor unit.

.2 General:

.1 The Indoor Unit shall be wall-mounted or ceiling mounted indoor unit section and shall have a modulating linear expansion device. The unit shall support individual control using appropriate controllers.

.3 Indoor Unit

.1 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

.4 Unit Cabinet:

- .1 The casing shall have a white finish. Multi directional drain and refrigerant piping offering multiple directions for refrigerant piping and draining shall be standard for ceiling-mounted units.
- .2 For wall-mounted units, there shall be a separate back plate which secures the unit firmly to the wall.

.5 Fan:

.1 The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right). A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

.6 Filter:

.1 Return air shall be filtered by means of an easily removable, washable filter.

.7 Coil:

.1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. Both refrigerant lines to the indoor units shall be insulated.

.8 Electrical:

.1 The unit electrical power shall be 208 volts, 1-phase, 60 hertz.

.9 Controls:

.1 This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system. Please refer to the controls section of this guide specification for details on controllers and other control options.

2.1.4 AHU Conversion Kit – Electronic Expansion Valve Kit

- .1 The AHU Conversion Kit is required for each DX cooling coil that is not part of a packaged evaporator, such as the coils on MUA-003 and 004 units. It will allow the DX coil to be controlled and communicate with the VRF condensers as if it were a packaged evaporator.
- .2 The AHU Conversion Kit will include an electronic expansion valve, as well as associated communication card or module, air and pipe thermistors, wiring harnesses, or other controllers or dry contact modules to allow for seamless integration into the VRF network and condenser control strategy.
- .3 The AHU Conversion Kit will be for the same refrigerant type as the rest of the VRF system.
 - .4 The AHU Conversion Kit will be by the same manufacturer as the VRF system.
- .5 Installation shall be as per the manufacturer's recommendations.

.6 The Deluxe MA Remote Controller shall require no addressing. The Deluxe MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. The PAR-21MAA shall require cross-over wiring for grouping across indoor units.

PAR-21MAA (Deluxe MA Remote Controller)						
Item	Description	Operation	Display			
ON/OFF	Run and stop operation for a single group	Each Group	Each			
			Group			
Operation	Switches between Cool/Dry /Fan.	Each Group	Each			
Mode	Operation modes vary depending on the air conditioner unit.		Group			
Temperature	Sets the temperature for a single group. Range of	Each Group	Each			
Setting	temperature setting Cool/Dry: 67°F-87°F (57°F-87°F for PEFY/PDFY/PFFY-E)		Group			
	Heat: 63°F-83°F (63°F-83°F for PEFY/PDFY/PFFY-E)					
	Auto: 67°F-83°F (63°F-83°F for PEFY/PDFY/PFFY-E)					
Fan Speed	Models with 4 air flow speed settings: Hi/Mid-2/Mid-1/Low	Each Group	Each			
Setting	Models with 3 air flow speed settings: Hi/Mid/Low	Each Group	Group			
Setting	Models with 2 air flow speed settings: Hi/Low		Group			
Air Flow	Air flow direction angles 100%-80%-60%-40%, Swing,	Each Group	Each			
Direction	Louver ON/OFF.	Lacii Gioup	Group			
Setting	Air flow direction settings vary depending on the model.		Group			
Weekly	ON/OFF/Temperature setting can be done up to 8 times	Each Group	Each			
Scheduler	one day in the week. The time can be set by the 1-minute	Lacii Gioap	Group			
Concado	interval.		O.oup			
Permit /	Individually prohibit operation of each local remote control	N/A	Each			
Prohibit Local	function (Start/Stop, Change operation mode, Set	•	Group *1			
Operation	temperature, Reset filter).					
'	*1: Centrally Controlled is displayed on the					
	remote controller for prohibited functions.					
Prohibition /	Setting via the System Controller, the operation for the	N/A	Each			
Permission of	following modes is prohibited:		Group			
Specified	Cooling Prohibited: Cool, Dry, Auto					
Mode	Heating Prohibited: Heat, Auto					
	Cooling-Heating Prohibited: Cool, Heat, Dry, Auto					
Display Indoor	Measures and displays the intake temperature of the	N/A	Each			
Unit Intake	indoor unit when the indoor unit is operating.		Group			
Temp						
Error	When an error is currently occurring on an air conditioner	N/A	Each Unit			
	unit, the afflicted unit and the error code are displayed					
Test Run	Operates air conditioner units in test run mode.	Each Group	Each			
			Group			
Ventilation	Up to 16 indoor units can be connected to an interlocked	Each Group	Each			
Equipment	system that has one LOSSNAY unit. LOSSNAY items that		Group			
	can be set are "Hi", "Low", and "Stop". Ventilation mode					
	switching is not available.					

PAR-21MAA (Deluxe MA Remote Controller)								
Item	Description	Operation	Display					
Set	The range of room temperature setting can be limited by	Each Group	Each					
Temperature	the initial setting. The lowest limit temperature can be Group							
Range Limit	made higher than the usual (67°F) in cool/dry mode, while							
	the upper limit temperature lower than the usual (83°F) in							
	heat mode.							
	*Function does not work in auto mode setting							
Auto Lock Out	to Lock Out Setting/releasing of simplified locking for remote control Each Group E							
Function	n buttons can be performed.							
	 Locking of all buttons 							
	 Locking of all buttons except ON/OFF button 							

2.1.5 Control Wiring - Installation

- .1 The contractor shall be responsible for the interconnecting control wiring between the indoor and outdoor units and control wiring between remote controllers, centralised control and relevant components. This work shall be co-ordinated with the Electrical / Controls Contractor for the rooting and trunking of the cables.
- .2 All control wiring are to be carried out in 2 core 16 AWG shielded cabling with colour coding and tagged with ID number at 3 metres intervals as per schematics for ease of identification and maintenance.
- .3 Control wiring shall not be run next to power wiring. A minimum space of 100mm between both control and power cables shall apply.

2.1.6 VRF System Installation

- .1 The fixing of all air conditioning equipment, installation of all refrigerant pipework and full commissioning shall be performed by a specialized refrigerant installer who shall be authorised to install the equipment. The installation of all internal and external units, refrigerant pipework, inter-connecting wiring, commissioning and testing shall be carried out by an approved refrigerant systems installers.
- .2 Full access shall be afforded to site during the installations stage of the project to allow them to verify that installation methods are fully in accordance with Mitsubishi requirements and that the equipment warranties will not be invalidated.

2.1.7 Refrigerant Pipework

- .1 Supply, install, test and commission all interconnecting refrigeration pipework between the outdoor and indoor units.
- .2 All pipework to be carried out in refrigerant quality ACR copper tubing and complete with the appropriate headers and joints. All pipework must be suitable for R410A.
- .3 Longest possible lengths of copper pipe should be used to minimize joints on site.
- .4 Appropriate refrigeration installation tools must be used. Dry Nitrogen must be used at all times in the system during brazing.

- .5 After installation of pipework, and prior to sealing of insulation joints and starting of equipment, pipework should be pressure tested. 44 PSIG test for 3 minutes minimum, then 217 PSIG for 3 minimum, then 478 PSIG for 3 minutes minimum, then strength test to 600 PSIG check the system for leaks and deformation, then lower the pressure back to 478 PSIG and pressure test for 24 hours and checked for leaks. Vacuumed/dehydrated to 300 microns, and hold at that vacuum for 12 hours (minimum)
- .6 Refrigerant (R410A) charge weight must be calculated, to the actual installed length of pipe work in accordance to the manufacturer recommendations.
- .7 The charging should be carried out with an appropriate charging station.
- .8 Pipework to be properly fixed and supported at a minimum of 1.5 meters (5 feet) centers or as specified by local code and where required should be run on galvanized trays.
- .9 Joints in copper pipe shall be brazed. Brazing shall be carried out to the requirements of the local code and as per the Canadian copper & brass development association recommendations.

2.1.8 Condensate Pipework

A condensate line shall be installed to each fan coil unit. This shall be installed and insulated all as per the standard specification. Minimum size of condensate pipes to be 25mm (1 inch) copper or plastic, insulated and pumped or by gravity from each fan coil/cassette, drains to run 1:80 min falls as indicated on drawings.

2.1.9 Log Books

.1 Full commissioning Logs shall be supplied by the manufacturer. These shall be completed fully and included with the main Installation and Operation Manuals prior to hand over. In addition, copy pages shall be returned to the manufacturer in order that the installation is logged and warranty honoured.

2.1.10 Warranty

.1 Warranty is one year provided maintenance is carried out to a proven satisfactory level.

PART 3 - EXECUTION

3.1 Installation of the condensing units

- 3.1.1 The condensing units will be installed on two inches high recycled rubber sleepers (Big Foot System or equivalent) supplied by the contractor. The sleepers will be capable to support 150% of the weight of the equipment.
- 3.2 Start-up and testing of direct expansion apparatus
- 3.2.1 Refrigeration equipment. Perform tests, dehydration and refrigerant loading prior to start-up, in presence and supervision of manufacturer technician.
- 3.2.2 Test:
 - .1 Provide sufficient quantities of refrigerant, dry nitrogen, cooling oil, necessary for equipment pressure tests and operation. Tests to be performed in presence of manufacturer representative.
 - .2 Prior to tests, verify if system is complete. Protect safety valves during tests. Upon completion of tests connect piping and check for leaks.
- 3.2.3 Submit to the Engineer a start-up schedule of equipment for approval before beginning works.

END OF SECTION

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2 1	Packaged Roof Ton Heating and Cooling Unit and Make-up Air Unit	_

PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

1.2.1 Content of this Section

- .1 Materials, equipment, accessories and methods of installation related to air-air energy recovery systems.
- .2 Materials, equipment, accessories and methods of installation related with groups of air treatment which contain, on site, a set of autonomous blocs.
- .3 Materials, equipment, accessories and methods of installation related with single packaged air treatment units, both horizontal and vertical type.
- .4 Materials, equipment, accessories and methods of installation related with groups of autonomous rooftop air conditioning units, and which are provided with either a gas burner, an electric heater, a hot water heating coil or a cooling coil.
- .5 Materials, equipment, accessories and methods of installation related with catwalks, ladders, stairs and grating.

1.3 Shop Drawings

- 1.3.1 Submit shop drawings and technical information in accordance with Section 20 05 00.
- 1.3.2 Produce execution and installation drawings of all systems for approval. Use 1:50 (¼"-1') minimum scale for all buildings.

1.4 Maintenance Data

1.4.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00.

1.5 Manufactured Items

- 1.5.1 Catalogue, listed or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency, signifying adherence to codes and standards in force.
- 1.5.2 Grilles, registers and diffusers shall be product of one manufacturer, i.e. grilles and registers by one, diffusers by one, or same.
- 1.5.3 Supply factory fabricated spiral ducts, fittings and special elements.
- 1.5.4 Supply factory fabricated flexible ducts.
- 1.5.5 Terminal units shall be product of one manufacturer for generic type.
- 1.5.6 Sound attenuators shall be product of one manufacturer for generic type.

1.6 Permits

1.6.1 Obtain all necessary permits and approvals by competent authorities.

PART 2 - PRODUCTS

2.1 Roof Top Units (RTU-X)

2.1.1 General

- .1 Single piece, single zone unit, with gas burner and a direct expansion refrigeration having the CSA and ULC label.
- .2 The unit shall include frame and housing, supply fan, heat exchanger, burner with integral induced draft fan, controls, air filter, refrigerant cooling coil, a compressor, condenser coil and fans, outside air damper, return damper, motorized exhaust damper.
- .3 Fuel piping and combustion gas vent.
 - Conforming to Provincial bylaws on energy matters.
 - Gas accessories conforming to FIA and FM standards.
- .4 Conforming to requirements of authorities having jurisdiction.
- .5 Housing shall have been tested for weather resistance according to AGA requirements rain proof test and bearing its approval. The unit shall further conform to AHRI 270-2015 sound rating.
- .6 Prefabricated roof curb conforming to National Roof Contractors Association standards.
- .7 Units having a nominal capacity greater than 40 kW (11.4 Tons) shall conform to AHRI 210/240-2017 Standard for Unitary Air-Conditioning Equipment.

2.1.2 Housing

.1 Support and frame from 2 mm (14 gauge) galvanized steel, and lift brackets on enclosure. Weatherproof housing from 1.2 mm (18 gauge) galvanized steel with baked enamel finish, flashing, removable doors or access panels, gaskets and quick closing devices. All areas exposed to conditioned air shall be covered with 25 mm (1") 32 kg./m³ (2 lbs/pi³) density, fiberglass lining.

2.1.3 Fans

.1 Supply fan: centrifugal fan mounted on rubber cushions, statically and dynamically balanced, driven by trapezoidal belts; motor fixed to the hinged base through to rubber cushion, and having an adjustable usable diameter pulley; motor-fan block mounted on an antivibration plate separated from the unit by spring dampers and flexible connections.

2.1.4 Air Filters

.1 Throw away frame mounted 50 mm (2") filters conforming to manufacturer's standard.

2.1.5 Heat exchangers and burners

- .1 Multiple flues passes gas exchanger with stainless steel tube primary heating surface and stainless steel tube secondary heating surface.
- .2 Gas Burner: factory mounted, wired and firing tested, complete with operating and safety controls.
- .3 Forced type burner.

2.1.6 Condensing Unit

1 Conforming to CSA B52-M1977 and UL 465-1978.

2.1.7 Evaporator

.1 Conforming to AHRI 210/240-2015 standard.

2.1.8 Capacity and options

.1 Refer to drawings.

2.2 Make-up air unit (MUA-X)

2.2.1 General

- .1 Unit MUA-001-002 is supplied by owner and need to be relocated by the contractor. It includes an AIR-AIR heat conservation module capable of transferring both sensible and latent heat, and is suitable for outdoor installation. The existing shop drawing for this unit are included as an annex to this section. A new condensing unit will be supplied, installed and be connected to the existing DX coil included in the MUA-001-002 unit by this contractor. The refrigeration work and the complete start-up of this unit is to be carried by this contractor.
- .2 Additional MUA units are defined on the drawings.

PART 3 - EXECUTION

- 3.1 Packaged Roof Top Heating and Cooling Unit and Make-up Air Unit
- 3.1.1 Install the new roof top units as per the manufacturer's recommendations on mounting base supplied by the manufacturer.
- 3.1.2 Connect the ducts to the existing make-up unit.
- 3.1.3 Inspect the equipment for damage prior to and after the installation.
 - .1 Protect the equipment from the weather during the installation.
 - .2 Follow the recommendations of the installation drawings; install the equipment on rooftop mounting frame, manufactured in plant.
 - .3 Install an insulated chimney with braces or anchors as shown on the drawings.
- 3.1.4 Install the Make-up Air Unit and condensing unit on two inches high recycled rubber sleepers (Big Foot System or equivalent). The sleepers should be capable to support 150% of the weight of the equipment. The sleepers should be located to distribute the unit weight equally on all sleepers.

END OF SECTION

SHOP DRAWING

Project : CMFO 2720 Richmond Rd.

Customer: The Master Group

Submital: 18908

Revision: A0

Submitted by:



Patrick Guay

2121 Nobel street, Sainte-Julie, Quebec J3E 1Z9

Tel: 514-874-9050 / Fax: 450-649-8756

Toll-free: 1-800-363-9197

DATE: September 16, 2015



PROJECT: CFMO 2720 Richmond Rd. **QUOTE:** 18908

REVISION: R7

CUSTOMER: The Master Group DATE: September 16, 2015

 MODEL:
 BC(ECW)-50-CTW-250-DX
 SYSTEM #:
 AHU
 QUANTITY:
 1

 ODT
 ODT

DIMENSIONS*

LENGHT: 174 in. WIDTH: 54 in. HEIGHT: 76 in. WEIGHT: 4254 lb

*Footprint

CABINET

LOCATION	Outdoor			
CONFIGURATION	Horizontal			
ACCESS **	Control on the left side, access doors see drawing			
SUPPLY AIR **	Horizontal end			
RETURN AIR **	Horizontal end			
FRESH AIR **	Horizontal end with inlet hood and bird screen			
EXHAUST AIR **	Horizontal on the right side with outlet hood and bird screen			
WALL	Galvanized steel outer liner 18ga , Galvanized steel inner liner 22ga			
FLOOR	Galvanized steel outer liner 22ga , Galvanized steel inner liner 18ga			
ROOF	Flat roof			
INSULATION	2" Fiberglass (1.0 lbs/ft3)(R= 7.8)			
STRUCTURE	5" welded structural steel "C" channel with welded lifting lugs			
EXTERIOR FINISH	2 mils dft Enamel			
DOOR	Nylon lever handle with nylon hinges and rubber bulb gasket			
** Facing supply airflow				

SUPPLY FAN

 AIRFLOW MAX.:
 2905 CFM
 ESP: 1.25 in.H2O
 FAN: 12-12
 CLASS: T2
 MOTOR: 3 HP
 RPM: 1800

 AIRFLOW MIN.:
 1110 CFM
 TSP: 3.45 in.H2O
 BHP: 2.48
 RPM: 2532 ARR.: 3
 TYPE: ODP

- Double width, double inlet fan with backward curved airfoil blades

- Variable frequency drive control by 0-10Vdc signal by other

RETURN FAN

 AIRFLOW MAX.:
 2905 CFM
 ESP:
 1.45 in.H2O
 FAN:
 10-8
 CLASS:
 R
 MOTOR:
 3 HP
 RPM:
 1800

 AIRFLOW MIN.:
 1110 CFM
 TSP:
 2.70 in.H2O
 BHP:
 2.59
 RPM:
 1607 ARR.:
 3
 TYPE:
 ODP

- Double width, double inlet fan with forward curved blades

- Variable frequency drive control by 0-10Vdc signal by other

_

DAMPER

Drivin Ex						
	QTY	MODEL	BLADE	ACTUATOR, OPTION AND CONTROL		
FRESH AIR:	1	TA-1000	Орр.	2 positions, spring return, end limit switch and signal by Bousquet		
Low leakage aluminum damper						
EXHAUST AIR:	1	TA-1000	Орр.	2 positions, spring return, end limit switch and signal by Bousquet		
Low leakage aluminum damper						
-						
_						

FILTER

TYPE: Pleated MERV-8 (Efficiency 30-35%) THICKNESS: 2" LOCATION: In the cabinet supply section
- Clogged filters sensor
- Galvanized steel filter rails

-

FILTER

TYPE: Pleated MERV-8 (Efficiency 30-35%) THICKNESS: 2" LOCATION: In the cabinet return section
- Clogged filters sensor
- Galvanized steel filter rails

INDIRECT FIRED HEATER

OUTPUT CAPACITY: 200 MBH TURNDOWN: 12:1 ΔT: 63 °F CONBUSTIBLE: Natural

- Output capacity and temperature rise corrected for sea level and 70°F

- CTW-2.5-250 (Sib)

- Stainless steel 304L 4 passes tubular heater

- Control 0-10V by other

- Aluminum chimney

- Flame safeguard with flame rod

COOLING COIL (DX)

CAPACITY: 88.1 MBH	QUANTITY: 1	CIRCUIT	: 1	AIR VELOCITY : 378 FPM			
REFRIGERANT: R-410a		ROW:	4	ENTERING TEMP. DB/WB:	78.0°F/66.0°F		
PRESSURE DROP: 0.7 PSI	MASS FLOW: -lb/h	FPI:	12	LEAVING TEMP. DB/WB:	56.8°F/56.4°F		
- galvanized steel frame; coppe	galvanized steel frame; copper tube; aluminum fin;						
- Condensing unit, pipping and	Condensing unit, pipping and control by other						
- Drain pan with 3 slopped side	and drain connection under	r the coil					

TOTAL HEAT RECOVERY WHEEL

SUMMER CAPACITY	TOTAL:	88.2 MBH	SENSIBLE: 35.4 MBH	EFFICIENCY:	66.3 %	
WINTER CAPACITY	TOTAL:	144.4 MBH	SENSIBLE: 119.7 MBH	EFFICIENCY:	34.2 %	
- Capacity and efficiency value provided with frost control						
- Frost control with a V	FD					

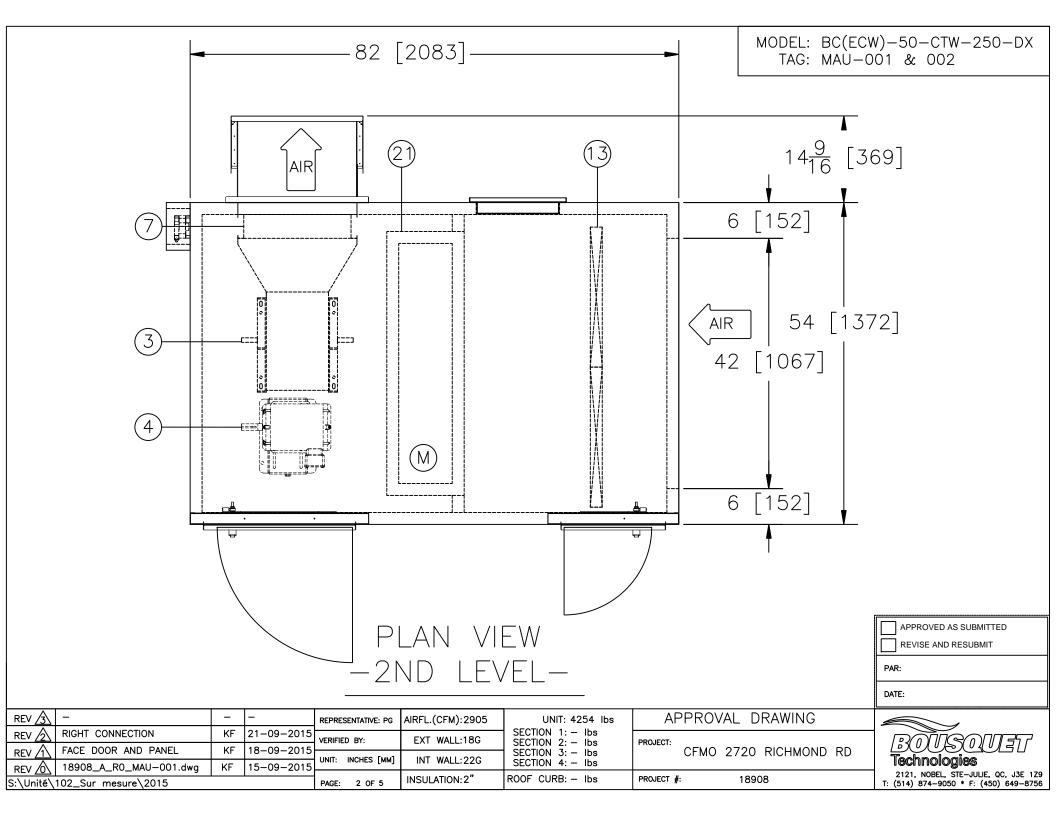
ELECTRIC DATA

VOLTAGE : 575/3/60	MCA:	12 A	MOP:	15 A
Factory wired unit include	ding the follo	owing eq	uipement a	and protection :
- Single point disconnect	switch			
- Heated and ventilated	control cabi	net		
- Adjustable inlet thermo	ostat			
- Change over				
- Remote control panel v	with two sw	itchs, ind	icators ligh	its and temperature selector
- Programmable room th	nermostat (s	hip loose	and instal	iled by other)
-				

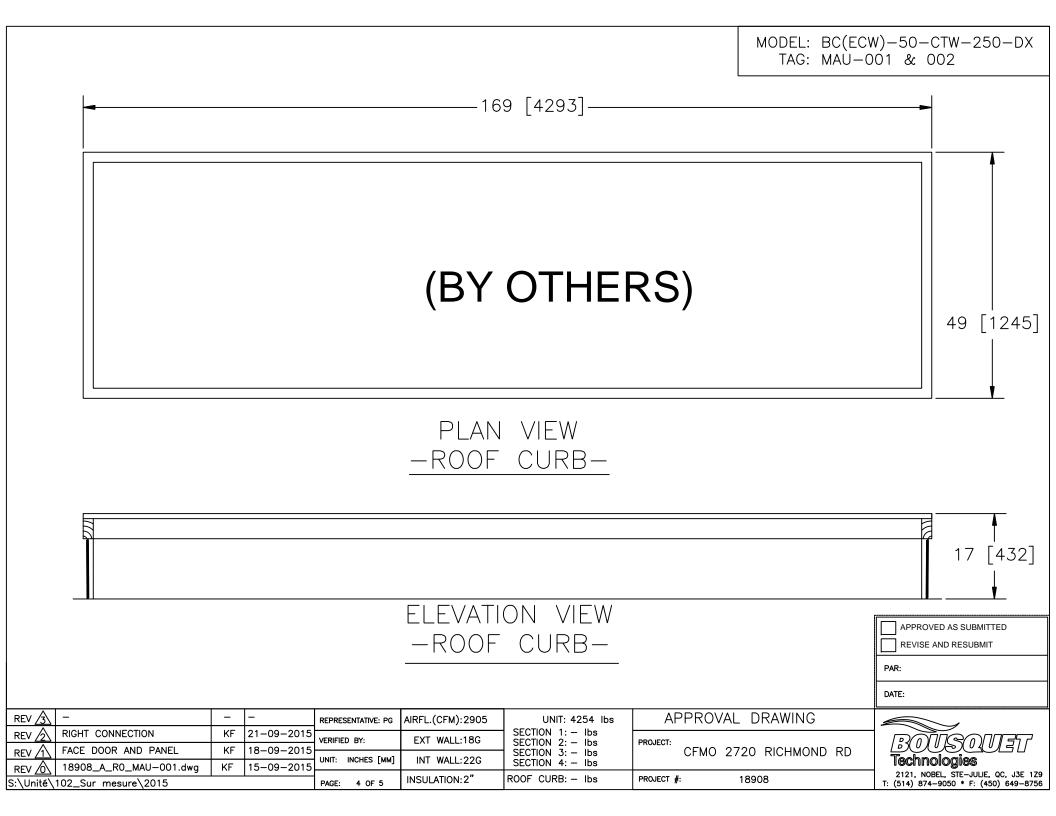
NOTES

-			
-			

MODEL: BC(ECW)-50-CTW-250-DXTAG: MAÙ-001 & 002 (28)(21)6 [152] ונטרנטו 54 [1372] AIR AIR 42 [1067] 83 [2108] 6 [152] <u>(2)</u> PLAN VIEW <u>G</u> -1ST LEVEL-APPROVED AS SUBMITTED REVISE AND RESUBMIT PAR: APPROVAL DRAWING REV 💰 REPRESENTATIVE: PG AIRFL.(CFM):2905 UNIT: 4254 lbs SECTION 1: - lbs SECTION 2: - lbs SECTION 3: - lbs RIGHT CONNECTION 21-09-2015 VERIFIED BY: EXT WALL:18G PROJECT: FACE DOOR AND PANEL 18-09-2015 CFMO 2720 RICHMOND RD UNIT: INCHES [MM] INT WALL: 22G SECTION 4: - Ibs 18908_A_RO_MAU-001.dwg 15-09-2015 2121, NOBEL, STE-JULIE, QC, J3E 1Z9 T: (514) 874-9050 * F: (450) 649-8756 INSULATION: 2" ROOF CURB: - Ibs PROJECT #: 18908 S:\Unité\102_Sur mesure\2015 PAGE: 1 OF 5



MODEL: BC(ECW)-50-CTW-250-DXTAG: MAÙ-001 & 002 <u>*H.T.*</u> 205<mark>13 [5228]</mark> _174 [4420] 66" (M)17 [432] 69 [1752] $6\frac{1}{2}$ [165] 76<u>1</u> [1931] 39 [990] AIR 22 [559] **(** 4 [102] 5 [127] 5 [127] 0 2"X4" WOOD ROOF CURB (INSULATION BY OTHERS) ELEVATION VIEW APPROVED AS SUBMITTED REVISE AND RESUBMIT PAR: APPROVAL DRAWING REV 💰 REPRESENTATIVE: PG AIRFL.(CFM):2905 UNIT: 4254 lbs SECTION 1: - lbs SECTION 2: - lbs SECTION 3: - lbs RIGHT CONNECTION 21-09-2015 VERIFIED BY: EXT WALL:18G PROJECT: FACE DOOR AND PANEL 18-09-2015 CFMO 2720 RICHMOND RD UNIT: INCHES [MM] INT WALL: 22G SECTION 4: - Ibs 18908_A_R0_MAU-001.dwg 15-09-2015 2121, NOBEL, STE-JULIE, QC, J3E 1Z9 T: (514) 874-9050 * F: (450) 649-8756 INSULATION: 2" ROOF CURB: - Ibs PROJECT #: 18908 S:\Unité\102_Sur mesure\2015 PAGE: 3 OF 5



NO.	DESCR	IPTION (RO)	QT
1	SUPPLY FAN:		ATZAF 12-12 T2	1
2	SUPPLY MOTOR:		3 HP SUPER-E / O.D.P. F1	1
3	EXHAUST FAN:		ATLI 10-8 R	1
4	EXHAUST MOTOR:		3 HP SUPER-E / O.D.P. F2	1
5	FRESH AIR DAMPER (NC):	OPPOSED	TA-1000 / 35 X 15	1
6	RETURN AIR DAMPER (NO):	-	-	-
7	EXHAUST AIR DAMPER (NC):	OPPOSED	TA-1000 / 20 X 18	1
8	FACE DAMPER (NO):	-	-	-
9	BY-PASS DAMPER (NC):	-	-	-
10	BALANCING DAMPER:	-	-	-
11	LOUVER:		-	-
12	FILTERS:	(MERV-8)	24 X 24 X 2	2
13	FILTERS:	(MERV-8)	24 X 20 X 2	2
14	FILTERS:	2		
15	FILTERS:	-		
16	FILTERS:	-		
17	HEAT EXCHANGER:		CTW-250-2.5-Sib	1
18	HEAT EXCHANGER:		-	-
19	HEAT EXCHANGER:			-
20	DIRECT FIRED BURNER:		-	-
21	ENERGY RECOVERY MODULE:		RRC-N-D-1125/1125-1005	1
22	COOLING COIL (SR-1):		4DX F 4C 18T x 41	1
23	COOLING COIL (SR-2):		-	-
_	ELECTRIC COIL (PRE-HEATING):		-	-
25	ELECTRIC COIL (HEATING):		-	-
	HEATING COIL (SC-1):		-	-
27	HEATING COIL (SC-2):		-	-
	DRAIN:		1" NPT	2
29	CONDENSING UNIT:		-	-
30	HUMIDIFIER:		-	-
31	SPACE FOR FUTURE COIL:			-
NO.	DES	CRIPTION		QT
C1	LIFTING LUGS:		FIXED (S2)	4

MODEL: BC(ECW)-50-CTW-250-DX TAG: MAU-001 & 002

NO.	DESCRIPTION		QTY
C1	LIFTING LUGS:	FIXED (S2)	4
G1	GAS INLET:	3/4" NPT	1
G2	REGULATOR VENT:	-	-
G3	PURGE (IRI):	-	-
G4	DRAIN HD:		-
E1	CONTROL BOX: (EXT)	30L X 50H X 15E	1
E2	ELECTRICAL PANEL:	25L X 35H	1
E3	MAIN ELECTRICAL DISCONNECT:	30A	1
E4	LIGHTS:		-
E5	120/1/60 GFCI OUTLET:		-
E6	LOCAL CONTROL PANEL:	-	-
E7	SMOKE DETECTOR:		-
E8	TRANSFORMER:		-

APPROVED AS SUBMITTED REVISE AND RESUBMIT PAR:

DATE:

REV 🔏 RIGHT CONNECTION KF 21-09-2015 FACE DOOR AND PANEL 18-09-2015 18908_A_RO_MAU-001.dwg 15-09-2015 S:\Unité\102_Sur mesure\2015

REPRESENTATIVE: PG	AIRFL.(CFM):2905	UNIT: 4254 lbs
VERIFIED BY:	EXT WALL:18G	SECTION 1: - Ibs SECTION 2: - Ibs
UNIT: INCHES [MM]	INT WALL:22G	SECTION 3: – Ibs SECTION 4: – Ibs
PAGE: 5 OF 5	INSULATION:2"	ROOF CURB: - Ibs

PROJECT: CFMO 2720 RICHMOND RD

18908

PROJECT #:

APPROVAL DRAWING

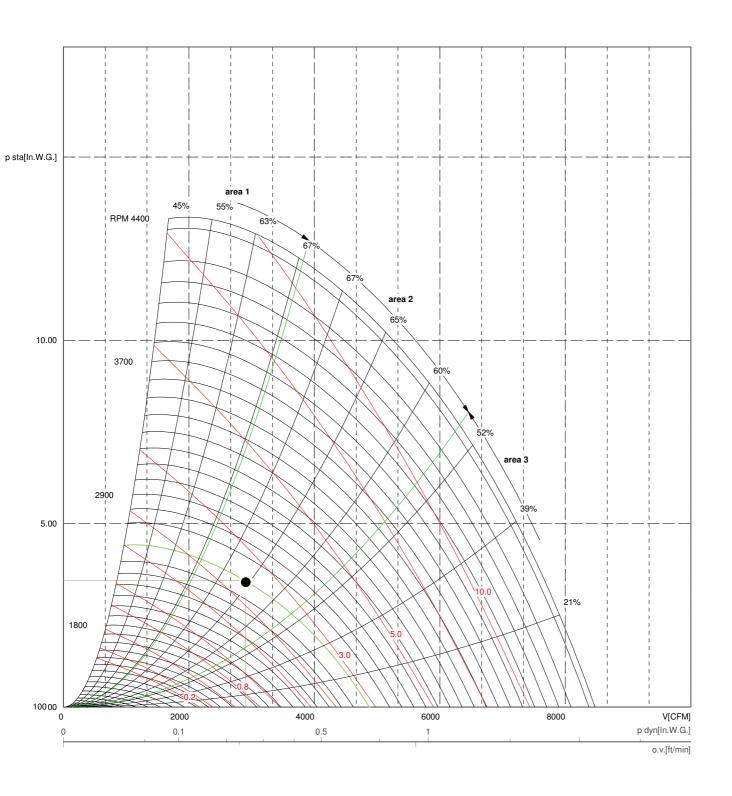
2121, NOBEL, STE-JULIE, QC, J3E 1Z9 T: (514) 874-9050 * F: (450) 649-8756



CMFO 2720 Richmond Rd. 18908

ruits or energy suv	IIIG		Fan working conditions	Free In	let - Free Outlet
Selected Fan	ATZAF	12-12 T2	Volume	2905	CFM
Max Fan RPM	4350	1/min	Total Pressure	3.70	In.W.G.
Max Shaft Power	10.50	BHP	Static Pressure	3.45	In.W.G.
Fan power	2.48	BHP	Total Efficiency	68.1	%
Moment of Inertia	4.25	lb ft ²	Static Efficiency	63.5	%
Required Working Point		•	Fan Speed	2532	1/min
			Temperature	68.0	°F
			Altitude	0	ft

The AMCA licensed air performance data has been modified for installation type A: Free Inlet - Free Outlet not included in the certified data. The modified performance is not AMCA licensed but is provided to aid in selection and application of the product

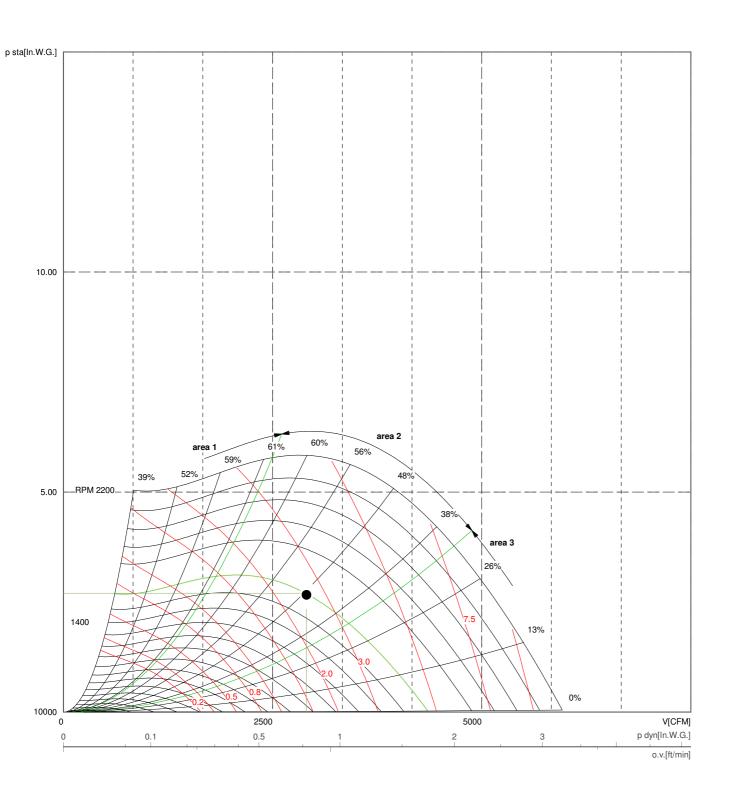


Pg 1/1



CMFO 2720 Richmond Rd. 18908

tans of energy sav	ing		Fan working conditions	Free In	et - Free Outlet
Selected Fan	ATLI 10) - 8 R	Volume	2905	CFM
Max Fan RPM	2100	1/min	Total Pressure	3.47	In.W.G.
Max Shaft Power	3.00	BHP	Static Pressure	2.70	In.W.G.
Fan power	2.59	BHP	Total Efficiency	61.3	%
Moment of Inertia	1.16	lb ft²	Static Efficiency	47.6	%
Required Working Point		•	Fan Speed	1607	1/min
			Temperature	68.0	°F
			Altitude	0	ft



Klingenburg Regenerative Rotating Heat Exchanger



Klingenburg USA, LLC 503 Old Thomasville Road PO Box 165 High Point, NC 27260 USA

Office: +1 / 336-884-5050 Cell: +1 / 336-345-0847 Fax: +1 / 336-884-5058

E-Mail: info@klingenburg-usa.com Internet: www.klingenburg-usa.com

Notes:







Type: Sorption	otor HUgo RRC-N-D17-					
			eating		ooling	
		_ Supply air	Exhaust air	Supply air	Exhaust air	
Inlet condition	Standard air volume	2905	2905	2905	2905	scfm
	Air volume	2421	2924	3041	2947	cfm
	Temperature (DB/WB)	-18.0 / -18.0	72.0 / 55.0	90.0 / 75.0	75.0 / 62.5	°F
	relative humidity	100.0	32.5	50.7	50.2	%
	absolute humidity	2.1	37.7	107.4	64.9	gr/lb
	Enthalpy	4.0	23.2	38.6	28.2	_BTU/lb
Outlet condition	Air volume	2789	2563	2963	3025	cfm
	Temperature (DB/WB)	45.9 / 40.6	9.5 / 9.3	79.2 / 67.1	85.9 / 71.1	°F
	relative humidity	63.3	95.0	54.2	49.3	%
	absolute humidity	28.9	8.5	80.7	91.5	gr/lb
	Enthalpy	15.5	3.6	31.7	35.1	_BTU/lb
Face air velocity		567	685	712	690	fpm
Pressure drop		0.498	0.695	0.735	0.702	in.WG
Pressure drop (Sta	ndard density)	0.687	0.687	0.687	0.687	in.WG
Effectiveness sens	sible*	71.4		72.1		%
Effectiveness laten	ite* ess according to ASHRAE Standard 8-	75.6	60	62.9		%
Heat recovery	ess according to ASI INAL Standard of	+ and And Standard To	00			
Sensible heat		200 975	-196 458	-35 404	35 550	BTU/h
Latent heat		53 668	-58 185	-52 790	52 790	BTU/h
Total heat		254 643	-254 643	-88 194	88 340	BTU/h
Recovery of moistu	ıre	26.79	-29.20	-26.75	26.59	gr/lb
. 13301017 51 11101010		49.91	-54.12	-49.10	49.10	lb/h

Calculation based on Air pressure Altitude Rotational speed	1.00 atm 0 ft 20 rpm	Co M	lectrical data ontroller (1-phase) otor (3-phase) onsumption	220 Volt 90 Watt 0.36 A	
Dimensions Height (A) Width (B)	1125 mm 44.29 in. 1125 mm 44.29 in.		Housing RR Rotor profil Thickness of A Wave height	l e D17 f the foil: D	0.07 mm 1.70 mm
Depth (C) Rotor diameter	330 mm 12.99 in. 1005 mm		Rotor depth		200 mm 7.87 in.
Weight	39.57 in. 227 lb	← B →	r C ¬		

Klingenburg Regenerative Rotating Heat Exchanger

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+1 / 336-884-5050

+1 / 336-345-0847

Notes:







		He	ating	
		Supply air	Exhaust air	
Inlet condition	Standard air volume	2905	2905	scfm
	Air volume	2421	2924	cfm
	Temperature (DB/WB)	-18.0 / -18.0	72.0 / 55.0	°F
	relative humidity	100.0	32.5	%
	absolute humidity	2.1	37.7	gr/lb
	Enthalpy	-4.0	23.2	BTU/lb_
Outlet condition	Air volume	2638	2707	cfm
	Temperature (DB/WB)	20.2 / 19.9	34.0 / 32.7	°F
	relative humidity	95.0	88.6	%
	absolute humidity	14.4	25.3	gr/lb
	Enthalpy	7.1	12.1	BTU/lb_
Face air velocity		567	685	fpm
Pressure drop		0.498	0.695	in.WG
Pressure drop (Sta	ndard density)	0.687	0.687	in.WG
Effectiveness sens	sible*	42.7		%
Effectiveness laten		34.8		%
*) Calculation of Effectivene	ess according to ASHRAE Standard 84 and AF	RI Standard 1060		
Heat recovery				
Sensible heat		119 746	-119 886	
Latent heat		24 695	-24 695	
Total heat		144 441	-144 582	
Recovery of moistu	ıre	12.33	-12.39	•
		22.97	-22.97	lb/h

Calculation based on Air pressure Altitude Rotational speed	1.00 atm 0 ft 1.3 rpm	Electrical data Controller (1-phase) Motor (3-phase) Consumption	220 Volt 90 Watt 0.36 A
Dimensions Height (A) Width (B) Depth (C)	1125 mm 44.29 in. 1125 mm 44.29 in. 330 mm	Rotor Thickne	•
Rotor diameter Weight	12.99 in. 1005 mm 39.57 in. 227 lb	B C	7.87 in.



514 874-9050 2121, Nobel Sainte-Julie, Québec J3E 1Z9

CONTROL SEQUENCE

Project: CFMO 2720 RICHMOND RD Reference #: 18908
Customer: MASTER Date: 2015-09-15

Unit #: MAU-001 & MAU-002

This document presents a description of the control sequence of the unit.

All temperature controls / readouts:

All programmation screens:

PLC (command screen embedded):

Remote command screen (HMI):

Remote control panel:

Communication:

*Fahrenheit English
No
No
No
No

Components

Drive

Each blower of the unit is coupled with a motor controlled by a drive (VFD). Both VFD's are synchronized together. Customer is supplying the 0-10 Vdc to modulate the CFM. Drives have a minimum Hz preset. Starting the drives and sending a 0 Vdc will bring them to their minimum Hz.

Changeover

Unit is equipped with changeover to enable heating or cooling mode following the outside air temperature.

Heating is enabled when air after recovery wheel is below 65°F (adjustable). Cooling is enabled when air after recovery wheel is above 70°F (adjustable).

Temperature sensors / thermostat

Programmable room thermostat is calling for override heating and also for 2 stages of cooling.

Burner

Burner is supplying 70°F (adjustable) air unless override is call by thermostat 130°F.

Energy recovery wheel (ERW)

ERW is continuously running at full speed. On near freezing, protection is reducing the wheel speed.

Dampers

Fresh air and return air dampers are normally close.



Sequence of operation

User selects "ON" on remote control panel.

User selects "HEAT" to force unit in heating mode.

User selects "COOL" to force unit in cooling mode.

User selects "auto" to have the changeover stat chose the proper mode.

Unit opens the F/A and R/A dampers.

Upon opened dampers status, both fans start to reach their minimum hertz.

If air after recovery wheel is below 65°F (adj.), burner will start and supply air at 70°F. If thermostat is calling for override, burner will supply air at 130°F.

If air after recovery wheel is above 70°F (adj.), cooling is enabled. Therefore, thermostat can call for the 2 stages of cooling. Bousquet unit is closing dry contacts to call for cooling stages.

Dry contacts / light status

Unit status light (mounted on remote control panel)

Blowers status Burner status Cooling status Burner fault Clogged filter Low limit

Interlock

User can use terminals 11 & 21 to interlock (24 vac) the unit with his security system. Having the two terminals jumped will enable the unit, otherwise unit will never starts.



<u>Alarms</u>

Supply blower overload

If supply blower overload input is on, the unit is shut down.

Return blower overload

If return blower overload input is on, the unit is shut down.

Burner alarm

If burner is on fault status the unit is shut down. Alarm is displayed:

- Light on remote control panel

Freezestat

If supply temperature is below $40^{\circ}F(4.5^{\circ}C)$ for 7 minutes, the unit wil shut down to prevent internal building from freezing.

Alarm is displayed:

- Light on remote control panel

Thermostat disconnected

If thermostat is disconnected, no more heating override or cooling is available.



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PART 1 - GENERAL

1.1 General Requirements

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies

1.2 Summary

- 1.2.1 Contents of this Section
 - .1 Materials, equipment, accessories and methods of installation related to radiant heating, heaters, convectors, baseboards and others.

1.3 Shop Drawings

1.3.1 Submit shop drawings in accordance with Section 20 05 00.

1.4 Maintenance Data

1.4.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00.

Refer to drawings.

2.5.1

PART 2 - PRODUCTS

2.1	Convectors - General
2.1.1	Except if otherwise indicated, the metal surfaces of the enclosure and the envelope shall be covered with a primer coat applied and baked at the factory.
2.1.2	Provide for noiseless expansion of components.
2.1.3	Doors shall allow access to the valves and vents.
2.2	Baseboards
2.2.1	Refer to drawings.
2.3	Standard Continuous Wall Convectors
2.3.1	Refer to drawings.
2.4	Cabinet Convectors
2.4.1	Refer to drawings.
2.5	Forced Flow Cabinets Heaters

PART 3 - EXECUTION

3.1 Fan Coil Units and Fan Heater Units

3.1.1 Install isolating valves on supply and return and lock shield globe valve on return, together with control valves shown. In public areas, use lock shield type on supply and return for isolation. Provide screwdriver vent on every cooling coil and heating coil. Clean all finned tubes and comb straight.

3.2 Convectors

- 3.2.1 Install convectors along piping layout. Allow for piping movement during normal operation.
- 3.2.2 Allow space for equipment maintenance. Should final location be different of what is shown on drawings, consult the Engineer prior to installation.
- 3.2.3 Should space requirements not be met, consult the Engineer and follow his instructions.
- 3.2.4 Refer to installation drawings supplied by the manufacturer. Check if electrical supply characteristics are as shown on nameplate.
- 3.2.5 Check if opening locations and weights of equipment are as shown on shop drawings.
- 3.2.6 If accessories and ancillaries of equipment are delivered separate, verify assembly instructions with the Engineer.

3.2.7 Valves

- .1 Unless otherwise indicated, install valves so that stems are vertical or horizontal.
- .2 For each equipment, install gate and balancing valves.
- 3.2.8 For encased cabinets between two walls, measure on site the available distance. Install a screwdriver-operated vent on convectors and radiators.

END OF SECTION

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PART 1 - GENERAL

1.1 General

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

- 1.2.1 Content of this Section
 - .1 Materials, equipment and installation methods associated with air conditioner, fan coils, humidifiers and terminal units

1.3 Shop Drawings

1.3.1 Submit shop drawings and technical information in accordance with Section 20 05 00.

1.4 Maintenance Data

1.4.1 Provide maintenance data for incorporation into maintenance manual specified in Section 20 05 00.

PART 2 - PRODUCTS

2.1 Electric Humidifier

- 2.1.1 Self-contained, microprocessor controlled wall mounted steam humidifier. Steam shall be generated by 800/825 incoloy electric heating immersion elements. The humidifier shall operate under normal or extreme water conditions. The conductivity of the supply water shall have no bearing on the operation sequence.
- 2.1.2 The humidifier shall have a level control, which cannot be triggered by water foaming. It must have the ability to sense foam and take a corrective action by going into drain cycle. The humidifier must have both an electronic temperature sensor inside the stainless steel evaporation tank next to the heating elements and an external bimetallic temperature cut-off mounted on the external wall of the evaporation tank.
- 2.1.3 The humidifier shall vary the drain time periods according to variations in water conditions. Hot water skimming during fill cycle is not acceptable.
- 2.1.4 The units shall operate in deionized water. They will be available to modulate.
- 2.1.5 All components, electrical wiring and plumbing connections will not be exposed and must be contained within the cabinet of the unit. The humidifier shall have two compartments, one mechanical containing the evaporation tank, supply and drain valves, water connections and a drip tray. The other compartment shall house the electrical and electronic components. To avoid heat transfer, the two compartments will be separated by an aluminum wall. Each compartment shall have a hinged lockable door to restrict access to unauthorized personnel.
- 2.1.6 The casing shall be constructed of 14-gauge aluminum and finished with baked enamel.
- 2.1.7 Steam shall be generated in a stainless steel cleanable evaporation container. The evaporation container will be easily removable from the unit. Electronic level sensing assembly, heating elements and manual reset high temperature safety cut-out switch will be secured to the top cover of the evaporation tank. For servicing, the cover will be easily removable from the evaporation tank by means of spring latches. After removal of the top cover, the evaporation tank will become an easily cleanable empty vessel.
- 2.1.8 All electrical wiring will be detachable between the top cover and the electrical cabinet by one-way quick connectors.
- 2.1.9 The evaporation container shall have a safety overflow connection and a drain port, which will be located on the side wall of the evaporation tank. This will minimize the risk of blockage caused by sediment build-up in the bottom of the tank. The overflow and drain port will be detached for servicing by means of a single quick disconnect assembly.
- 2.1.10 The supply water to the unit shall be controlled by a quiet solenoid valve and the drain shall be operated by a pump, which will permit solid mineral particles to pass through the drain without being obstructed.
- 2.1.11 Provide an Internal Drain Cooler to automatically limit drain discharge temperature. The drain water should not exceed 140 deg. F (60 deg. C) during normal operation.

- 2.1.12 The humidifier shall have an alphanumeric display and control module ("ADCM") on the front panel of the unit. It will display in the scroll mode %R.H., actual steam output and water level. It will also indicate special diagnostic parameters such as abnormal operation, time delays, etc. The humidifier shall be programmable using the menu UP/DOWN buttons to program %R.H., set point, frequency of drain cycles, output span control and indication on number of actual service hours. After 72 hours of no demand, the humidifier will go into "End of Season" mode draining the unit. After 1000 hours of operation, ADCM will display need for a service and led CHECK light will blink on and off.
- 2.1.13 The control modulating signal shall be 0-10 VDC or 2-10 VDC or 4-20 mA to modulate 0-100% of the capacity. The maximum output can be minimized by using the electronic feature. Modulation of all elements shall be achieved using zero voltage crossing switching. It will be backed up by an electromechanical contactor. To avoid harmonics and peak electrical loads, Time Proportioning modulation using only electro-mechanical relays will not be acceptable.
- 2.1.14 Apart from the alphanumeric display, the front panel display on the humidifier shall include indicator lights to show "POWER", "FILL", "STEAM" humidity demand, "DRAIN" cycle and "CHECK" system warning. It shall also include a manual three positions rocker switch for "Automatic Operation", "Unit Off" and "Manual Drain".
- 2.1.15 The steam distribution will be done by distributors with minimal absorption distance in the duct. Manifolds shall be stainless steel with brass eyelets. All manifolds shall be completely factory assembled with welded connections requiring no gaskets.
- 2.1.16 The unit shall be CSA certified.
- 2.1.17 The unit shall be supplied with the appropriate proportional programmable controller or ON/OFF humidity controls.
- 2.1.18 Safety controls shall include high limit humidistat and pressure differential switch.
- 2.1.19 Appropriate inspection of the installation and start-up will be done by the manufacturer's agent.
- 2.1.20 Refer to drawings for capacity and options.
- 2.1.21 Acceptable products:
 - Neptronic SK300M Series;
 - Pure EC Series;
 - Carel UR Series;
 - Accepted equivalent.

Decentralized HVAC Equipment - Ventilation

PART 3 - EXECUTION

3.1 Humidifier

- 3.1.1 Install units in accordance with manufacturer's instructions, plumb and level, firmly anchored in locations as required by seismic restrain indicated and maintain recommended clearances.
- 3.1.2 Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor as approved by Engineer. Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted.
- 3.1.3 Furnish copy of manufacturer's piping connection diagram submittal to piping contractor as approved by Engineer. Install and connect devices furnished by manufacturer but not specified to be factory mounted.

END OF SECTION

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APPENDIX

Mechanical Tables

Variable frequency drive test

PART 1 - GENERAL

1.1 General Prescriptions

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Summary

1.2.1 Contents of this Section

.1 Materials, equipment, accessories and installation methods associated with the integrated automation of all systems specified to comply with the prescribed sequences of operation, descriptions and tables in this specification and / or shown on the drawings in order to be operational.

1.3 Mechanical Staff Training

- 1.3.1 Provide qualified technician services to the Owner for 2 days to show the Owner's representatives how to operate the building controls and control systems.
- 1.3.2 This training must be done as a class and the Engineer must previously approve the agenda for the training program.

1.4 Documents to Provide

- 1.4.1 Numerical controls documents to be provided once all the systems have been started up and commissioning has been completed to the Engineer's satisfaction:
 - .1 Provide a copy on a CD or DVD of the as-approved software programmed in each panel.
 - .2 Provide a copy on a CD or DVD of the libraries containing the graphic diagrams programmed.
 - .3 Provide all the necessary documentation to allow the Owner to reinsert the programs into the system components.
 - .4 Provide the library on a computer file of all the provided equipment in the framework of the project (catalogued data sheets, troubleshooting methodology, replacement parts, etc.).
- 1.4.2 Data required in tests and calibration Section.
- 1.4.3 Guarantee and certificates.

1.5 Special Tools and Replacement Parts to be provided

- 1.5.1 When the control works are accepted, provide in surplus:
 - .1 Any special tools required for normal maintenance.
 - .2 Any special cables to allow for interface with control hardware components.
 - .3 Two (2) keys for the room thermostats and humidistats.
 - .4 Two (2) keys to the panels.

1.6 Shop Drawings

- 1.6.1 Supply for verification the following shop drawings, according to Section 20 05 00.
 - .1 All control diagrams for the automatic operation of all systems.
 - .2 All technical details of components supplied by this Section.
 - .3 Drawings showing the architecture of the centralised management system, the exact location of the local panels and control panels.

Page2

- .4 List of points, including their identification, their setpoint value(s), their operating range, and the values attributed to their alarms conditions.
- 1.6.2 On the shop drawings, use the same naming for the systems and the components as the ones used in the specifications and on the drawings, including the coding for the inputs and outputs of the controllers.

PART 2 - PRODUCTS

2.1 Automatic Control System

- 2.1.1 The automatic control system must include, but is not limited to, the following:
 - Operator's station;
 - All communication wiring gbetween operator workstation and digital controllers;
 - All programmable numerical controllers (CNP) and numerical controllers for specific applications (CNA) fully operational as per the sequences of operation and number of points to control or supervise as specified in Section 25 90 00:
 - Control wiring (conduits and cables) between input/output devices and the controllers.
- 2.1.2 Modular design for future expansions and modifications.
- 2.1.3 Each digital control unit must be able to operate independently of the other units, in case of network or operator station breakdown. Each digital control unit must possess the software and the memory required for: programmed start/stop, alarms, etc.
- 2.1.4 The system must include advanced language software, allowing for execution of all operations required or described below. The operator interface must be in English.
- 2.1.5 The system and its accessories have to be easily operable, so that a relatively experienced operator can proceed with all the described operations, as well as to those necessary to restart the system without assistance from the manufacturer. To add or remove a point, or modify the programming in all or in part, it is essential that this work is able to be executed exclusively on site, in a fast manner, concisely and without needing auxiliary programming other than that which is already supplied.
- 2.1.6 The input and output control points indicated on diagrams and in control sequences can be transmitted via a communication link of an equipment's digital controller such as in a variable frequency drive, a chiller, etc. or via independent elements of the control system. The objective is to satisfy the specified sequences. When using the communication link of an equipment's digital controller, all required interfaces are the responsibility of the present Section.

2.2 Manufacturers

- 2.2.1 All devices from a particular category must be of the same type and must come from the same manufacturer.
- 2.2.2 Provided products shall have been on the market for at least three (3) years.
- 2.2.3 Acceptable products for the components other than the numerical control system.
 - Lar-Mex inc:
 - Native BACnet controller with BTL certification.
- 2.2.4 Acceptable installation: Supplier/Manufacturer of components, authorized installer with at least five (5) years with the product family.

2.3 Electrical Wiring and Connections

- 2.3.1 Supply and install conduits and electrical wires as prescribed by Division 26.
- 2.3.2 Cable Hangers
 - .1 Loose cables are accepted only in suspended ceilings. Low voltage control cables and category 3, 5 or 6 communication cables shall be hanged with Erico's "Cable Cat" series or equivalent supports of appropriate configuration for the number of cables.

2.3.3 Conduits and electrical wires must have the following characteristics:

- .1 Metallic conduits
- All conduits must be in galvanized steel, unless mentioned otherwise on drawings or in this Section:
- Conduits size must comply with the Ontario Electrical Code for the number and size of conductors in the conduits, except some specific places where conduits of a bigger size are required and empty conduits that have specified dimensions.
- .2 Threaded and rigid conduits
- Conduits that have at least one of the following conditions must be of standard thickness and threaded:
 - Installed in concrete;
 - Installed underground;
 - Installed outside;
 - Diameter larger than 50 mm (2");
 - 600 Volts circuits and their command devices;
 - Explosion-proof installations.
- Conduit extremities must be reamed to remove metal burrs. Threads are carefully cut.
 Thread length must be kept to the minimum required to connect the conduits to the boxes or to the equipment.
- .3 Thin wall rigid conduits
- All conduits having at least one of the following conditions are of thin wall type (E.M.T.):
 - Diameters of 50 mm (2") or less;
 - Conduits of bypass circuits of 120/208 V and 347/600 V:
 - All conduits that are not submitted to the requirements mentioned in the above article for the threaded conduits.
- .4 Flexible conduits
- Flexible conduits length must be between 600 and 900 mm (24" and 36");
 - To connect hanging equipment like motorized dampers, valves and similar equipment;
 - To connect analyzers of combustible products in ventilation ducts;
 - For the primary and secondary connections of the dry transformers.

2.4 Communication System

2.4.1 General

.1 The hook-up of the operator's station (main or local) to any controller, must allow an interface with all other controllers, in local or remote mode.

2.4.2 Communication conformity

.1 The communications must comply with the IEEE 802.3/Ethernet standard, ASHRAE BACnet, standard 135-2010 or Lonworks protocol.

- .2 The communication taking place on the network must ensure a transfer of values and operator interfaces which are transparent at the architectural and inter-network level ("peer to peer"):
 - The hook-up of an operator interface to any controller of the communication network must allow the operator to interface with all other controllers. The operators must be able to visualise and edit the data, the state information, the reports, the operating software, the personalised programs, etc., of all controllers of the communication network;
 - All values of the data base (objects, software variables, personalized program variables) of any controller must be readable from any other controller on the communication network;
 - All objects and their characteristics must easily be visualized and shared on the entire system.

2.4.3 Communication network

- .1 The systems must be designed to allow a performing, reliable and secure communication between different sections (segments).
- .2 The installation must allow future network expansion and for network technology and communication protocol changes. It must include the following, but not limited to:
 - Transmission network realized with pairs of stranded screened wire;
 - Dedicated standard Ethernet type communication network, 10 MB/s minimum.
- .3 If the new control network cannot be compatible with the corporate network, the present Section must provide and install its own network.
- 2.4.4 The system must allow a direct communication with the chiller/cooling tower management system. The present Section is responsible for the communication between both networks through the BACnet standard with the ASHRAE 135 protocol. The information to be transfer to the building control system is defined in the sequence of operation section.

2.5 System Architecture

- 2.5.1 The criterions for determining the number of CNP and CNA are the following:
 - .1 The number of controller provided must be sufficient to respect the intention and the requirements of this Section;
 - .2 All measure points and control points integrated to one specific system must reside in the same controller;
 - .3 Unless exceptions, all systems must be controlled via completely programmable controller (CNP). The specific application controllers (parametric) CNA are acceptable only in the following cases:
 - Terminal units control;
 - Small equipment control, such as convectors, fan coils or unit heaters.
 - .4 The following technical rooms are equipped with at least one CNP:
 - .5 In addition to the connected points, provide the modules to connect 15% of future points of each type (DI, AI, DO and AO), and do so, for each technical room.
 - .6 The following systems are controlled by one or several CNP, independant from all the other systems:
 - Fresh air system.

.7 The multiplexers are not accepted.

2.6 Programmable Numerical Controllers (CNP-)

2.6.1 General

- .1 Programmable numerical controller (afterwards referred to as "CNP") taking charge of the direct control of the systems to which it is connected to.
- .2 CNP capable of carrying out the regulation and the energy management of the completely independent systems.
- .3 CNP built in order to be able to connect to one or many other CNP and operator stations and be an active organ. In the event that the transmission is interrupted between the CNP's and operator stations, the CNP must be able to take charge of all control and energy management functions as usual.
- .4 Equip each CNP with a clock in real time and a secular calendar, in order to automatically execute functions that are dependant on time. This clock must be capable of synchronising with the clock of all the other CNP's and operator stations.

2.6.2 Panel supply

.1 The panel may be supplied by the local current, 120 Vac, 60 Hz. For 24 Vac, 60 Hz supply, supply and install a transformer inside the local control panel. The panel must keep the active memory alive for a period of at least 72 hours, in the event of a power failure or a shut down in order to maintain the special programs defined by the operator and the operation parameters of the control loops.

2.6.3 Inputs and outputs

- .1 The panel must be capable of accepting the following inputs: thermistor, potentiometer, continuous modulating voltage, binary contact, accumulator and impulsion counter. The signals at the output of the panel must be matched to the controlled equipment, according to each equipment specific application. Where converters or other auxiliary components are necessary, provide and install, inside the control panel (PCL) all the required equipment to ensure a proper operation of the panel and the entire regulation system. The inputs and outputs (voltage or current) of the following types are accepted: 4 to 20 mA; 0 to 100 mA; 0 to 1 V d.c.; 0 to 5 V d.c.; 0 to 10 V d.c.; 2 to 10 V d.c.
- .2 The CNP shall be capable of handling several independent loops and be capable of accepting slave modules to group sets of points locally without having to interact with other CNP; remote points used to adjust or modify setpoint, as per the outside air temperature, may be connected to an other CNP.

2.6.4 Regulation

- .1 The CNP must offer the following algorithms:
 - Proportional control (P);
 - Proportional and integral control (PI);
 - Proportional, integral with the derivative function control (PID);
 - Two position control.

2.6.5 Software

- .1 The software must at least include the operating system supervisor, the transmission controller, the application programs, the operator interface and the control logic that control the operation sequences of the whole system.
- .2 Control logic must have access to all values and states of all the control points connected to the controller, including global and shared values in order to ensure cascade or interconnection control.
- .3 Programs must be automatically executed without any intervention from the operator. They must also be sufficiently flexible to allow them to be personalized.
- .4 The software must be written in programming languages similar to BASIC (BASIC, « Plain English », etc.) or in a high level graphical general command language allowing to make regulation loops.
- .5 The language must support conditional instructions (IF, THEN, ELSE, ELSE-IF), boolean values (AND, OR, NOT) and comparison (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL).
- .6 The language must accept mathematical operators (+, -, x, /, square root and exponentials "x" to the "y", absolute value, maximum value, minimum value, etc.)

2.6.6 Energy management

- .1 Equip the CNP with all energy saving functions in its resident program, to allow it to apply them to one or many HVAC systems to reduce the energy supply. These preprogrammed functions consist of at least the readjustment of the temperature remotely, the outside air economiser cycle, the optimal start, the programmed starts/stops and the control of the supply of outside air by enthalpy.
- .2 The energy saving functions must meet all the mandatory and prescriptive requirements of ASHRAE 90.1-2010, as per sections 6.4, 6.5, 9.4 and 10.4.
- .3 Zones are controlled individually by thermostats within the zone
- .4 Static pressure sensors controlling VAV fans shall be placed such that the setpoint is less than one-third of the total design fan static pressure.

2.6.7 Totalization of the events/functionning cycles.

- .1 The CNP must be able to automatically totalize and memorize functionning periods of any binary input and output.
- .2 The CNP must automatically sample, calculate and memorize daily, weekly and monthly energy consumption associated with input analog signals or binary signals sectected by the operator.
- .3 The CNP must automatically count the daily, weekly or monthly occurrences of any event (ie. number of cycles of a pump, etc.)

- .4 The totalization program must be able to treat and memorize totals of up to 99 999.9 units (ie. kWh, litres, tons, etc.).
- .5 The operator must be able to define warning signal tresholds. He must also be able to create personalized messages in the cases these treshold are reached.

2.7 Numerical Controllers for Specific Applications (CNA-)

- 2.7.1 Numerical controller for specific applications (configurable) (hereafter referred to "CNA", having the same characteristics as the numerical programmable controller, except with limited programming capabilities. These controllers can generally be parameterized, i.e. equipped with pre-programmed algorithms allowing the direct control of the systems to which they are connected through the adjustment of the operation parameters.
- 2.7.2 In case of transmission failure, the controller must continue to work independently from the network.

2.8 Precision of Transmission

2.8.1 The complete transmission system shall have a minimum accuracy of:

 \pm 0.5 °C (± 1 °F) in all cases;

± 3% R.H. in all cases.

2.8.2 This accuracy shall correspond to cumulate accuracies of transmitters, converters transmission lines, amplifiers, coders, decoders and indicators.

2.9 Electronic and/or Numerical Transmitters

2.9.1 General

- .1 Equipped with the necessary elements to allow a linear transmission along the entire transmission range. They shall be of sturdy construction and allow easy access. They must be compatible with controllers.
- .2 Sensors and transmitters must not be affected by external signal such as portable transceiver.

2.9.2 Temperature

- Ambient temperature sensors or transmitter must be wall-mounted with slotted covers with brushed aluminium finish and protected as per indications.
- .2 Temperature sensors and transmitters inside air ducts must be mountable on differents orientations. Their length must be sufficient to allow for a temperature reading at the center of the duct.
- .3 Transmitters located in mixing boxes shall be long enough to allow proper sampling.
- .4 Oustide temperature sensors or transmitters must be protected from the wind and the sun by rust proof baffles. They must have a threaded fitting to recieve a conduit from a watertight junction box, type NEMA 4.
- .5 Temperature transmitter must minimally have the following characteristics:
 - Integrated a zero adjustments and a range adjustments;
 - Smallest temperatue range suitable for the specified usage. As an example:
 - 40 to 60 °C (- 40 to 140 °F) for the outside temperature:
 - 0 à 50 °C (32 à 122 °F) for outside supply air temperature, for room temperature and for chilled water;
 - 0 to 100 °C (32 to 212 °F) for hot water.
- .6 Precision: ± 0.5 °C (± 1 °F).

2.9.3 Relative humidity

- .1 Supply transmitters with all necessary components to compensate for anticipated temperature variations at reading location. Select transmission range large enough to ensure relative humidity readings in normal operating conditions.
- .2 Incorporated device to adjust the zero and the measuring range:
 - Minimum range 5 to 95% R.H.;
 - Precision: ± 3% R.H.

2.9.4 Pressure differential

- .1 Sensor must measure pressure differentials. It must be built to resist maximum pressures even if one line is not connected.
- .2 Material shall be corrosion resistant independently of the carried media.
- .3 Incorporated device to adjust the zero and the measuring range.
- .4 Precision: ± 1% of the scale.

2.9.5 Pressure

- .1 Operating from a pressure differential, to be selected to ensure proper operations at all time.
- .2 Entrance protection against overpressure to at least twice the normal entering pressure.
- .3 Material shall be corrosion resistant independently of the carried media.
- .4 Incorporated device to adjust the zero and the measuring range.
- .5 Precision: ± 1% of the scale.

2.9.6 Current

- .1 Combined sensor/transducer, to measure line current and produce proportional signal.
 - Precision: ± 2% of scale.
- .2 Field adjustable range to suit motor applications.
- .3 Acceptable products: Veris or approved equivalent.

2.9.7 Carbon dioxide

- .1 Continuous CO₂ level transmitter using the principle of non-dispersive infrared. Scale from 0 to 2000 PPM with ± 3 % accuracy. Output signal: 0 to 10 V d.c. or 4 to 20 mA.
- .2 The unit includes a sampling tube, analyser and transmitter installed in a ventilated case for wall or duct mounting.
- 3 Acceptable products: Vulcain 90DM4, Armstrong AMC-310 or approved equivalent.

2.9.8 Natural gas flow meter

- .1 Equipped with a mesuring tube and transmitter with integrated power supply. Precision must be ± 2 % of the nominal value indicated on diagrams. Response must be linear down to 5 % of nominal flow indicated on diagrams.
- .2 These devices shall be a thermal mass flow meter of the industrial type.
- .3 The transmitter must have a 4 to 20 mA output signal compatible with the building automation system.

- .4 Equipped with a flanged stainless steel measuring tube.
- .5 The measurement and data processing must be executed by the control system at least once every five (5) minutes.
- .6 Acceptable products: Endress & Hauser serie Proline t-mass or approved equivalent.

2.10 Thermometric Wells

- 2.10.1 Provide the required wells. Provide them to the concerned Sections for their installation.
- 2.10.2 The wells shall be made from Type 316 stainless steel.

2.11 Electric Actuators

2.11.1 General

- .1 Supply actuator with fastening devices as required.
- .2 Electric actuator must be proportional with a working range between 0 and 10 V c.c. or between 4 and 20 mA c.c, depending on the case.

2.11.2 Control valve actuators

- .1 All control valve actuators must be electronic DDC type. Except for terminal units, all control valve actuators must have a return spring to come back to their normal position on loss of power.
- .2 Actuators for motorized valves for convectors may have modulating or electric or electronic floating control.
- .3 With indication on measurement scale of the actual position of the valve.
- .4 Acceptable products: Belimo or approved equivalent.

2.11.3 Register actuators

- .1 Install in sufficient quantity to ensure proper operation any time. Select actuators according to operating pressures and register dimensions. Install, on fresh air and on return air registers, actuators corresponding to a 50% surface oversize.
- .2 Actuators must be equipped with a return spring allowing registers to return to their specified positions in case of a failure.
- .3 Provide auxilliary contats to confirm full opening and closing of registers.
- 4 Acceptable products: Belimo or approved equivalent.

2.11.4 VAV box actuators

.1 Modulating, electric or electronic floating point control type actuator can be used.

2.12 Control Valves (RC...)

2.12.1 General

.1 Valves shall be made of materials ensuring resistance to operating pressures and temperatures. Supply valves with linear characteristics for chilled water and steam services. Supply "equal percentage" valves for all other services. All 3 way valves shall be "equal percentage" type.

- .2 All characteristics given on drawings to be considered, as follows:
 - CV: theoretical result:
 - D: diameter in millimetres (inches) for reference only.
- .3 Normally open or normally closed valve as per indications.
- .4 Stainless steel shaft.
- .5 Trim and seat in a material compatible with specified use.
- .6 Replaceable trim.
- .7 Valve of nominal diameter less or equal to DN 2
 - NPT thread conical sleeve;
 - Class 250 as per ANSI specifications and bearing their approval seal.
- .8 Valve of nominal diameter greater or equal to DN 21/2
 - · Flanged ends;
 - Class 150 ou 250 as specified and as per ANSI specifications and bearing their approval seal.
- 2.12.2 2-way: (RC2-)
- 2.12.3 3-way: (RC3-)
- 2.12.4 Selection
 - .1 Check all pressures and operating temperature pressure losses, specified flows to ensure accurate control and stable operation at all times. All calculations, results and operating pressures and closing pressures shall be handed to Engineer for verification. They are part of the shop drawings.
 - .2 Valve shut-off pressure must overcome maximum pressure differential in network.

2.13 Electrical Switches (I...)

- 2.13.1 General
 - .1 Sealed electrical switch, activated by an adjustable mechanism linked to a detection sensor.
- 2.13.2 Freezestat (IG-).
 - .1 Anti-freeze switch must open circuit when temperature falls below setpoint. Sensing element is 6 m (20') long and detects the lowest temperature point along the capillary length. Complete with automatic reset device.
- 2.13.3 Humidity (IH-)
 - .1 The switch must open its circuit when the humidity raises above the setpoint. The setpoint range goes from 15% H.R. to 95% H.R. with a 5% H.R differential.
- 2.13.4 Pressure (IP-)
 - .1 Adjustable setpoint switch with SPDT contact. This switch opens its circuit on a rise or a drop in pressure. Detecting element is isolated from pressure source (steam, hot water, etc.).
 - .2 Entrance protection against overpressure to at least twice the normal entering pressure.
 - .3 Siphon tube protection for pressure switch on steam and on high temperature hot water.

2.13.5 Air flow (IDA-)

.1 This diaphragm type switch is activated by airflow.

2.14 Electronic room temperature sensors (TA)

2.14.1 Electronic sensor mounted in a compact casing equipped with a display window allowing to read the room temperature measured by the sensor. It also has a setpoint adjustment device in a preprogrammed range with + and – buttons. Furthermore, by pressing the + and – buttons, the setpoint appears temporarily for 5 seconds.

2.15 Local Control Panels (PCL-)

- 2.15.1 The local control panels must be made of metal. The panels' dimensions must be sufficiently large to allow the installation of all control equipment inside. Each system's control panel must be located near the corresponding system.
- 2.15.2 When several systems are part of a same lean-to, the controls can be grouped in the same area.
- 2.15.3 Embed the concerned system's indicators on the front part on hinges. Mount on the front part of the panel a complete and detailed control diagram, covered in plastic.
- 2.15.4 Install a pocket inside, in order to put the control diagram and the sequence of the corresponding system.
- 2.15.5 Equip the front part with a key-lock device. Hand over two (2) keys to the Owner.
- 2.15.6 The whole assembly must be CSA approved.
- 2.15.7 Each cabinet and apparatus installed on the front panel must be clearly identified with a white ebonite plate with black writing.
- 2.15.8 Each panel must be provided with the required metallic structure.

2.16 Converters

2.16.1 Provide all the required converters in order to convert signals of different types. The converters must convert the signal from the transmitter into a signal compatible with the CNP or the signal from the CNP into a signal compatible with the controlled element.

2.17 Electric Relay (RE...)

2.17.1 Plug-in type with suitable mounting base. CSA approved and with sufficient contact capacity depending on application. Provided with dust proof casing and status light.

Single pole relay, double throw (RESPDT-);

- Double pole relay, double throw (REDPDT-).
- 2.17.2 Time delay relays (RET...)
 - .1 They are CSA approved and they shall have sufficient contact capacity depending on application. Provided with dust proof casing;
 - .2 They are of sturdy construction c/w desired time adjustment;
 - .3 Primarily of two types:
 - on delay (RETOD-);
 - off delay (RETFD-).

- 2.17.3 Minimum position relay (REM...)
 - 0 to 100% adjustable potentiometer with dial and appropriate controls.

2.18 Low voltage transformer

- 2.18.1 CSA approved 120/24 V, 60 Hz transformer with a coil of continuous copper conductor and high dielectric strength isolation.
- 2.18.2 Meet NEMA standards.
- 2.18.3 Include all transformers with sufficient capacity to insure a complete automatisation of electromechanical systems.

2.19 Variable Frequency Speed Controllers

2.19.1 Certifications

- .1 Variable speed controllers shall be CSA or cUL approved.
- .2 The complete unit including the cabinet, the speed controller, the bypass circuit and other components shall be CSA approved.

2.19.2 Manufacturer's shop drawings shall include:

- · Dimensions and weights;
- · Technical specifications;
- Wiring diagrams.

2.19.3 Type of load

- .1 The load is made up of variable torque centrifugal pumps.
- .2 The speed controller shall operate adequately at all speeds. Verify with the system suppliers the motor starting and running torques at different speeds.
- .3 The speed controller shall be capable of starting the system when the system is in forward or reverse rotation, at any speed. Should the controller not be capable of starting the unit when in reverse rotation, install breaking resistors on the D.C. bus to prevent system rotation when not energized.

2.19.4 Cabinet

- .1 Speed controller and bypass shall be installed in a NEMA 1 enclosure.
- .2 The cabinet shall have ventilation slots with replaceable filters to eliminate internal heat build-up.
- .3 The cabinet shall be wall mount.
- .4 It shall have hinged door with handle and lock and key.
- .5 Equipped with disconnect switch complete with the possibility to lock the lever in the "open" position with padlocks.
- .6 2-way selector "AUTO-OFF" which allows operation to be set as automatic control, or off-line for servicing.

- .7 The following components shall be shown on LCD display on the outer face of the door:
- "CONTROLLER RUNNING";
- "CONTROLLER FAULT";
- "MOTOR FAULT";

2.19.5 Speed controller

.1 Input characteristics:

Voltage : 600 V a.c. ± 10%

• Number of phases : 3

• Frequency : 60 Hz ± 2 Hz

Input power factor minimum at any speed : 0.95Efficiency : 0.95

.2 Output characteristics

Power : HP according to tables;

Voltage : 575 V;
Frequency : 0 to 120 Hz;
Maximum carrier frequency: 2 kHz;
Waveform type : PWM;
Direct current : 100%;
One minute peak current : 150%.

- .3 The unit to be of the programmable microprocessor type with control panel and alphanumeric display.
- .4 The following functions to be programmable:
 - Starting and running frequencies;
 - V/Hz ratio;
 - Acceleration/deceleration;
 - Boost;
 - Speed.
- .5 The following information to be displayed:
 - Output voltage;
 - % load;
 - % speed;
 - Ready to start;
 - In use;
 - Operation under selected speed.
- .6 Unit protected against the following events which are displayed on the alphanumeric panel:
 - Loss of phase;
 - Under voltage;
 - Over voltage;
 - Overload;
 - Short circuit;
 - Ground fault;
 - Overheating;
 - Internal component failure.

.7 Environmental operating conditions:

Ambient temperature : 0 to 40 °C (32 to 104 °F)

Relative humidity (non condensing) : 20 to 90% R.H.
Altitude : 3300 feed (1000 m)

2.19.6 Inductors

- .1 A 3 % smoothing inductor on the d.c. bus and a 5% input inductance shall be supplied on all variable speed drives. Shunt type filters shall not be accepted. The total current harmonic distortion not to exceed 30% at the a.c. controller input of each controller.
- .2 In order to reduce the wave reflexion between the controller and the motor, a 3% inductor shall be installed at the motor. Make standing wave tests and supply a written report showing the wave shapes on an oscilloscope with or without the inductor.

2.19.7 Control signals

- .1 The following control elements stop the motor when the speed controller or the bypass circuit drives it. Provide the necessary control circuits:
 - Signal from the control panel:
 - Start/stop signal.
 - Control elements directly connected to the speed controller:
 - Motor thermistors (Thermistor trip circuits to be compatible with the motor thermistors);
 - Fire alarm contact;
 - External protection (frost detection, disconnect auxiliary contact closing).
- .2 The speed controller accepts the 0 to 10 V d.c. or 4 to 20 mA speed signal from the control panel and communicates with the control panel according to the BACnet MS/TP protocol.
- .3 The following signals shall be transmitted to the control panel:
 - Speed value 0 to 10 V d.c. or 4 to 20 mA;
 - Load value 0 to 10 V d.c. or 4 to 20 mA;
 - Unit fault contact;
 - Proof of operation contact obtained by a current reading on one phase of the motor circuit.

2.19.8 Acceptable products:

ABB, ACH 550 Siemens, SED2;

Danfoss:

Trane, TR200;

Allen-Bradley, Power Flex 40/70.

2.19.9 Motor characteristics

.1 Motor characteristics may be found in Division 22 and Division 23, article on "Motors".

PART 3 - EXECUTION

3.1 Installation

- 3.1.1 Install all systems and their control systems according to verified shop drawings and in compliance to manufacturer's recommendations. The installation must be done by qualified.
- 3.1.2 Install all conduits, cables, sleeves, outlet boxes, system cabinets, terminal boxes, anchorings, devices, etc. in accordance with requirements edicted in the electricity chapter of the building construction code and all appropriate sections in applicable local codes.
- 3.1.3 Provide, install and connect every electrical interlock required between each motors in order to ensure proper sequences of operation as specified.
- 3.1.4 Prewired equipments specified in other Sections are not included in this Section. In these cases, provide, install and perform all required connections from these equipments to their respective control panels.
- 3.1.5 Provide, install and start-up softwares in the operator stations.
- 3.1.6 Position of probes, thermostats and humidistats shown on drawings are approximate and shall be used as a reference only. The exact position will be determined on-site.
- 3.1.7 In no case, must the probe or room thermostat be affected by the sun or by any other source of heat or cold or by any air draft.
- 3.1.8 When a probe or a thermostat has to be installed on a cold or hot wall, provide and install an insulated and ventilated base.
- 3.1.9 Protect outside probes from any interaction with sun and wind with the use of rust proof screens.
- 3.1.10 For temperature probes installed in a thermowell, fill the inside wall of the thermowell with a heat transfer agent.
- 3.1.11 Install and connect gas detector and accessories as required by manufacturer.
- 3.1.12 Provide and install an appropriate metallic support for any automation device installed on an insulated ventilation duct.
- 3.1.13 Terminals controllers into finished room shall be installed inside metallic boxes. Theses boxes' cover shall hide the space between the metal and the construction around the boxes. The construction shall be approved by the Engineer and shall included a lock.
- 3.1.14 When allowed by code, install an isolation valve and a shock absorber between the pressure sensor and the measured pressure source:

In steam and hot water networks, protect sensible elements with a siphon tube placed between the isolation valve and the sensors.

3.1.15 Variable frequency drives

.1 Installation

- The VFD must be installed according to the manufacturer's recommendations, as stated in the installation guide.
- Supply cable must be install according to the VFD manufacturer recommendations, as stated in the installation guide.
- Install the wall-mounted variable frequency drive on a plywood attached on steel profiles attached to the floor and to the builing structure.
- Attach the variable frequency drives to the floor with 40 mm (1½") steel profiles.

- Connect all the required control circuits to the drives.
- Connect all the interlocks and local protections to ensure they are functional both under normal operation and on bypass operation.
- Program and adjust the drive settings according to the Engineer recommendations.

.2 Essais

- A qualified technician from the manufacturer must test on the drives to demonstrate that the system is working properly under the whole range of speeds and on bypass mode.
- Make sure to obtain collaboration from all involved trades (mechanical, automation, electrical).
- An authorized reprensentative from the manufacturer must certify the start-up of every contral device.
- Fill-in the table "Variable frequency drive test" in appendix for every motor.
- Execute wave reflection test to the motor with an oscilloscope and produce a paper copy of the waveform. Submit the results to the Engineer.
- Measure harmonic distortion in the incoming current to every drive to ensure the 30% threshold is not exceeded. Execute this test on one drive at a time at 30%, 50%, 65%, 80% and 100% of the normal speed of the motor.
- Use a calibrated meter BMI PP-4300 Task 808 or HIOKI 8807-51/8808-51.

.3 Product support

- Well-trained support personnel and application engineers who are familiar with the VFD must be locally available and be able to offer service in no more than four (4) hours.
- A 24 hours a day support line must also be available 365 days a year.
- An electronic training on CD support must be handed to the Owner at project completion.
 This training must include the following elements: installation, programming and utilizing
 the VFD, bypass and serial communication functions and devices.

.4 Warranty

Warranty period must last 24 months after the certified start-up date and a maximum of 30 months after the shipping date. This warranty ensures reimbursement of on-site parts and labor work. A 24 hours a day support line must also be available 365 days a year.

3.2 Tests, Calibration

3.2.1 Calibration

- .1 Calibrate all control equipments for perfect operation.
- .2 Check and adjust controls. This shall be demonstrated to Engineer.
- .3 Tests results acceptance do not relieve the Contractor from supplying equipment conforming to current standards and bylaws and to the requirements of this specification.
- 3.2.2 Tests results acceptance will not relieve the Contractor's responsibility to ensure that all systems are conforming to the contract requirements.

3.3 Start-up

- 3.3.1 Once the installation is completed, test, adjust all the control, automation and security devices specified in this Section. The tests must include, at least the following:
 - .1 Using an outside probe, read and record temperature, humidity and/or static pressure for every control point of every system. Compare these values with the recorded values of every installed probe.

- .2 Simulate every EB (Binary entry) to verify the settings and to ensure proper functioning of all contacts.
- .3 Simulate every SB (Binary output) to ensure proper functioning and to verify delays.
- .4 Simulate every SA to ensure proper functioning of all controlled equipment, to verify proper shut-downs and to verify all signals.
- .5 To optimize system performances, fine tune all PID values and, if required, modify logical sequences to better suit the installation needs.
- .6 Simulate all freeze conditions and ensure proper operation sequences of all equipment. Also verify these controls when the outside temperature is below 18 °C (0 °F). These tests must be performed in the presence of the Engineer.
- .7 Simulate all alarms for every control panel. These tests must be performed in the presence of the Engineer.
- 3.3.2 Perform required corrections and adjustments and provide a fully functioning system to the Engineer's satisfaction.

3.4 Commissioning

- 3.4.1 Proceed to the commissioning in three phases, including:
 - .1 On-site input and output verifications;
 - .2 System commissioning;
 - .3 Integrated systems commissioning.
- 3.4.2 Prepare commissioning protocols and worksheet. Submit these documents to the Engineer for revision and to the Owner for approbation before beginning commissioning.
- 3.4.3 Document commissioning work on the worksheets as per documentation good practices.
- 3.4.4 Coordinate commissioning with the general Contractor and the Owner to ensure the systems are available when required. Notify in writing the operation personnel of the commissioning calendar in order to have all the required authorized personnel and the Engineer present during the whole process
- 3.4.5 Ensure that every control panel has been installed as per drawings and specifications and as per verified shop drawings before starting commissioning.
- 3.4.6 Verify, test and bring online every sensor and control device.
- 3.4.7 Commissioning includes, without being limitative, the following:
 - Online verification and actual sensor accuracy;
 - .2 Sensor range verification;
 - .3 Control points value reports;
 - .4 Binary alarms and switch settings;
 - .5 Actuator range of motion verification;
 - .6 Integrated security verification in the case of loss of signals, of loss of power or of loss of network communication.
- 3.4.8 When every control device has been calibrated and tested, put every program online and in service on the numerical control system.

- 3.4.9 Demonstrate, in the presence of the Owner and the Engineer each programmed sequence and document results in writing. Any difference with the specifications and drawings and the real behavior will be documented, corrected and tested again.
- 3.4.10 Execute and document a five (5) days efficiency testing following the commissioning tests.
- 3.4.11 Commissioning will be accepted if the system works as specified during the whole testing period. A routine maintenance will not be considered as a malfunction. If any failure happens during the tests and it cannot be fully repaired in the following eight (8) hours, the Owner has the right to require new efficiency tests conducted at the Contractor's expenses
- 3.4.12 Demonstrate that all the control points and all the system functions satisfy the requirements from the drawings and specifications. Use commissioning data sheets to demonstrate and record.
- 3.4.13 Provide all test instruments and ensure all these instruments have been calibrated with an NIST traceability in the past year. Provide a copy of the calibration certificate to the Owner.

END OF SECTION

Section 25 00 00

APPENDIX 1

• Variable Frequency Drive Test

Variable frequency drive test						
Motor number Load type						
Motor Name Plate Power (HP) Voltage (V) Number of phases Current (A) Service Factor Speed (RPM) Frame Design			Speed Cont Unit numl Manufact Model Size (HP) Maximum Technolo	ber urer) n current (A)		
Verifications - Phasing - Rotation - Insulation (Meg ohms)			Protection d Fuses Breaker Overload Elemen	(A) (A) (A)		
		surements at			1	
% speed according to control panel Readings at the fan Air flow (CFM) Static pressure (in.H ₂ O)	30	50	65	80	100	100 Bypass
Readings at the controller Speed (Hz) Current Phase A (A) Phase B Phase C Voltage Phases A-B (V) Phases B-C Phases C-A Acceleration 0-100% (sec)						
Comments:						
Verified by: (Regulation)						Date:
Verified by:				(D	ivision 23)	Date:
Verified by:	_		_	(D	ivision (26)	Date:

END OF SECTION

Section 25 00 00

Page 1

APPENDIX 2

Mechanical Tables – Control Valve

PAGE 1

CONTROL VALVES

					FLU	JID			STE	AM		T	Z
IDENTIFICATION	ROOM SERVED	MANUFACTURER / MODEL	FOLIPMENT	FLOW usgpm	SPECIFIC GRAVITY	PRESSURE LOST psi	Cv	FLOW lb/h	INLET PRESSURE psig	OUTLET PRESSURE psig	Cv	NOTES	REVISION
				9F	<u>.</u>	P			perg	pg			
SYSTEM MUA-002	2 to 004												
V3-1			MUA-002	3,6	1	4	1,8					1,2	
V3-2			MUA-003	6,6	1	4	3,3					1,2	
V3-3			MUA-004	5,2	1	4	2,6					1,2	
												↓	
RADIATORS, UNIT	T HEATERS OR FA	N POWERED MIXIN	IG BOXES										
V2-100	002		UH.1	2,3	1	4	1,2					1	
V2-101	003		UH.1	2,3	1	4	1,2					1	
V2-102	007		UH.1	2,3	1	4	1,2					1	
V2-103	101		FF.4	2,89	1	4	1,4					1	
V2-104	101,1		2 x WALLFIN.E	3	1	4	1,5					1	
V2-105	101,1		2 x WALLFIN.E	3	1	4	1,5					1	
V2-106	129		FF.1	2,24	1	4	1,1					1	
V2-107	130		FF.1	2,24	1	4	1,1					1	
V2-108	131		HCC.4	0,24	1	4	0,1					1	
V2-109	138		HCC.3	1,325	1	4	0,7					1	
V2-110	140		WALLFIN.C	0,65	1	4	0,3					1	
V2-111	140,1		WALLFIN.D	0,65	1	4	0,3					1	
V2-112	142		HCC.4	0,24	1	4	0,1					1	
V2-113	143		HCC.3	1,325	1	4	0,7					1	
V2-114	144		3 x WALLFIN.D	1,95	1	4	1,0					1	
V2-115	144,1		2 x WALLFIN.D	1,3	1	4	0,7					1	
V2-116	148		WALLFIN.D	0,65	1	4	0,3					1	

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		T		<u> </u>	. .	T	T T		1 1.1
V2-117	149	HCC.3	1,325	1	4	0,7			1
V2-118	150	FF.4	2,89	1	4	1,4		$\overline{}$	1
V2-119	153	HCC.3	1,325	1	4	0,7			1
V2-120	114	RADIANT	2,2	1	1,77	1,7			1
V2-121	123	RADIANT	1,73	1	1,77	1,3			1
V3-100	114 & 123	Radiant floor pump	3,93	1	1,77	3,0			1,2
V3-101	114	HC-1		1	4				1,2
V3-102	123	HC-1		1	4				1,2
V3-103	111	FF.3	2,89	1	4	1,4			1,2
V3-104	141	FF.1	2,24	1	4	1,1			1,2
V2-200	201	FF.2	2,89	1	4	1,4			1
V2-201	203	HCC.2	0,6	1	4	0,3			1
V2-202	204	2 x HCC.2	1,2	1	4	0,6			1
V2-203	205	2 x HCC.2	1,2	1	4	0,6			1
V2-204	207	HCC.2	0,6	1	4	0,3			1
V2-205	209	FF.2	2,89	1	4	1,4			1
V2-206	210	WALLFIN.J + WALLFIN.H	1,7	1	4	0,9			1
V2-207	212	WALLFIN.D	0,8	1	4	0,4			1
V2-208	213	4 X HCC.2	2,4	1	4	1,2			1
V2-209	214	2 x HCC.5	1,2	1	4	0,6			1
V2-210	215	4 X HCC.2	2,4	1	4	1,2			1
V2-300	301	HCC.1	1,88	1	4	0,9			1
V2-301	303	WALLFIN.C	0,5	1	4	0,3			1
V2-302	304	2 x WALLFIN.D	1	1	4	0,5			1
V2-303	305	2 x WALLFIN.D	1	1	4	0,5			1
V2-304	307	WALLFIN.D	0,5	1	4	0,3			1
V2-305	308	HCC.1	1,88	1	4	0,9			1
V2-306	310	WALLFIN.F	0,8	1	4	0,4			1
V2-307	312	2 x WALLFIN.C + 1 x WALLFIN	3,6	1	4	1,8			1
V2-308	314	WALLFIN.D	0,5	1	4	0,3			1
V2-309	315	2 x WALLFIN.D	1	1	4	0,5			1
V2-310	316	2 x WALLFIN.D	1	1	4	0,5			1

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V2-311	317	WALLFIN.D	0,5	1	4	0,3			1	
V2-312	318	2 x WALLFIN.C + 1 x WALLF	IN 3,6	1	4	1,8			1	
V3-300	309	WALLFIN.J + WALLFIN.F	1,7	1	4	0,9			1,2	

	NOTES	
1	WATER	
2	3-WAY VALVE	

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PART	2 - PRODUCTS	2
2.1	Not applicable	2
PART	3 - EXECUTION	3
3.1 3.2	Requirements applicable to all systems	3 5

PART 1 - GENERAL

1.1 General Prescriptions

- 1.1.1 The current Section is integral to Section 25 00 00 "Integrated Automation".
- 1.1.2 Section 20 05 00 "General Requirements Concerning Common Work Results" is applicable.

1.2 Summary

- 1.2.1 Section includes:
 - A detailed narrative of the sequence of operation for each system, including:
 - Control logic of each system.

PART 2 - PRODUCTS

2.1 Not applicable.

PART 3 - EXECUTION

3.1 Requirements applicable to all systems

3.1.1 Control mode

- .1 For equipment used in redundancy configuration such as pumps, fans, etc, the start-up is alternated on a per week basis. On status loss for more than 2 minutes, start the relief/lag equipment.
- .2 The enthalpy control must include a dead band for adjustment of minimum differential temperature between outdoor and return air.
- .3 On automatic start-up of equipment, the BAS must assure that the equipment runs for a minimum period to avoid frequent start/stops.

3.1.2 Analog alarms

- .1 For all analog points of measure, program alarms for high and low limits.
- .2 Provide four alarm levels, two high limits and two low limits. Certain alarm limits are already indicated in the control sequence.
- .3 Alarms generated by transmitters located in ventilation ducts or plumbing must be linked to fan or pump status so as to avoid alarms when system is not functioning.

3.1.3 Critical alarms

- .1 When status is available, program critical alarms for the following control points:
 - Unwanted start/stop of fans and pumps;
 - Freeze risks;
 - High or low pressures:
 - Equipment faults;
 - Control variable out of limit range (level, pressure, temperature).
- 2 When an unwanted stop alarm persists for over 2 minutes, the function command is removed.
- .3 Critical alarms are, unless otherwise stipulated, linked to the fire alarm so as to avoid redundant alarms upon fire alarm.

3.1.4 Maintenance alarms

- .1 When state is available, set maintenance alarms for the following:
 - System stop;
 - Dirty filters;
 - Run time.
- 3.1.5 The set points stated in this Section are given as working assumptions. They shall be fully editable with the BAS according to actual building operation and experience.

3.1.6 Set point ramp

- .1 On system start or when changing set points, provide control algorithms to advance the set point to the desired valve from measured variable before the start.
- .2 Ramps progression speeds must be adjustable.

3.1.7 Startup following a return of failure.

- .1 When power returns, electromechanical equipment (such as fans, pumps, etc.) are reset based on a predetermined sequence to avoid overloading. Provide programmable time delays for each controlled equipment. Similarly, on power failure, equipment contacts shall open to restart in sequence.
- 3.1.8 1 Determination of demand and supply setpoints.
 - .1 Equipment supply temperatures are reset based on zone demand, i.e. representative building loads.
 - System schedules will be inherited from its associated zones.
- 3.1.9 1 ASHRAE 90.1-2010 compliance with sequences and strategies.
 - .1 Mandatory control requirements for HVAC systems include:
 - .1 When a thermal zone is served by both heating and cooling systems, there shall be a deadband of at least 3 °C between cooling and heating setpoints. When a single temperature setpoint is given, it shall be the average between the heating and cooling setpoints.
 - .2 When heating and cooling to a zone are controlled by separate thermostats within the zone, heating and cooling setpoint overlap is automatically prevented by programming, mechanical stops or limit switches. Zone controls will prevent reheating, recooling, mixing or simultaneously supplying heatied air with cooled air, and other simultaneous operation of heating and cooling systems to the same zone.
 - .3 Space heating setpoints and setbacks are permitted to go down to 13 °C.
 - .4 All heating and cooling zones shall be controlled by the DDC system, and will have 7-day schedule control with manual override. The manual override will revert back to scheduled at the end of a defined time period to prevent an operator from running the system permanently in manual override mode.
 - .5 When a system is not required due to unoccupied mode or no thermal load, it shall be possible to automatically stop the system's fan.
 - .6 Anciliary systems such as humidifiers shall be automatically stopped when their associated systems are stopped.
 - .7 When a system has both humidification and dehumidification sequences or modes, the controls shall prevent simultaneous humidification and dehumidification.
 - .8 Optimum start sequences shall be implemented for all systems to transition spaces from unoccupied setpoints to occupied setpoints. The optimum start sequences shall, at a minimum, be a function of the difference between space temperature and occupied setpoint, as well as the amount of time prior to scheduled occupancy.
 - .9 Motorized shutoff dampers on all outside air and exhaust air systems shall be shut off during preoccupancy sequences and when system or space is not in use, except for freecooling applications.

.2 For systems with airside economisers:

- .1 For multi-zone systems, economiser dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature. Single-zone systems may use mixed air temperature only.
- .2 All air economisers shall be capable of automatically reducing goutdoor air intake to the design minimum outdoor air quantity when outdoor air intake will no longer reduce cooling energy usage. High limit shutoff controls and their settings shall be enthalpy-based, as per Table 6.5.1.1.3B in ASHRAE Standard 90.1-2010.
- .3 For systems with variable air volume fans:
 - .1 Static pressure sensors controlling VAV fans shall be placed such that the setpoint is less than one-third of the total design fan static pressure.
 - .2 Systems with DDC of individual zone boxes and central control feature static pressure setpoint reset such that the setpoint is reset lower until one zone damper is nearly wide open.
 - Multiple-zone VAV systems with DDC of individual zone boxes and central control feature automatic reduction of outdoor air intake flow below design rates in response to changes in system ventilation efficiency as defined in ASHRAE Standard 62.1 Appendix A.

3.2 Sequences

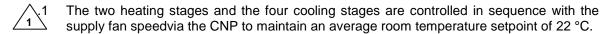
3.2.1 Make-up air unit (MUA-001)

- .1 System shutdown:
 - .1 Supply and exhaust fans are stopped.
 - .2 Outside air and exhaust dampers are closed.
 - .3 The gas heater is stopped
 - .4 The condenser is stopped.
 - .5 The heat recovery wheel is stopped.
 - .6 The humidifier is stopped.
- .2 System start-Up:
 - .1 A command from the CNP opens the outside air damper according to an occupancy schedule.
 - .2 Upon full-open confirmation of the outside air damper, the supply fan starts at low speed.
 - .3 The exhaust damper opens by electrical interlock with the supply fans.

- 4 Upon full-open confirmation of the exhaust damper, the exhaust fan starts at low speed.
- .3 Normal operation:
 - 1. The supply temperature setpoint is readjusted from a high of 22 °C to a low of 12 °C depending on the demand from the zones.
 - 2. The supply fan is constant volume.
 - .1 The humidifier is modulated by the CNP to maintain the relative humidity in the exhaust at setpoint. The CNP limits the relative humidity in the supply at a maximum of 80% R.H.
- .4 Heating mode: Outside air temperature below 12 °C
 - 1 The speed of the heat recovery wheel is modulated by the CNP in sequence with the gas heater to maintain the supply temperature at setpoint.
 - .2 The CNP limits the speed of the heat recovery wheel to maintain the exhaust temperature above 1 °C.
- .5 Cooling mode: Outside air temperature above 14 °C
 - .1 The heat recovery wheel stops when the outdoor temperature is both above 10 °C and below room temperature plus 3 °C. When the outdoor temperature is above room temperature plus 3 °C the CNP starts the heat recovery wheel at full speed.
 - .2 The two cooling stages are activated by the CNP to maintain supply temperature at setpoint.
- .6 Local Protection :
 - .1 The humidifier stops when either the low flow switch (IDA) or the high humidity limit switch (IH) is triggered.
 - .2 The supply fan is stopped when the freezestat switch (IG) is triggered. The freezestat is set to 5 °C (41 °F).
 - .3 A fire alarm contact stops the system.
- .7 Alarm:
 - .1 Fan run status and heat recovery wheel status are sent to the CNP.
 - .2 Humidifier fault is sent to the CNP.
 - .3 Status of filters is sent to the CNP.
 - .4 Alarms are sent when variables exceed their limits:
 - Supply temperature: SP ± 2°C;
 - exhaust relative humidity: < 15 % R. H.;
 - supply relative humidity: > 90 % R.H. (when humidifying).

3.2.2 Packaged rooftop unit (RTU-01)

- .1 System shutdown:
 - .1 Supply fan is stopped
 - .2 The heating and cooling stages are stopped
 - .3 The outside air and exhaust dampers are closed.
- .2 System start-Up:
 - .1 The CNP starts the supply fan according to either an occupancy schedule or to limit the room temperature to a maximum value outside of regular operation times. The system can also start by special request.
 - .2 The CNP opens the outside air and exhaust damper to its minimum position according to the occupancy schedule.
- .3 Normal operation:



.2 The outside air and exhaust damper are modulated by the CNP to maintain the carbon dioxide (CO₂) level in the return duct at setpoint.

The outside air damper is moved to the design occupied value when the cafeteria exhaust fan is turned on.

At cooling demands less than or equal to 50%, the supply fan controls shall reduce the airflow to no greater than two-thirds of the fun fan speed.

- .4 Local Protection:
 - .1 The supply fan is stopped when the freezestat switch (IG) is triggered. The freezestat is set to 5 °C (41 °F).
 - .2 A fire alarm contact stops the system.
- .5 Alarm:
 - .1 Rooftop unit fault is sent to the CNP.
 - .2 Alarms are sent when variables exceed their limits:
 - Room temperature: SP ± 2°C;
 - carbon dioxide level: > 1200 ppm.
- 3.2.3 Packaged rooftop unit (RTU-02)
 - .1 System shutdown:
 - .1 Supply fan is stopped
 - .2 The heating and cooling stages are stopped

3 The outside air and exhaust dampers are closed.

.2 System start-Up:

- 1 The CNP starts the supply fan according to either an occupancy schedule or to limit the room temperature to a maximum value outside of regular operation times. The system can also start by special request.
- .2 The CNP opens the outside air and exhaust damper to its minimum position according to the occupancy schedule.

.3 Normal operation:



- The two heating stages and the two cooling stages are controlled in sequence via the CNP to maintain an average room temperature setpoint of 22 °C.
- .2 The outside air and exhaust damper are modulated by the CNP to maintain the carbon dioxide (CO₂) level in the room at setpoint.

.4 Local Protection:

- .1 The supply fan is stopped when the freezestat switch (IG) is triggered. The freezestat is set to 5 °C (41 °F).
- .2 A fire alarm contact stops the system.

.5 Alarm:

- .1 Rooftop unit fault is sent to the CNP.
- .2 Status of filters is sent to the CNP.
- .3 Alarms are sent when variables exceed their limits:
 - Supply and return temperature: SP ± 2°C;
 - carbon dioxide level: > 1200 ppm.

3.2.4 Packaged rooftop unit (RTU-03)

- .1 System shutdown :
 - .1 Supply fan is stopped
 - .2 The heating and cooling stages are stopped
 - .3 The outside air and exhaust dampers are closed.
 - .4 The bypass damper is open.

.2 System start-Up :

.1 The CNP starts the supply fan according to either an occupancy schedule or to limit the room temperature to a maximum value outside of regular operation times. The system can also start by special request.

.2 The CNP opens the outside air and exhaust damper to its minimum position according to the occupancy schedule.

.3 Normal operation:



The supply fan speed is modulated by the CNP to maintain duct static pressure at setpoint 2/3 downstream of supply fan.

- .2 The two heating stages and the two cooling stages are controlled via the CNP to maintain the temperature in the supply duct at the calculated set point. This set point is readjusted from 23 °C to a minimum of 12 °C according to the highest cooling demand in the spaces.
- .3 The outside air and exhaust damper are modulated by the CNP to maintain the carbon dioxide (CO₂) level in the return duct at setpoint.
- .4 The humidifier is modulated by the CNP to maintain the relative humidity in the return at setpoint. The CNP limits the relative humidity in the supply at a maximum of 80% R.H.

.4 Local Protection:

- .1 The humidifier stops when either the low flow switch (IDA) or the high humidity limit switch (IH) is triggered.
- .2 The supply fan is stopped when the freezestat switch (IG) is triggered. The freezestat is set to 5 °C (41 °F).
- .3 A fire alarm contact stops the system.

.5 Alarm:

- .1 Rooftop unit fault is sent to the CNP.
- .2 Humidifier fault is sent to the CNP.
- .3 Alarms are sent when variables exceed their limits:
 - Supply and return temperature: SP ± 2 °C:
 - Return relative humidity: < 15 % R. H.;
 - supply relative humidity: > 90 % R.H. (when humidifying);
 - carbon dioxide level: > 1200 ppm;
 - supply static pressure: SP ± 60 Pa.

3.2.5 MUA-002 to 004

- 1 System shutdown:
 - .1 Supply and exhaust fan are stopped
 - .2 The outside air and exhaust dampers are closed.
 - .3 The recirculation damper is opened.
 - .4 The electronic expansion valve is closed (Cooling coil on MUA-003 and MUA-004 only)

- 5 The heating coil's control valve is closed.
- .2 System start-Up:
 - .1 A command from the CNP opens the outside air damper according to an occupancy schedule.
 - .2 Upon full-open confirmation of the outside air damper, the supply fans start.
 - .3 The exhaust damper opens by electrical interlock with the supply fans.
 - .4 Upon full-open confirmation of the exhaust damper, the exhaust fans start.
- .3 Normal operation:
 - On a static pressure increase in the heat exchanger, the recirculation damper is modulated via the CNP to de-ice the heat exchanger if the static pressure does not drop after 10 minutes (adjustable).
- .4 Heating mode: Outside air temperature below 12 °C
 - .1 The heating coil's control valve is modulated by the CNP to maintain supply temperature at setpoint of 22°C.
 - .2 The condenser is deactivated when unit in heating mode.
- .5 Cooling mode: Outside air temperature above 14 °C (Cooling coil on MUA-003 and MUA-004 only)
 - .1 The heating coil's control valve is closed and the condenser for cooling is activated.
 - .2 The cooling stage is activated by the CNP to maintain supply temperature at setpoint of $15.5~^{\circ}\text{C}$.
- .6 Local Protection:
 - .1 The supply fan is stopped when the freezestat switch (IG) is triggered. The freezestat is set to 5 °C (41 °F).
 - .2 A fire alarm contact stops the system.
- .7 Alarm:
 - .1 Supply and exhaust fault is sent to the CNP.
 - .2 Status of filters is sent to the CNP.
 - .3 Alarms are sent when variables exceed their limits:
 - Supply and return temperature: SP ± 2°C;
 - carbon dioxide level: > 1200 ppm.
- 3.2.6 Heating system control
 - .1 System shutdown:



The boilers (CH-1 to CH-3) are stopped.

- .2 The supply pumps (P-1 to P-3) for the boilers are stopped.
- .3 The pumps on the heating network (P-4 and P-5) are stopped.
- .2 System start-Up:
 - .1 One of the boilers pumps (P-1, P-2 or P-3) starts.
 - .2 One of the heating network pumps (P-4 or P-5) starts at low speed.
- .3 Normal operation :
 - .1 The boilers are configured as master slave. The boiler controller master modulates the three (3) boilers CH-1 to CH-3 by the CNP to maintain the heating network's supply temperature at set point according to the outside temperature:

Outside temperature	Supply temperature set point
-29 °C (-20 °F)	81 °C (180 °F)
15 °C (59 °F)	30 °C (86 °F)



- A boiler pump (P-1, P-2 or P-3) will only operate when its associated boiler is running, conditional of appropriate safeties and rundowns.
- .3 The heating network pump (P-4 or P-5) is started (the one with the least running time) and its speed is modulated by the CNP to maintain the primary heating network's differential pressure at setpoint (determined during balancing).
- .4 Local Protection:
 - .1 The boilers stop on a low flow indication switches.
- .5 Alarm:
 - .1 Variable frequency drives fault is sent to the CNP.
 - .2 Status of boilers is sent to the CNP.
 - .3 Alarms are sent when variables exceed their limits:
 - network supply temperature: SP ± 2°C;
 - network differential pressure: SP ± 10 kPa.
- 3.2.7 Daycare rooms
 - .1 Unoccupied:
 - .1 The terminal unit is closed.
 - .2 The heating radiator valve is modulated via the CNP to maintain the temperature of the zone at a minimum of 13 °C in the rooms.

.2 Occupied:

.1 The terminal unit is modulated in sequence with the hot water baseboard's control valve by the CNP to maintain the room temperature at setpoint.

.3 Alarm:

- .1 Alarms are sent when variables exceed their limits:
 - Room temperature occupied: SP ± 2°C.

3.2.8 Perimeter heating, unit heater and stairs

.1 Unoccupied:

1.1

The heating radiator valve is modulated via the CNP to maintain the temperature of the zone at a minimum of 13 °C in the rooms.

.2 Occupied:

.1 The hot water baseboard's control valve is modulated by the CNP to maintain the room temperature at setpoint.

.3 Alarm:

 $\frac{1}{1}$

Alarms are sent when variables exceed their limits:

- Room temperature occupied: SP ± 2 °C.

3.2.9 / Spaces with 1 A/C or 2 A/C units with perimeter heating

.1 Heating mode

- .1 The hot water baseboard's control valve is modulated by the CNP to maintain the room temperature at setpoint.
- .2 Evaporators are off.

.2 Cooling mode

- .1 The hot water baseboard's control valve is closed.
- .2 Evaporators are allowed to start by the CNP to maintain the room temperature at setpoint to the highest cooling demand in rooms.

.3 Local protection

1 Heating and cooling are never allowed at the same time in a single room.

3.2.10 / 1 Fan Powered Mixing Box

.1 System start:

.1 The fan is started by the CNP according to the room schedule or when room temperature reaches unoccupied set point outside normal occupation hours. The system can also start upon special demand

.2 Normal operation :



The terminal unit is modulated in sequence with 3-way heating control valve by the CNP to maintain the room temperature at setpoint.

3.2.11 Radiant floor

- .1 System off:
 - .1 The pump P-6 is off.
 - .2 The three-way control valve for the radiant floor is in recirculation mode.

.2 System start:



On a request for radiant floor heating, pump P-6 is started by the CNP.

- .3 Normal operation:
 - .1 The three-way control valve is modulated by the CNP to maintain the heating water floor return temperature set point and to limit the maximum floor temperature to 29 °C and 35 °C respectively in the centre and at the perimeter.

Mode	Outside temperature	Return temperature to the radiant floor
Llooting	-15 °C and less	29.4 °C
Heating	10 °C and more	21.1 °C

.2 The two-way control valve for each room is modulated by the CNP to maintain floor temperature at set point.

.4 Alarm:

- .1 Pump run status is sent to the CNP
- .2 Alarms are sent when variables exceed their limits:



Return temperature: SP ± 2 °C

Floor temperature (centre): > 31 °C. Floor temperature (perimeter): > 37 °C.

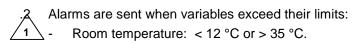
- , ,
- 3.2.12 Boiler room and electrical room ventilation
 - .1 System off:
 - .1 Exhaust fan is off.
 - .2 The outside air and exhaust dampers are closed.



The unit heater valve is modulated via the CNP to maintain the temperature of the zone at a minimum of 13 °C in the rooms.

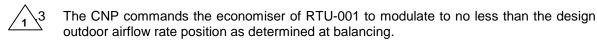
.2 System start-Up:

- .1 The CNP starts the exhaust fan (EF-4) at low speed on cooling demand.
- .2 The outside air and exhaust damper opens by electrical interlock with the exhaust fan.
- .3 Normal operation:
 - .1 The two zone dampers and exhaust fan speed are modulated in sequence with the unit heater control valve to maintain zone temperature at setpoint.
- .4 Alarm:
 - .1 Fan operating status is sent to the CNP.



3.2.13 Kitchen hood near gym

- .1 System off:
 - .1 Exhaust fan (EF-3) is off.
- .2 System start-Up:
 - .1 The CNP starts the exhaust fan according to the occupancy schedule of the kitchen. The system can also start by special request.
 - .2 The CNP also commands hood control panel according to the same occupancy schedule.



- .3 Alarm:
 - .1 Fan operating status is sent to the CNP.
 - .2 Hood control panel fault is sent to the CNP.

3.2.14 Daycare kitchen hood

- .1 System off:
 - .1 Kitchen fan is off.
- .2 System start-Up:
 - .1 The CNP starts the kitchen exhaust fan according to the occupancy schedule of the kitchen. The system can also start by special request.
 - .2 The CNP also commands hood control panel according to the same occupancy schedule.
- .3 Alarm:

- .1 Hood control panel fault is sent to the CNP.
- 3.2.15 Washroom exhaust
 - .1 System off:
 - .1 Exhaust fan is off.

.2 Normal operation:

- .1 The CNP starts the fan according to the occupancy schedule of the associated supply system:
 - EF-1 with system RTU-03
 - EF-2 with system RTU-01
- .3 Alarm:
 - .1 Fan run status is transmitted to the CNP.
- 3.2.16 Storage exhaust
 - .1 System off:
 - .1 Exhaust fan is off.
 - .2 Normal operation:
 - .1 The exhaust starts the fan according to the occupancy schedule.
 - .3 Alarm:
 - 1. Fan run status is transmitted to the CNP.
- 3.2.17 Elevator drain sump / Sanitairy sump pump
 - .1 Normal operation:
 - .1 The pump is operated with a control panel supplied with the pump.
 - .2 Alarm:
 - .1 Alarm is sent to the CNP when sump level is at alarm high level.

END OF SECTION

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PART 1 - GENERAL

1.1 General

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - Conductors and connectors;
 - · Cables and connectors;

PART 2 - PRODUCTS

2.1 Conductors

- 2.1.1 Reference standards
 - .1 Thermoplastic insulated conductors conforming to CSA standard C22.2 no. 75
 - .2 XLPE insulated conductors conforming to CSA standard C22.2 no. 38
- 2.1.2 Conductors shall be cooper with cross linked polyethylene type RW90 40° or TW75 insulation as specified, good for 600 V. Conductors shall be solid for sizes 12 and 10 and stranded for other sizes.
- 2.1.3 Unless specifically indicated otherwise materials used for the manufacture of the conductors shall be copper throughout except for conductors no. 1/0 AWG or larger which can be, at contractor's choice, CSA approved ACM aluminium alloy, such as Alcan's NUAL or equal. "EC grade" class 1350 aluminium conductors are not accepted. Except otherwise noted sizes shown on the drawings are in accordance with copper conductor.
- 2.1.4 Conductor application
 - .1 Distribution and branch circuits
 - RW90 indoor and above ground outside;
 - RWU90 outdoor and buried;
 - Size 12 AWG minimum.
 - .2 Control and audio circuits
 - TW75 indoor;
 - TWU75 outdoor and buried;
 - Size 14 AWG minimum;
 - .3 Grounding conductor in same conduit with other conductors.
 - TW75 or RW90 (green) indoor;
 - TWU75 or RWU90 (green) outdoor or buried;
 - Size 12 AW minimum.
 - .4 Surface grounding conductor, single conductor in a conduit or direct buried
 - Bare;
 - Size 12 AWG minimum.
- 2.1.5 Fire alarm and communication circuits, according to article "Detection and Fire Alarm".
- 2.1.6 The following information shall be permanently marked, at regular intervals, on low voltage conductors.
 - .1 The size followed by a blank for copper conductors followed by the mention ALACM for ACM aluminium alloy conductors.
 - .2 The conductor insulation type.
 - .3 The name of the manufacturer.
 - .4 FT-1 or FT-4 category, where applicable.

2.1.7 Acceptable manufacturers:

- General Cable:
- Nexans Canada inc.;
- Prysmian;
- · Alcan.

2.2 Splices and Terminations

2.2.1 Connection to conform to CSA standard C22.2 no. 65

2.2.2 Up to 750V

- .1 For conductor size no. 10 AWG and smaller use Thomas & Betts Marrette connectors or equal.
- .2 For larger conductors use Burndy compression connectors, Color Keyed series from Thomas & Betts or equal, insulated with 3M cold shrink insulator, series 8420 or equal.
- .3 NEMA lug connector, dimension conforming to conductors and connection plate. Compression connectors, Color Keyed from Thomas & Betts or equal.
- .4 Lugs, terminals and screws shall be compatible with copper and aluminium conductors. They shall be marked for this application.
- .5 For connection of copper to aluminium use, Alcan's Coppertail Thomas & Betts BI-PIN or Burndy's Hyplug connectors.

2.3 Cables

2.3.1 AC90 (BX) type armoured cable

- .1 Armoured cable conforming to CSA standard C22.2 no. 51.
- .2 RW90 conductors, sizes as shown, and having the material specified under sub-article "Conductors".
- .3 Interlocking aluminium armour.
- 4 AC90 type for 600 Volts.

2.3.2 TECK type armoured cable

- .1 TECK type armoured cable conforming to CSA standard C22.2 no. 131.
- .2 Stranded, RW90 type insulation, copper conductor sizes as shown, and having the material specified under sub-article "Conductors".
- .3 Bare copper grounding conductor, stranded for multi-conductor cables, and bare copper concentric grounding conductor for single conductor cables.
- .4 Tape covering.
- 5 PVC protective sheathing.
- .6 Interlocking aluminium armour.
- .7 PVC jacket HL type when outside.
- .8 TECK 90 (-40 °C) type, FT-4.

2.3.3 ACWU90 type armoured cable

- .1 ACWU90 type armoured cable conforming to CSA standard C22.2 no. 51.
- .2 Conductors made from materials specified under sub-article "conductors", stranded with RW90 type insulation, and having the size as shown.
- .3 Base ground conductor, stranded for multiconductor cables and base concentric ground conductor for single conductor cables.
- .4 Aluminium interlocked armour.
- .5 PVC protective jacket.
- .6 ACWL90, FT-4 type cable.

2.3.4 Cable applications

- .1 AC90 type armored cable: in hanged ceilings, dry walls and dry location. For connection of lighting fixtures and switches, receptacles from a junction box on a horizontal distance not exceeding 3 m (10'). Install cable drops for luminaires of sufficient length to allow the luminaire to be relocated to any location within a 3000 mm radius.
- .2 TECK type armoured cable: as shown
- .3 ACWU90 type armoured cable: as shown.

2.3.5 Acceptable manufacturers:

- General Cable;
- Nexans Canada inc.;
- Prysmian;
- Alcan.

2.4 Cable Connectors

- 2.4.1 Cable connectors conforming to CSA standard C22.2 no. 188
- 2.4.2 Cable connectors to suit copper or aluminium cables.
- 2.4.3 Description and catalog number apply to 16 mm (½") cables. For all other cable sizes connectors shall be from the same series.
- 2.4.4 AC90 type armoured cable: Thomas & Betts no. 302 series connector.
- 2.4.5 TECK" type armoured cable: Thomas & Betts "Star Teck" series or Iberville CI-TC series.
- 2.4.6 Type ACWU90 armoured cable: Thomas & Betts "Star Teck" series or Iberville CI-TC series.

PART 3 - EXECUTION

3.1 Wires and Cables

3.1.1 General

- .1 All wires and cables to be handled with great care at all times. No wire or cable installation below temperature limits set by the manufacturers will be allowed.
- .2 Special care shall be taken to prevent wire or cable crushing or scratching.
- .3 Use CSA approved lubricants compatible with the wire or cable jacket to reduce pulling tension.
- .4 Horizontal cable runs in dry walls are prohibited.

3.1.2 Branch circuit wiring:

- .1 Conductors smaller than #12 AWG not permitted.
- .2 Wiring for branch circuits shall be sized to limit the voltage drop from the Panelboard to the farthest outlet to 2% when carrying 80% of the branch circuit breaker rated current.
- .3 For 15A. 120 volt circuits using shared neutrals use #12 AWG for runs up to 30 m. Larger conductor sizes must be used for runs in excess of 30 m. The shared neutrals shall be oversized, minimum 150% of phase conductor rating.
- .4 For 15A. 120 volt circuits using separate neutrals use #12 AWG for runs up to 21 m. Larger conductor sizes must be used for runs in excess of 21 m.
- .5 Shared neutrals are not acceptable.

3.1.3 Cable installation

- .1 Fasten to cable trays or supports with cable clamps installed at intervals approved by the Provincial Electrical Code; install enough clamps to insure a rigid installation and to adequately support the weight of cables in vertical runs.
- .2 When cables are grouped, space them to the diameter of the largest component.
- .3 Respect distance between cables specified under the Provincial Electrical Code for cable tray installation to obtain their maximum ampacity.
- .4 Install cables only when cable tray installation is completely finished and only when risk of construction damage is past.
- .5 The metal sheath of BX cables shall be cut with the appropriate tool (hacksaws not allowed) and cable extremities to be fitted with insulating bushings.
- .6 To maintain colour coding sequence in multi conductor control cables always draw the wires in the same direction.

3.1.4 Installation of conductors

- .1 Tie and shape conductor bundles in panels, cabinets and motor control centers, using Thomas & Betts Ty-Rap cable ties.
- .2 Install wires and cables in conduits as shown.
- .3 Do not pull spliced conductors in conduits.
- .4 Simultaneously install all conductors in the same conduit.
- .5 Cables installed in parallel shall be made from the same material, have same size conductors, same insulation type, same length, exempt from splices, terminated at both ends on a same multiple lug connector or on the same bus bar. They shall be installed according to the Provincial Electrical Code. When the capacity of existing feeders is increased by the addition of parallel cables, the above requirements shall apply.
- .6 When the size of the conductor is larger than the size of the lug receiving it, per example to reduce voltage drop, use the largest size allowed for the lug and install a compression connector, type "H" from Thomas & Betts or equal, between the two conductors. Use tools recommended by manufacturer. Install over the connector an insulating cover designed to suit the connector.
- 3.1.5 Installation of ACM aluminium alloy cables and conductors.
 - .1 After the removal of the insulation, brush the conductor, apply Alcan's oxide inhibitor compound, Burndy's Penetrox or Ideal's Nualox and make the connection with the equipment labelled and approved for use with aluminium conductors.
 - .2 Use connectors approved for use with aluminium and copper conductors.
 - .3 When a connector is not CSA approved for use with aluminium, use a CSA approved adaptor to make the transition from aluminium to copper.

3.1.6 Sealing barriers

- .1 When cables pass vertically through a concrete slab, MCT type from Nelson, multicable transit barriers shall be used to seal the path.
- .2 When horizontal cable runs pass through a concrete or concrete block wall, fire insulating barriers similar to the "Fire Stop" system shall be installed. An elastomeric compound jointly used with fire proof panels shall render the installation to IEEE 634 standard.

END OF SECTION

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PART 1 - GENERAL

1.1 General

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - Electrical conduits and accessories;
 - Splitter through;
 - Connection boxes;
 - Raceways.

1.3 Shop Drawings and Technical Data

- 1.3.1 Submit shop drawings and technical data regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 Submit shop drawing and technical data of the following items:
 - Splitter through and cabinets.

PART 2 - PRODUCTS

2.1 Conduits

2.1.1 Reference standards

- .1 Threaded galvanized steel rigid conduits conforming to CSA C22.2 no. 45 standard.
- .2 Electric metallic tubing (EMT) conforming to CSA C22.2 no. 83 standard.
- .3 PVC conduits conforming to CSA C22.2 no. 211.2 standard.
- .4 Flexible metallic conduits and flexible and watertight PVC covered metallic conduits, conforming to CSA C22.2 no. 56 standard.
- .5 Non metallic flexible conduits conforming to CSA C22.2 no. 227.3 standard.

2.1.2 Application

- .1 Electric metallic tubing (EMT):
 - For utilization and distribution panel feeders;
 - For branch circuits and auxiliary systems;
 - In suspended ceilings, masonry and dry walls;
 - When poured in concrete (not for service entrance).
- .2 Electric metallic tubing (EMT) with red coating:
 - For Fire Alarm;
 - Product : Columbia True Color EMT.
- .3 PVC conduits:
 - For outdoor installation on roofs;
 - For underground installation and in corrosive environments;
 - For the below grade part of an underground service entrance.
 - For outdoor power, signal and communication services:
 - Spec type: buried
- .4 Flexible metallic conduit
 - For connections to transformers in dry areas.
- .5 Flexible and watertight PVC covered metallic conduits:
 - For connection to motors and other equipment generating vibration.
- .6 Flexible non metallic tubing
 - For branch circuits and auxiliary systems in concrete slabs.
- 2.1.3 Acceptable manufacturers:
 - Columbia;
 - Scepter (PVC);
 - Ipex (PVC).

2.2 Conduit Supports

2.2.1 One hole malleable iron clamp for apparent conduits up to 53 mm (2"). Two (2) hole clamps for conduits larger than 53 mm (2").

- 2.2.2 Saddler to hang conduits from apparent metallic structures.
- 2.2.3 U type channels to support several conduits or TECK cable with spacing conforming to Provincial Electrical Code.
- 2.2.4 Threaded steel rods to support suspended conduits and having a bearing capacity adequate for the load. Minimum 6 mm (1/4") diameter.
- 2.2.5 The following catalog numbers apply to 16 mm (½") conduits. For any other size conduit use supports from the same series.
 - .1 Galvanized steel clamps, Unistrut series U814.
 - .2 Angle iron support, Thomas & Betts series #1276 for rigid conduits and series #4159, 16 mm (½") for EMT
 - .3 Concrete wedge anchor, Star Co Series 3435-0000
 - .4 Brick and masonry expansion shield, Star Co Series 1835-0300.
 - .5 Cable and conduit clamp, Unistrut series M5026.
 - .6 PVC covered steel clamps for PVC conduits, Scepter CS series.
- 2.2.6 TECK Cable Fasteners
 - .1 Nylon tie, Ty-Rap, MX series, for cables installed in horizontal raceways.
 - .2 Cable clamps, Thomas & Betts series CH118, for cables installed in vertical raceways or on U type channels.

2.3 Conduit Connectors

- 2.3.1 Reference standards
 - .1 Connectors conforming to CSA C22.2 no. 18 standard.
 - .2 PVC connectors conforming to CSA C22.2 no. 85 standard
- 2.3.2 Connectors shall be specifically designed for conduits used.
- 2.3.3 Prefabricated "L" type connectors where 90° elbows are required on 27 mm (1") and larger conduits.
- 2.3.4 The following catalog numbers apply to 16 mm ($\frac{1}{2}$ ") conduits. For other sizes use connectors from the same series.
 - .1 Electric Metallic Tubing
 - Connectors: Iberville no. 5004;
 - Set screw couplings: Iberville no. 5104.
 - .2 PVC conduits
 - · Couplings: Scepter EC series;
 - Terminal adapters: Scepter TA or FA series.
 - .3 Flexible and watertight PVC covered metallic conduits
 - Connectors: Thomas & Betts no. 5332.
 - .4 Flexible conduits
 - Connectors: Thomas & Betts no. 302.

- .5 Non metallic flexible conduits
 - Connectors: Scepter series KTC, KC or KTA according to application.
- .6 Watertight expansion fittings

2.4 Splitter Troughs, Cabinets, Junction and Pull Boxes

2.4.1 Reference standards

- .1 Pull and junction boxes and with hinged covers conforming to CSA C22.2 no. 40 standard.
- .2 Splitter troughs conforming to CSA C22.2 no. 76 standard.

2.4.2 Splitter troughs

- .1 Sheet metal enclosure with welded edges and hinged shaped cover with locking facility when closed.
- .2 Copper or aluminium bus bars c/w terminals corresponding to the number and size of the incoming and outgoing conductors as shown.
- .3 Unless otherwise indicated the splitter troughs shall have sufficient length to accommodate the layout of the secondary equipment.
- .4 Supply at least three space terminals for each terminal size in 400 A and less splitter troughs.

2.4.3 Cabinets

- .1 Type "E" sheet metal, surface mounted enclosure with overlapping folded edges, hinged door, handle, latch and lock.
- .2 Type "T" sheet metal, surface or recessed mounted enclosure, with hinged door, latch, lock with two keys and supplied with 19 mm (¾") thick plywood backpanel. Fire alarm terminals shall be double pole, ceramic, Weco series 560.

2.4.4 Junction and pull boxes

- .1 Welded steel boxes with screw fastened flat cover for surface mounting.
- .2 Cover with a 25 mm (1") minimum trim compatible with recessed pull and junction boxes.

2.4.5 Acceptable manufacturers:

- Bel;
- Roger Girard;
- Iberville.

2.5 Boxes

2.5.1 Reference standards

- .1 Outlet and branch circuit boxes conforming to CSA C22.2 no. 18 standard.
- .2 PVC boxes conforming to CSA C22.2 no. 85 standard.

2.5.2 General

- .1 Box dimensions to conform to Provincial Electrical Code.
- .2 Outlet boxes shall be gauged where several wiring devices are to be installed at the same location.
- .3 Covers for boxes which are not used for wiring devices shall be plain.

- .4 Gauged outlet boxes shall be complete with barrier when outlets from separate systems are grouped together.
- .5 Knock down boxes are not acceptable except when used on outlets with non metallic sheathed cable.

2.5.3 Ganged outlet boxes

Electro galvanized steel boxes, for single or multiple recessed mounting of wiring devices in steel studded gypsum board walls, having minimum dimensions 76 mm x 51 mm x 51 mm (3" x 2" x 2") or as shown, series 1102. 102 mm x 102 mm (4" x 4") boxes with extension when more than one conduit penetrate one side with plaster ring where required. Thomas & Betts series 52151 or 52171.

2.5.4 Surface mounted outlet boxes

- .1 Electro galvanized steel boxes for EMT connected outlets, 102 mm x 60 mm x 48 mm (4" x 2%" x 2") minimum size.
- .2 FS or FD type cast iron surface mounted boxes, single or ganged, with manufactured threaded openings for rigid conduits and mounting ears.

2.5.5 Ceiling outlets boxes

.1 102 mm (4") octagonal boxes for lighting fixture and ceiling outlets, Thomas & Betts series 54151 or 54171.

2.5.6 Plaster or ceramic tile outlet boxes.

.1 102 mm (4") sided or larger boxes with extension and plaster ring for recessed wiring devices in plaster or ceramic tile walls, Thomas & Betts series 52151 or 52171.

2.5.7 Masonry outlet boxes

.1 Electro galvanized gauged outlet boxes for recessed multiple wiring device installation in apparent masonry walls (concrete bricks or blocks), Thomas & Betts series MB.

2.5.8 Concrete boxes

.1 Electro galvanized steel boxes for flush mounting of wiring devices in concrete, with compatible extension and plaster rings where required, Thomas & Betts series 52151 or 52171.

2.5.9 PVC conduit boxes.

.1 PVC boxes shall be used on PVC conduit networks.

2.5.10 Outdoor boxes

2.5.11 Weatherproof designed for Heavy Cast Aluminium covers with two screws and for flush mounting, Legrand series 4600.

2.5.12 Acceptable manufacturers:

- Iberville;
- Thomas & Betts;
- Roger Girard;
- Bel:
- Crouse Hinds;
- Appleton.

2.6 Empty Conduit Systems for Telecommunication

- 2.6.1 Conduits shall be electric metallic tubing (EMT) as described in article "Conduits". Conduits shall have plastic grummets at both ends. Use of "LB, LL or LR" types elbow is prohibited.
- 2.6.2 Conduit diameter for telecommunication (data and telephone) shall not be smaller than the requirements of the following table:

Conduit size	Maximum quantity of cable
21 mm (¾")	3
27 mm (1")	6
35 mm (1¼")	10
41 mm (1½")	14
53 mm (2")	20
63 mm (2½")	30
78 mm (3")	40

- 2.6.3 Except otherwise noted, for telecommunication (data and telephone) install one conduit between the outlet and an accessible location in a suspended ceiling. Refer to the architectural and mechanical drawings.
- Outlet boxes for telecommunication shall be single gang for a maximum of four (4) cables and double gang for five (5) to eight (8) cables. When boxes are used, they shall have a minimum depth of 64 mm (2½"), two (2) gangs.
- 2.6.5 Filling factor for other systems shall be as per tables of provincial electrical code for power conductor.
- 2.6.6 Verify bending radius of cable and install conduits in respect to the cable manufacturer requirement. For fiber optic networks, use long radius elbows and pull boxes having an appropriate size to avoid damage on cables.

PART 3 - EXECUTION

3.1 Conduits

3.1.1 General

- .1 All conduits are not shown on the drawings. Those that are shown are only represented schematically. When the specified conduit size is indicated, do not install smaller diameter conduits.
- .2 All conduits shall be concealed except those installed in mechanical and electrical rooms and parking areas.
- .3 Apparent conduits shall be installed in such a manner as not to decrease the headroom and to use the less possible space.
- .4 All supply conduits to panels, motor control centers etc., and all conduits for motor branch circuits shall be complete with a green ground conductor sized according to table 16 of the Provincial Electrical Code.

3.1.2 Bending and cutting of conduits

- .1 Bend conduits cold and insure that the resulting flattening does not reduce the original conduit diameter by more than 1/10. Conduits having a flattening greater than 1/10 diam. or which have twisted bends shall be considered defective and shall be replaced.
- .2 All conduits greater than 21 mm (¾") diam. shall be mechanically bent.
- .3 Bending radii shall not be smaller than manufactured bends.
- .4 Conduit ends to be reamed to remove bars which could damage conductors.

3.1.3 Installation of conduits

- .1 All electrical conduits to be fastened with appropriate clamps. Electrical conduits shall not be attached to suspended ceilings, plumbing, ventilation or air conditioning ducts or any other apparatus. Steel cables or holed straps shall not be accepted.
- .2 Unless otherwise shown, conduits shall not pass through structural elements.
- .3 All surface mounted metallic conduits shall be fastened with malleable iron clamps, bolts and anchors. Follow Provincial Electrical Code for spacing.
- .4 Flexible conduits shall be fastened with TY-RAP plastic straps from Thomas & Betts.
- .5 When conduits are grouped, they shall be mounted on suspended or surface mounted galvanized U shaped steel channels.
- .6 Attach single suspended conduits with steel clamps.
- .7 Rod diameters and support spacing shall be determined from the configuration of the grouped conduits. Support channels shall be as manufactured by Unistrut, Wieland or Burndy.
- .8 Install conduits parallel to steam or hot water pipes spacing them at least 150 mm (6") horizontally and 75 mm (3") vertically.
- .9 Conduit runs to include a maximum of three 90° elbows or a length of 30 m (100'). Provide cable supports in vertical runs according to the spacing shown in table 21 of the Provincial Electrical Code. The supports shall be mounted in a box and be manufactured by O-Z/Gedney. Each run extremity to end into a box.

- .10 Expansion sleeves to be installed at building expansion joints and on long and straight conduit runs. Electrical continuity to be insured by flexible links compatible with the materials and according to the Provincial Electrical Code.
- .11 All conduits to be capped to prevent foreign objects from entering during the construction.
- .12 Corrosive cleaning agents shall not be used. Remove and replace the obstructed section.
- .13 Insure that conduit interior is dry before proceeding with cable pulling.
- .14 Supply and install a polypropylene rope in empty conduits to ease the eventual pulling of wire or cables.
- .15 Each motor connections to end with a watertight flexible conduit section.
- .16 Conduit installation to be such as to insure electric continuity of grounding.

3.1.4 Apparent conduits

- .1 Conduits to be installed parallel to or perpendicular to building site lines.
- .2 Leave a 1,500 mm (60") clearance for conduits installed in the back of gas operated infrared heaters.
- .3 When required conduits shall be installed on girder ribs.

3.1.5 Concealed conduits

- .1 Horizontal conduit runs in masonry walls and dry walls are prohibited.
- .2 Unless indicated otherwise, conduits may not be installed in concrete topping or terrazzo.

3.1.6 Underground conduits, direct burial

- .1 Conduits shall be buried to the specified depth.
- .2 Install grouped conduits on undisturbed soil or on 150 mm (6") thick granular fill compacted to 95% dry Proctor Index.
- .3 Before proceeding with conduit installation excavate the whole path to insure that no obstacles will interfere with the conduit.
- .4 Install conduits to specified levels and grades with minimum slope of 1:400 for water drainage.
- .5 Install conduits according to the specified layout using preformed rigid plaster interlocking spacers to achieve a 50 mm (2") minimum vertical and horizontal spacing. Spacing slips to be not more than 1,500 mm (60") from one another and bottom rows to be installed at specified grade. Joints on successive layers to be staggered by 750 mm (30").
- .6 Apply a thick coat of bituminous paint on all joints to render them waterproof (except for joints on PVC conduits).
- .7 Use galvanized steel conduits for that part of the conduit run which emerges beyond the definitive ground level.
- .8 Perform transposition and direction changes with 5° elbows.
- .9 Use bell ends at access to conduits in manholes and buildings.
- .10 Use conduit adapter sleeves to mate metallic to non-metallic conduits.
- .11 Cut, trim and ream conduit ends, to manufacturer's recommendations, to obtain finished conduit ends similar to the manufactured ones.

- .12 Protect the conduit array with a 150 mm (6") thick sand layer over conduit row.
- .13 Install a Brady Identaline tape marker with the "Underground power line" warning, above the conduit run, before backfilling.

3.1.7 Concrete encased conduits, in floors and walls

- .1 Install conduits without interfering with steel armature. Organize conduits to reduce at strict minimum quantity of cross-overs.
- .2 Do not install in concrete slabs conduits having a diameter larger than 25% of the slab thickness. Encase conduits with minimum 25 mm (1") concrete cover.
- .3 Protect conduits at their point of emergence from the concrete mass.
- .4 Before the pouring of the concrete, install sleeves where conduits pass through concrete walls or slabs.
- .5 Install oversized sleeves where conduits are to pass through a water repellent membrane. Install sealing paste between the sleeve and conduit.
- .6 Tamp concrete around all conduits.

3.1.8 Conduits under a slab on ground.

.1 Conduits 27 mm (1") and larger shall be installed under the slab and encased in a 75 mm (3") thick concrete mass. Install a 50 mm (2") thick sand layer between the concrete mass and the slab.

3.1.9 Flexible non metallic conduits

.1 Flexible non-metallic conduits, encased in concrete, shall not be installed at low temperature, to prevent breakages. All damaged flexible conduits shall be replaced by other flexible non-metallic conduits before the concrete pouring as surface mounted electric metallic tubing after the concrete pouring.

3.1.10 Vertical runs

.1 In vertical runs install pull boxes at the minimum spacing required by the Provincial Electrical Code in Table 21. Support medium voltage cables with R type from O-Z/Gedney for high tension and Q type for the rest.

3.1.11 Conduit inside ventilation systems

.1 Seal all conduits penetrating into ventilation systems to supply equipment inside the systems to prevent air leaks at the penetration points.

3.1.12 Conduit fittings

- .1 Fittings for threaded rigid conduits shall be coated with red lead before being threaded.
- .2 Electric metallic tubing couplings shall be of the set screw type.
- .3 Weatherproof type fittings shall be used on outdoor or humid installations.

3.2 Boxes, Splitter Troughs and Cabinets

3.2.1 Boxes

- .1 Boxes to be independently supported from the conduit to which they are connected.
- .2 Install recessed elements flush with the finished wall when possible, use plaster rings and insure that edges of the wall covering are at 6 mm (¼") from the opening.

- .3 Fill boxes with foam or paper to prevent construction materials from entering.
- .4 Provide sufficiently large openings on boxes for the conduits and armored cable installation. Reducing washers are not allowed.
- .5 Wall outlets shall be installed to the mounting height shown on the legend drawing.
- .6 Masonry boxes to be symmetrically installed and aligned with the masonry.
- .7 Pull and junction boxes shall all be accessible once all works from other trades is finished.
- 3.2.2 Splitter troughs and cabinets
 - .1 Install splitter troughs and cabinets plumb and square to the walls of the building at the location shown on the drawings.
 - .2 Supply and install identification tags showing voltage, number of phases and input current rating.
- 3.2.3 Pull and junction boxes
 - .1 Supply and install the number of pull and junction boxes required to complete the installation.
- 3.3 Empty Conduit System for Telecommunication
- 3.3.1 Supply and install a complete empty telecommunication conduit/cable tray system as shown on the drawings.
- 3.3.2 Perform conduit installation according to article "Conduits". Install a pull rope in each conduit.
- 3.3.3 Perform cable tray installation according to article "Cable Trays".
- 3.3.4 Perform the installation to the standards of the service utilities concerned.

END OF SECTION

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APPENDIX

- Circuit Breaker Tests and Calibration
- Tests on Motors

PART 1 - GENERAL

1.1 General

- 1.1.1 Section 20 05 00 "General Requirements Concerning Common Work Results" applies.
- 1.1.2 Section 20 05 02 "Specific Requirements Concerning Common Work Results for Electrical" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned and/or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - Low voltage switchboard;
 - Metering:
 - Distribution transformers;
 - Starters:
 - Distribution and utilization panels;
 - · Safety switches;
 - Circuit-breaker;
 - Fuses.

1.3 Shop Drawings and Technical Data

- 1.3.1 Submit shop drawings and technical data regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 Submit shop drawing and technical data of the following items:
 - Low voltage switchboard;
 - Metering;
 - Distribution transformers;
 - Starters:
 - Distribution and utilization panels;
 - Safety switches:
 - Circuit-breaker;
 - Fuses.

PART 2 - PRODUCTS

2.1 Electric Entrance

2.1.1 Reference standards

- .1 Design, materials, construction and arrangement of the complete installation shall conform to standard practice and to the requirements of the latest edition or revisions of the following standards:
 - Hydro-Ottawa's conditions of service;
 - Hydro-Ottawa's commercial Design specifications and Standards;
 - CSA-C22.3 no. 7 "underground systems".
- 2.1.2 Connection to the utility is done at:
 - (EXISTING) 347/600 V, 3 phases, 4 wires directly on the 347/600 V, 400A, Hydro-Ottawa network.
- 2.1.3 Buried PVC conduits conforming to sub article "Conduits" in underground conduits, direct burial.

2.2 Grounding and Bonding

- 2.2.1 Reference standards
 - .1 CSA C22.2 no. 0.4 standard for equipment grounding and bonding.
 - .2 CSA C22.2 no. 41 standard for grounding and bonding materials.
 - .3 Materials to conform to CSA C22.3 no. 2 standard unless indicated otherwise.
- 2.2.2 Copper bus bars
 - .1 Rectangular cross-section pure copper having a conductivity of 98%.
 - .2 Sizes as shown
- 2.2.3 Conductors
 - .1 Bare; stranded, 98% conductivity copper.
 - .2 Insulated: type TW 75.
 - .3 Size: as shown.
- 2.2.4 Connectors
 - .1 Exothermical welds similar to the Cadweld process.
 - .2 Split bolt type: Burndy series KS Servit or approved equivalent.
 - .3 Compression type: Burndy Hyground system or approved equivalent.
 - .4 For elevated floors: Burndy no. GRF4C-3 or approved equivalent.
- 2.2.5 Unless otherwise noted, EMT may be used for equipment grounding of all branch circuits. A grounding conductor is required for all feeder and motor circuits and for outlets on dedicated circuits.
- 2.2.6 Tightening torques recommended by the manufacturers or Provincial Electrical Code shall be respected for all bolted-on connections.

2.3 Dry Type Transformers Up to 600 V

2.3.1 General

- .1 Dry type transformers conforming to CSA C22.2 no. 47 and C9 standards.
- .2 Single phase or three phases transformers as shown.
- .3 All transformers shall meet the requirements of the C802 standard as per the following criteria's:
 - Shall comply with efficiency standards described in CSA C802.2 or EPA "Energy Star";
 - The linear efficiency band as per CSA C802 shall be met between 35% to 65% of the maximum kVA indicated on the transformer name plate.
- .4 Equipment protected for installation in sprinkler protected rooms.

2.3.2 Three phases power transformers above 15 kVA

- .1 ANN type.
- .2 Class H (220) insulation with winding temperature rise not exceeding 150 °C.
- .3 Copper windings. Three (3) primary windings, delta connected. Three (3) secondary windings, wye connected, with grounded neutral.
- .4 Dielectric insulation good for 1.2 kV.
- .5 BIL: 10 kV.
- .6 With four 2.5% taps: 2 FCAN and 2 FCBN.
- .7 CEMA 1 type ventilated enclosure, or as shown, with lifting eyes and front and side removable metallic panels or installed in the service entrance cabinet as shown.
- .8 Primary and secondary permanently identified terminals fitted with solder less connectors.
- .9 Primary and secondary connection lugs, separately mounted from windings.
- .10 Impedance between 4 and 6.5%.
- .11 CSA acceptable noise levels:
 - 45 from 15 to 50 kVA;
 - 50 from 51 to 150 kVA;
 - 55 from 151 to 300 kVA;
 - 60 from 301 to 500 kVA.
- .12 Minimum nominal Efficiency Level of 98.2%
- .13 Finishing paint: baked-on ASA 61 grey enamel.

2.3.3 Acceptable manufacturers:

- Delta;
- Hammond;
- Bemag.

The transformers shall be "Industrial/Standard" series. The "Commercial/Residential" series, such as Marcus, Delta Commercial series are not accepted.

2.4 Starters Up to 600 V

2.4.1 Reference standards

Control apparatus manufactured to EEMAC/NEMA standards and CSA approved.

2.4.2 General

- .1 Overload relay with heating elements on each phase, with front door mounted manual reset and trip indicator. Unless otherwise noted the overload relays to be class 20.
- .2 Unless otherwise noted supply 1 normally open (N.O.) and 1 normally closed (N.C.) auxiliary contacts in addition to those required.
- .3 Remote control device terminal board. Consult the control diagrams on the drawings to provide necessary terminals required for remote control.
- .4 Quick action solenoid driven contactors, size 0 or larger. Half-size contactors are not allowed.
- .5 Control and supply terminals.
- .6 Wiring and connection diagrams visibly installed inside enclosures.
- .7 Each wire and each terminal identified with permanent marking identical to what is shown on the wiring diagrams to ease the connection of outside wiring into the starter.

2.4.3 Manual starters

- .1 Single phase, three phase manual starters, type, nominal capacity and enclosure as shown.
- .2 Quick make quick break mechanism.
- .3 Pilot Light

2.4.4 Full voltage, non reversing, magnetic starters

- .1 Full voltage, non-reversing, magnetic starters type, nominal capacity and enclosure as shown.
- .2 One three poles magnetic contactor.
- .3 One three poles overload relay.

2.4.5 Combination starters

- .1 As shown the above mentioned starters shall be of the combination type with circuit breaker lever operated from outside the enclosure and having a device which permits:
 - The installation of three padlocks in the "OFF" position;
 - The unit to be locked in the "ON" position;
 - · To independently lock the enclosure door;
 - The prevention of operating the starter with the enclosure door open.
- .2 The circuit breakers shall conform to article "Molded case circuit breakers"

2.4.6 Pushbuttons

.1 Heavy duty flush mounted black pushbutton with one (1) N.O. contact and one (1) N.F. contact having a 10 A rating complete with escutcheon as shown; red stop-lock pushbutton with lock pushed in position.

2.4.7 Stop lock pushbutton

.1 Same pushbutton as described previously with possibility to be locked in the pushed in position. The key allows the pushbutton to be reset.

2.4.8 Selectors

.1 three position(ON-OFF-AUTO), maintained contact, heavy duty selector switch with standard lever and 10 A, 120 V a.c. contact arrangement as shown.

2.4.9 Pilot lamps

.1 Heavy duty transformer type pilot lamps, Amber for overload, green for ON and red for OFF, 120 V power supply, lamp voltage compatible with transformer secondary label as shown.

2.4.10 Control transformer

- .1 Control transformer conforming to CSA C22.2 no. 66 standard, single phase, dry type, primary voltage as shown with 24V secondary complete with secondary fuse in series with starter coil.
- .2 Size transformer according to control circuit loading and add 20% spare capacity.
- .3 Tight regulation of output voltage within the range of magnetic coils and excitation solenoids.

2.4.11 Material identification

.1 Nameplates supplied and installed according to specifications

2.4.12 Acceptable EEMAC/NEMA manufacturers:

- Cutler Hammer
- Allen Bradley
- Schneider (Square D)
- Siemens
- GE
- Klockner Moeller (for approved model)

2.5 Circuit Breaker Type Distribution Panels

- 2.5.1 Distribution panels conforming to CSA C22.2 no. 29 standard.
- 2.5.2 Supplied by the same manufacturer.
- 2.5.3 Voltage 347/600 V
- 2.5.4 Arrange bus bars per phase order. All circuits shall be identified by a letter, as shown on drawings.
- 2.5.5 Panels shall have bus bars, and number of branch circuits and circuit breakers as shown.
- 2.5.6 Panels to be complete with door, lock and two keys, locks and keys to be interchangeable for all panels of the same type.
- 2.5.7 Bus bars shall be copper with full capacity neutral copper bar. Circuit breaker supports and circuit breakers to be of compatible material having the same expansion coefficients.
- 2.5.8 For surface mounting as shown on drawings.
- 2.5.9 Panel bus bars to be compatible with bolted-on circuit breakers.
- 2.5.10 Standard finish: ASA 61 grey baked enamel.
- 2.5.11 Circuit breakers: conforming to article "Molded case circuit breakers".

2.5.12 Acceptable manufacturers:

- Bolted-on circuit breaker panels:
- Schneider:
- Cutler-Hammer;
- · Siemens:
- GE.

2.6 Utilization Panels

- 2.6.1 Utilization panels conforming to CSA C22.2 no. 29 standard.
- 2.6.2 Supplied by the same and only manufacturer.
- 2.6.3 Voltage 120/208 V.
- 2.6.4 Arrange bus bars so that odd numbered circuit breakers be on the left and even numbered circuit breaker be on the right of the panel. Each circuit shall be identified.
- 2.6.5 Panels to have bus bars sizes, number and capacity of branch circuit's breakers as shown.
- 2.6.6 Panels shall be complete with door, lock and two keys each.
- 2.6.7 Bus bars to be copper with full capacity copper neutral. Circuit breakers and their installation supports shall have the same expansion coefficients.
- 2.6.8 Branch circuit bars to be compatible with bolted-on circuit breaker.
- 2.6.9 Standard finish ASA 61, grey.
- 2.6.10 Acceptable manufacturers:
 - Schneider;
 - Cutler-Hammer;
 - · Siemens;
 - GE.

2.7 Moulded Case Circuit Breakers

- 2.7.1 Moulded case circuit breakers conforming to CSA C22.2 no. 5 standard.
- 2.7.2 Circuit protection devices contained in plastic insulated enclosures.
- 2.7.3 Bolted to the panel bus bars.
- 2.7.4 Quick make quick break mechanism.
- 2.7.5 Manually operated.
- 2.7.6 Complete with thermal and magnetic trip unit compensated for an ambient temperature of 40°C (104°F).
- 2.7.7 Multipole breakers to have a common trip device and operating lever.
- 2.7.8 In 120 or 208 Volts circuits use, unless otherwise noted on the distribution diagram or on the panel description sheets, single, two or three pole circuit breakers having the ratings as shown and with a 10 kA minimum RMS, symmetrical rupturing capacity.
- 2.7.9 In 600 Volts circuits use, unless otherwise noted on the distribution diagram or on the panel description sheets, single, two or three pole circuit breakers having the ratings as shown and with a 22kA minimum RMS, symmetrical rupturing capacity.

- 2.7.10 When breaker are supplied in existing panels, supply a model of the same manufacturer's that has rupture capacity equal or superior to the existing breakers in this panel. Refer to the panels details and drawings. Those breakers shall be new.
- 2.7.11 Authentication of new breakers (not counterfeited)
 - .1 Except specifically otherwise noted, all breakers installed in panels (new or existing) shall be new and obtained exclusively from a distributor authorized by manufacturer.
 - .2 Submit with breaker shop drawings, a copy of the purchase order to the distributor. Quantities, models and sizes shown on the purchase order shall correspond to those indicated on the shop drawings.
 - .3 Retain all packing slips of material delivered to the job site and provide one copy to the Engineer. All packing slips shall bear one signature attesting receiving by the Contractor.
 - .4 In case of default to the requirement of this article, the Engineer may request a verification by the manufacturer of breakers. Costs related to this verification will be at Contractor's expense.

2.8 Safety Switches

- 2.8.1 Reference standards
 - .1 Safety switches conforming to CSA C22.2 no. 94 standard.
 - .2 CSA type 2, 3, 4 and 4 enclosures conforming to CSA C22.2 no. 94 standard.
 - .3 Fuse holder conforming to CSA C22.2 no. 39 standard.
- 2.8.2 Supplied by the same and only manufacturer.
- 2.8.3 With or without fuse in a NEMA 3R metallic enclosure for indoor installation and NEMA 12 enclosure for outdoor installations.
- 2.8.4 Complete with facility to lock the lever in the "closed" or "open" position with three padlocks.
- 2.8.5 Mechanically latched door with preventing its opening when the switch is closed (screw driver defeatable mechanism).
- 2.8.6 Each switch fuse holder to be appropriate for the type of fuse specified and shown without the use of adapters.
- 2.8.7 Quick make, quick break mechanism.
- 2.8.8 Heavy duty construction
- 2.8.9 Safety switches for elevator controllers shall be fitted with one type C auxiliary contact. Connect this contact to the elevator controller with 4 # 18 AWG conductor inside a 21 mm (3/4") conduit.
- 2.8.10 Standard ASA 61 grey baked enamel finish.
- 2.8.11 Acceptable manufacturers:
 - Cutler-Hammer;
 - Schneider;
 - · Siemens;
 - GE.

2.9 Fuses

- 2.9.1 Fuses conforming to CSA C22.2 no. 106 and C22.2 no. 248 standards.
- 2.9.2 High rupturing capacity (HRC) fuses 200kA RMS symmetrical and current limiting fuses.

- 2.9.3 Supplied by the same and only manufacturer
- 2.9.4 Fuse types
 - .1 Motor and transformer circuits,
 - Class J form I, double element, time delayed;
 - Acceptable manufacturers:
 - Bussmann, LPJ type;
 - Or equal from Gould, Little Fuse, Mersen.
 - .2 For other circuits
 - 0 to 600 A; class J, form I, quick action;
 - •
 - Acceptable manufacturers:
 - Bussmann (JKS and KRP);
 - · Or equal from Gould, Little Fuse, Mersen.
- 2.9.5 Fuses size shown on the drawings is as per Provincial Electrical Code. Fuses are chosen for normal industrial service. Contractor shall use the size recommended by the fuses manufacturer for the type of connected load under normal industrial service and also supply appropriate switches and fuse holders.

PART 3 - EXECUTION

3.1 Panelboard

3.1.1 Installation

- .1 Unload, move, unpack, inspect and locate the equipment at the expected location and install according to instructions shown on the drawings and as recommended by the Manufacturer.
- .2 Immediately perform a visual inspection of all equipment during its reception in order to expose any fault.
- .3 Set the apparatus level with the floor to prevent mechanical stress and bolt it down.
- .4 Install circuit breakers and execute all connections.
- .5 Verify the mechanical resistance of manufactured connections and their electrical resistance.
- .6 Once the installation of the apparatus is completed, remove all foreign matter and dust from the equipment before energizing.
- .7 Correct all deficiencies and defects without cost to the Owner.

3.1.2 Tests

- .1 Execute on site tests according to article 7.5 of EEMAC standard G8.2 for tests on the existing installation.
- .2 Execute start up tests as required by the utility.
- .3 In addition to the tests required by the manufacturer, execute all complete tests of all the installed equipment as described in the present article together with the final installation check before the final acceptance test.
- .4 Inform the Engineer in advance of the test to insure his presence.
- .5 Supply qualified personnel, the equipment, instruments etc. in order to execute tests on the different electric systems to the Engineer's satisfaction.
- .6 Insure the good general operation of the installation and the operation, in particular, concerning the following:
 - Security;
 - Phase to phase and phase to neutral insulation level;
 - Ground continuity;
 - Resistance to ground.

3.1.3 Verification and testing of the apparatus.

- .1 Verify all tap connections to insure that they are firm and well executed.
- .2 Verify that all switches are clean, undamaged and operate freely. Insure that all contacts are solid and that joints, links and contacts are well lubricated (when applicable).
- .3 Verify the interlock system, auxiliary mechanism and the circuit breaker operation jointly with the operation of the protective relays.
- .4 Verify that the 1,000 V megger resistance value of the bus bar, circuit breaker/switch assembly is greater than 3 megohms. Note all values.
- .5 Perform calibration and tests on circuit breakers according to appendix "Circuit Breaker and Test Calibration".

3.2 Earthing and Grounding

3.2.1 General

- .1 Install a complete, permanent and continuous system for earthling and grounding of networks, circuits and apparatus. The system shall include electrodes, conductor, connectors and required accessories on drawings to satisfy local authorities.
- .2 Install connectors according to manufacturer's recommendations.
- .3 Protect surface mounted conductors from damage.
- .4 Underground connections and connections to steel structures, ground electrodes, lightning protection electrodes system, conductive gas pipes and conductive water pipes shall be exothermically welded.
- .5 Use mechanical connectors on equipment supplied with grounding terminals.
- .6 Use tinned copper conductors on aluminium structures.
- .7 Do not install bare copper conductors near lead sheathed cables, which have no insulating jacket.
- .8 Soldered connections are not allowed.
- .9 Provide a jumper ground cable connected one end of a flexible conduit link with a ground lug, a solder less terminal, a cable clamp or a screw with Belleville washer.
- .10 Install braided links at bus duct joints when the connection is not insured by the material proper.
- .11 Install dedicated grounding conductors to connect outdoor lighting and block heater receptacles.
- .12 Ground the building steel structure and metallic covering, welding the copper to the steel, at 3000mm interval on both side.
- .13 Makes ground connections in a radial mode only, the connections terminating at one and only one grounding point. Avoid loop connections.
- .14 Connect the source end of the single conductor cable shield to the source cabinet and provide a non metallic entrance plate at the load end.
- .15 Ground secondary distribution cabinets.
- .16 Insure that the grounding method is uniform throughout the installation.

3.2.2 Electrodes

- .1 Ground the continuous conductive and buried water supply pipe on the road side of the water meter.
- 2 Install a ground jumper across the water meter.
- .3 Install ground electrodes embedded in the foundation footings and connect them to the grounding network.
- .4 Install rods used as grounding electrodes and execute connections as shown.
- .5 Connect together all independent electrodes.
- .6 Use size 3/0 AWG copper conductors to connect electrodes.
- .7 Take necessary steps in sandy or rocky terrain to obtain an acceptable ground resistance. Connect as shown.

3.2.3 Neutral Grounding

- .1 Make sure that the circuit neutral and the voltage transformer neutrals together with the utility connection neutral are directly connected to the power transformer neutral and are not connected to the main grounding terminal of the substation.
- .2 Connect grounding electrodes to neutral conductors for each grounding installation.
- .3 Connect the neutral of the substation transformer to the neutral bus bar using a conductor of the same size as the transformer secondary neutral.

3.2.4 Grounding of cable trays.

.1 Install an insulated grounding conductor on cable trays and ground at 15m (50') intervals along the path.

3.2.5 Equipment grounding

.1 Execute overall equipment grounding as shown namely; service connection equipment, transformers, conduits, motor frames, starters, control panels, steel structure, elevators, distribution panels, exterior lighting networks, ventilation systems, combustible lines and others.

3.2.6 Grounding bus bars

- 1 Mount copper bus bars on insulating supports anchored to the electrical room walls.
- .2 Connect non electrified elements of equipment installed in the electrical room to the grounding bus bar with individual bare stranded copper conductors as shown.

3.2.7 Tests

- .1 Execute tests according to the General Conditions of Section 20 05 02.
- .2 Check continuity and measure the grounding network resistance using appropriate methods to the site conditions and to the satisfaction of the Engineer and local competent authorities.
- .3 Execute the tests before energizing the electrical equipment.
- .4 Disconnect the ground fault indicators during the tests.

3.3 Dry Type Transformer Up to 600 V

- 3.3.1 Install dry type transformers according to supplied indications.
- 3.3.2 Install transformers level, upright on "TICO" pads.
- 3.3.3 Remove shipping blocks after physical installation and just before energizing.
- 3.3.4 Loosen all insulating pads until there is no compression left on them.
- 3.3.5 Make only those connections shown on wiring diagram.
- 3.3.6 Energize transformers, if possible, immediately after the installation work is finished.
- 3.3.7 Provide a flexible connection on the primary and secondary side of each transformer using flexible conduits. A grounding conductor shall be installed in each flexible connection.
- 3.3.8 Perform the mechanical grounding of the transformer.

3.4 Starters Up to 600 V

- 3.4.1 Install starters in motor control centers, as shown on the drawings.
- 3.4.2 Install individual starters on Unistrut type support in order to maintain a spacing around the enclosures when wall mounted. When installed on a free standing structure the supports shall be reinforced with cross members.
- 3.4.3 Insure that fuses and overload relays are of the appropriate size.
- 3.4.4 Install control devices and execute interconnections as shown.
- 3.4.5 Execute on site power and control connections as shown.
- 3.4.6 Execute interconnections with the fire alarm system.
- 3.4.7 Perform tests according to the requirements of this specification and of the manufacturer.
- 3.4.8 Operate switches and contactors to insure their proper operation.
- 3.4.9 Verify starting and stopping sequences for contactor and relay.
- 3.4.10 Insure that sequential controls, safety closures between adjacent starters, material and control devices operate according to specifications.

3.5 Panels

- 3.5.1 Install panels where shown and fasten them solidly, plumb and square with adjacent surfaces.
- 3.5.2 Install surface mounted panels on plywood. Panels to be grouped on common plywood as much as possible.
- 3.5.3 Connect all circuits to respective loads as shown.
- 3.5.4 Connect each neutral conductor to the neutral bus bar, each neutral conductor being appropriately identified.
- 3.5.5 When distribution panels are installed side by side, the enclosures shall be of the same size and welded together. Doors shall have the same size, be perfectly aligned and mounted on separate covers
- 3.5.6 The following circuit breakers shall be complete with locking devices to restrict their use to authorized personnel only:
 - .1 Emergency lighting and "Exit" lights circuits.
 - .2 Fire alarm panel.

3.6 Molded Case Circuit Breaker

- 3.6.1 Install circuit breakers and connect as shown.
- 3.6.2 When a panel is replaced with a new one, the contractor shall verify the compatibility of the existing breakers with the new panel type. New breakers shall be supplied if the existing breakers are not compatible with the new panel and cannot be relocated.

3.7 Safety Switches

- 3.7.1 Install and connect safety switches including fuses as shown.
- 3.7.2 Install on each fused safety switch a lamicoïde plastic nameplate indicating the size of the fuses installed.

3.8	Fuses
3.8.1	Install fuses in fuse holders just before energizing.
3.8.2	Insure that fuses and holders are perfectly matched.
3.8.3	Insure that the right fuse is used to protect the corresponding circuit
3.8.4	Store the spare fuses in an orderly manner.

END OF SECTION

Section 26 20 00

APPENDIX

Circuit Breaker Tests and Calibration

CIRCUIT BREAKER TESTS AND CALIBRATION

1. General Instructions

- 1.1 The following tests are required on all circuit breakers. Inform the Engineer at least two (2) days before those tests.
- 1.2 Submit one properly filled copy of the annexed "On Site Breaker Test Report" form for each tested circuit breaker. The test methods shall be in accordance with the Manufacturer's recommendations.

2. Protection Relay Adjustment Tables

- 2.1 One copy of the "Coordination of Protections" tables in which the specified adjustments are noted is enclosed.
- 2.2 Use these tables in order to execute on site breaker tests.
- 2.3 When an adjustment is missing in the table, formally request it two (2) weeks before the equipment commissioning.
- Verify all adjustments and advise the Engineer of any difference with the Quebec Electrical Code, or Manufacturer requirements, in order to obtain a revised setting.

3. On site breaker test report.

- 3.1 Visual inspection.
- 3.1.1 Visual inspection of the condition of:
 - Plug-in, control and power contacts;
 - Arc chutes to verify the presence of cracks.
- 3.1.2 Visual inspection to check the presence of removable jumpers and the position of "ON-OFF-TEST" contacts.
- 3.1.3 Check the lubrication
- 3.2 Verification of operation
- 3.2.1 Verification of electrical operation:
 - Shunt trip;
 - Spring loading mechanism;
 - Electrical closing;
 - Electrical interlock in "ON-OFF-TEST" positions with specified control circuit.
- 3.2.2 Insure that the wiring between sensors and protection relays is complete and that the polarity is respected.
- 3.2.3 Verification of mechanical operation of:
 - Manual tripping;
 - Manual spring loading;
 - Key interlock between breaker and other equipment;
 - Interlock with "ON-OFF-TEST" positions;
 - Good alignment of the breaker in each position.
- 3.3 Insulation Resistance Tests
- 3.3.1 The breaker's pole insulation in the OFF position at 1 000 V D.C. with a megohmmeter.

- 3.3.2 The phase-to-phase insulation in the ON position.
- 3.3.3 The tripping circuit as described in the specifications.
- 3.3.4 The transformer secondary at 1000 V D.C. with a megohmmeter as described by the following method:
 - Disconnect the neutral conductor of the current transformers from ground;
 - Connect the megohmmeter between the floating neutral point of the current transformers and ground and execute the test;
 - Connect the neutral conductor of current transformers to ground.
- 3.4 Component Characteristics
- 3.4.1 Note the characteristics (type and rating) of the installed fuses, phase and ground sensors and current transformers and insure that they are in accordance with the characteristics and ratings of the specifications and to the adjustment tables to come.
- 3.5 Main Contacts Resistance
- 3.5.1 Verify with a DC current source the resistance of Phases A, B, C. power contacts. The current source shall supply 50 A for breakers below 800 A and 100 A for breakers 800A and above. The noted results shall be in microhoms.
- 3.6 Verification of Protection Devices Tripping with Current Injection
- 3.6.1 Verification of the settings of phase overcurrent and ground protection relays by the secondary current injection method in parallel with the current transformers according to the following method:
 - For low voltage breakers, the current injection shall be done with the test module matched with the breaker type as provided by the Manufacturer. For medium voltage breakers, the current injection shall be done cirectly at current transformer terminals;
 - Install a shorting jumper at current transformer terminals for the phase test;
 - Connect the current source, read operating time and determine the tripping threshold for each phase. Readjust, if necessary.
- 3.6.2 Execute the following tests:
 - Five (5) tests for each phase relay;
 - Three (3) tests for each ground relay;
 - Five (5) tests for each protection relay other than those mentioned above such as directional, differential relays, etc.
- 3.6.3 For the medium voltage breakers, the injected current shall be gradually decreased to zero after each test and before the opening of the current source circuit in order to avoid the magnetization of the current transformers.
- 3.6.4 Compile the relay test results as follows:
 - Enter the characteristics, the adjustment band and specified adjustment.
 - Enter the reading in "ADJ. AT" column, and then check the accuracy of each reading with the specified precision of the Manufacturer of the relays.
- 3.7 Remarks and Results
- 3.7.1 Enter particular remarks as required.
- 4. Report
- 4.1 Immediately notify the Engineer, in writing, of any noted deviation or/and deficiency.

4.2 Submit the report and include it in the Operation and Maintenance Manuals.

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ELECTRICITY ON SITE AIR BREAKER TEST REPORT				Section 26 20 00		
SUBSTATION		BREAKER NO.:		BRAND:		
TYPE:		SERIAL NO.:	NOMINAL VOLTAGE:		OLTAGE:	
- Fill all blan	k spaces and	em in "VERIF." colur enter results t to the engineer	n	_		
1. VISUAL INSPECTION			2. OPERATION VER	RIFICATION		
ITEM		VERIF.	ITEM			VERIF.
CONTACTS			ON-OFF TEST POS	ITION		
ARC CHUTES			ELECTMECHAN. (PERATION		
LUBRICATION			ELECTMECHAN. I	NTERLOCK		
3. INSULATION RESISTANCE T	EST		4. COMPONENT CH	IARACTERIST	rics	
ITEM		VERIF.	ITEM		TYPE	RATING
BETWEEN POLES (AA', BB', CC	;')		FUSES			
PHASE TO GROUND (A, B & C)			PHASE SENSOR			
PHASE TO PHASE (AB, BC, CA))		GROUND SENSOR			
TRIPPING CIRCUIT	CURRENT TRANSF					
5. MAIN CONTACTS RESISTAN	ICE (DRAW-O	UT AND BREAKER	POLES)			
A: , , Micro-oh	nms; B:	, ,	Micro-ohms; C:	,	, Micro	o-ohms.
6. VERIFICATION OF PROTECT	TION DEVICES	TRIPPING WITH C	CURRENT INJECTION			
ADJUSTMENTS TYPE	OF RELAY	ADJ. BAND	SPECIF. ADJUST	ADJ. AT	V	ERIF.
LONG	TAP					
DELAY	ELAY					
SHORT	TAP					
DELAY	ELAY					
INST.	TAP					
	TAP					
GROUND D	ELAY					
UNBAL.	TAP					
7. REMARKS AND RESULTS						
VERIFICATION DONE BY:			COM	PANY:		
(SIGNATURE):						

APPENDIX

• Tests on Motors

TESTS ON MOTORS

TY	PE OF LOAD	MOTOR NO				
Mc	TOR NAMEPLATE					
•	Power (HP)					
•	Service factor					
•	Speed (RPM)					
•	Frame					
•	Insulation					
•	Voltage (V)					
•	Number of phases					
•	Current (A)	-	_			_
VE	RICATIONS					
•	Phasing					
•	Rotation					
•	Insulation (Megohms) (phase to frame)					
RE	ADINGS AT MOTOR	<u>Un-loaded</u> (Un-coupled)	Full load			
•	Current (A) Phase A Phase B Phase C					
•	Voltage (V) Phase A-B Phase B-C Phase C-A					
•	Acceleration (sec)					
•	Surface temperature					
ST	ARTER				-	
•	Number					
•	Manufacturer					
•	Model					
•	Size					
PR	OTECTIONS SIZE					
•	Fuses (A)					
•	Breaker (A)					
•	Overload (A)					
	- Heater size					
Co	mments					
	rified by:		(Division 23)	Date:		
Ver	rified by:		(Division 26)	Date:		

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PART 1 - GENERAL

1.1 General

- 1.1.1 Section 20 05 00 "General Requirements Concerning Common Work Results" applies.
- 1.1.2 Section 20 05 02 "Specific Requirements Concerning Common Work Results for Electrical" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned and/or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - · Lighting control system;
 - Switches:
 - Plugs;
 - · Dimmers;
 - · Timers;
 - · Wall plates.

1.3 Shop Drawings and Technical Data

- 1.3.1 Submit shop drawings and technical data regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 Submit shop drawing and technical data of the following items:
 - Lighting control system;
 - Switches;
 - Plugs;
 - Dimmers;
 - Timers:
 - Wall plates.

PART 2 - PRODUCTS

2.1 Wiring Devices

2.1.1 Reference standards

- 1 Spec grade outlets, plugs and other wiring devices conforming to CSA C22.2 no. 42 standard.
- .2 Spec grade manually operated switches conforming to CSA C22.2 no. 111 standard.
- .3 Special switches conforming to CSA C22.2 no. 55 standard.

2.1.2 Switches - 120V

- .1 Single pole, double pole, three way, four way switches rated 20 A at 120 V.
- .2 Manually operated AC switches as shown and having the following characteristics.
 - Accepts conductors from 14 to no. 10 AWG;
 - Contacts: silver/cadmium oxyde alloy;
 - Screw terminals for side or rear connection;
 - Toggle, coloured.
- .3 Use switches from the name and sole manufacturer in the same installation.
- .4 Colours:
 - Brown: in technical room, hangars, false ceilings and unfinished areas;
 - White: in offices, rooms and corridors;
- .5 Acceptable manufacturers:
 - Hubbell series HBL 1221 or equal from Leviton, Bryant, Pass & Seymour, Arrow Hart.

2.1.3 Switches - Digital

- .1 Low voltage switches for DLM network.
 - 24 VDC
 - 2 RJ45 Ports
 - 1, 2, 3, 4 or 8 control buttons, each with LED status indicator
 - Infrared (IR) transceiver
 - 5-year warranty;
 - Color: white.
- .2 Use switches and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .3 Acceptable manufacturers:
- .4 Legrand series LMSW or approved equivalent.

2.1.4 Outlet receptacles

- .1 Duplex receptacles: CSA type 5-15 R, 125 V, 15 A, "U" shaped ground, having the following characteristics:
 - Industrial grade;
 - Molded coloured nylon body;
 - Screw terminal for side or rear connection of conductors up to no. 10 AWG;
 - Break-out fins permit two circuit conversion;

- Eight back access connection points and four lateral connection screws;
- Double-wipe contacts and riveted ground contacts;
- Hubbell, serie HBL5252.
- .2 Duplex receptacles: CSA type 5-20R, 125 V, 15/20 A, "U" shaped ground, having the following characteristics:
 - Industrial grade;
 - Molded coloured nylon body;
 - Screw terminal for side or rear connection of conductors up to no. 10 AWG;
 - Break-out fins permit two circuit conversion;
 - Eight back access connection points and four lateral connection screws;
 - Double-wipe contacts and riveted ground contacts;
 - T shaped contact for use with 15 A or 20 A plug;
 - Hubbell, serie HBL5362.
- 2.1.5 Duplex receptacles: CSA type 5-15R or CSA type 5-20R, 125V, 15A or 20A as per indications. "U" shaped ground, with ground fault circuit interrupter, having the following characteristics:
 - Conforming to UL943;
 - Industrial grade;
 - Molded coloured nylon body;
 - Screw terminal for side or rear connection of conductors up to no. 10 AWG;
 - Ground fault circuit interrupter with a short circuit current interruption capacity of 10kA;
 - Red DEL indicating a loss of capacity to provide ground fault protection;
 - "test" and "reset" buttons;
 - Interrupter trip level between 4 and 6mA in a 0.025 seconds delay (Class A);
 - Double-wipe contacts and riveted ground contacts;
 - Similar to Hubbell products, series GF15 and GF20.
 - .1 All other receptacles designed for voltages and current capacities as shown.
 - .2 Use outlet receptacle from the same and sole manufacturer in the same installation.
 - .3 Colours:
 - Brown: in technical rooms, hangars, false ceilings and unfinished areas;
 - White: in offices, rooms and corridors;
 - .4 Acceptable manufacturers:
 - Equal products from Leviton, Bryant, Pass & Seymour or Arrow Hart are approved.
- 2.1.6 Wall plates
 - .1 All wiring devices to be installed with wall plates.
 - .2 All wall plates for the same installation shall be from the same and only manufacturer.
 - .3 Steel sheet wall plates for surface mounted service boxes.
 - .4 Satin finish type 301 stainless steel wall plate for all wired devices.
 - .5 Supply common wall plates when wiring devices are gauged.
 - .6 Galvanized steel wall plates for surface mounted wiring devices in type FS or FD conduit boxes. Wall plates shall be designed for attachment to the boxes with four screws.

- .7 Supply and install, for outdoor mounted receptacles, heavy cast aluminium weatherproof covers(Legrand series 4600) and gaskets. Cover plates shall be designed for attachment to the boxes with two screws.
- .8 Acceptable manufacturers:
 - Legrand
 - Leviton;
 - Hubbell;
 - Bryant;
 - Pass & Seymour;
 - Arrow Hart.

2.1.7 Electronic Time Switches

- .1 To be used for the exterior lighting control as indicated on drawings.
- .2 Program can be repeated on an annual basis.
- .3 Automatic input voltage selection from 120-277 VAC, 50/60 Hz.
- .4 To-the-minute programming for accurate load control and reduced energy costs.
- .5 Astronomic feature provides sunset ON and sunrise OFF settings.
- .6 Astronomic programming can be combined with independent programs to provide a sunset ON and timed OFF program.
- .7 N.O. Contact Ratings: Resistive: 30A @ 120/240VAC, 1HP @ 120VAC and 2HP @ 240VAC.
- .8 2-circuit field (jumper) configurable for: 2 independent outputs, DPST output, or 1 channel ON pulse OFF pulse output.
- .9 Up to 4000 setpoints or events.
- .10 Programming via USB and Ethernet Access.
- .11 Automatic Daylight Saving Time (DST(ON/OFF adjustment (factory enabled).
- .12 Non-volatile memory protects programming indefinitely.
- .13 Temporary override or permanent manual override available via control buttons.
- .14 Enclosure: NEMA 1.
- .15 Acceptable manufacturers:
 - Intermatic no. ET9000 Series;
 - or approved equivalent.

2.1.8 Digital Dimming Wall Switch

- .1 Low voltage dimming control for DLM network.
 - 24 VDC
 - 2 RJ45 Ports
 - 7 LED dimming level indicator
 - Infrared (IR) transceiver
 - 5-year warranty;
 - Color: white.

- .2 Use dimming control and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .3 Acceptable manufacturers:
- .4 Legrand LMDM-101 or approved equivalent.
- 2.1.9 Dual Tech Wall Switch Occupancy Sensor
 - .1 Technical specifications:
 - Dual Technology (PIR and ultrasonic);
 - 120V
 - Time delay: field-adjustable from 5 minutes to 30 minutes;
 - No minimum load requirements, maximum load 1000 W;
 - •
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
 - · Color: white.
 - .2 During installation, configure the motion sensor so its coverage is limited to the controlled room or space. Adjust time delay to 15 minutes.
 - .3 Use wall switch occupancy sensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
 - .4 Acceptable products:
 - Legrand Series DSW-301 or DSW-302 (As indicated on drawing) or approved equivalent.
- 2.1.10 0-10V Dual Tech Dimming Wall Switch Occupancy Sensor
 - .1 Technical specifications:
 - Dual Technology (PIR and ultrasonic);
 - 120V
 - 0-10V Dimming Control Signal
 - Time delay: field-adjustable from 3 minutes to 30 minutes;
 - No minimum load requirements, maximum load 1000 W;
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
 - Color: white.
 - .2 During installation, configure the motion sensor so its coverage is limited to the controlled room or space. Adjust time delay to 15 minutes.
 - .3 Use dimming wall switch occupancy sensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
 - .4 Acceptable products:
 - Legrand Series DW-311 or approved equivalent.

2.1.11 Digital Dual Wall Switch Occupancy Sensor

- .1 Technical specifications:
 - Dual Technology (PIR and ultrasonic);
 - 24 VDC from DLM network;
 - 2 RJ45 ports;
 - 1 or 2 switch buttons, each with LED status indicator;
 - Infrared (IR) transceiver
 - Time delay: field-adjustable from 1 minutes to 30 minutes;
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
 - Color: white.
- .2 During installation, configure the motion sensor so its coverage is limited to the controlled room or space. Adjust time delay to 15 minutes.
- .3 Use dimming wall switch occupancy sensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .4 Acceptable products:
 - Legrand Series LMDW-101/102 or approved equivalent.

2.1.12 Dual Tech Occupancy Sensor Ceiling/Corner Mount

- .1 Technical specifications:
 - Dual Technology (PIR and ultrasonic);
 - 24VDC from DLM network;
 - 2 RJ45 ports
 - LCD display and pushbuttons for setting sensor and system parameters;
 - Time delay adjustable from 1 to 30 minutes;
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
 - · Color: white.
- .2 During installation, configure the motion sensor so its coverage is limited to the controlled room or space. Adjust time delay to 15 minutes.
- .3 Use occupancy sensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .4 Acceptable products:
 - Legrand LMDC-100 and LMDX-100 (for corner) or approved equivalent.

2.1.13 Dual Tech Occupancy Sensor Ceiling Mount

- .1 Technical specifications:
 - Dual Technology (PIR and ultrasonic);
 - 120V
 - Time delay: field-adjustable from 5 minutes to 30 minutes;
 - No minimum load requirements, maximum load 800 W;
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
 - Color: white.

- .2 During installation, configure the motion sensor so its coverage is limited to the controlled room or space. Adjust time delay to 15 minutes.
- .3 Use occupancy sensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .4 Acceptable products:
 - Legrand Series DT-355 or approved equivalent.

2.1.14 Closed Loop Digital Photosensor

- .1 Technical specifications:
 - Photodiode with an extended range of 1 to 6 553 footcandles;
 - Spatial response : 100°
 - 24VDC from DLM network;
 - 1 RJ45 Port
 - Infrared (IR) transceiver
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
- .2 During installation, configure the photosensor to read both daylight and electric light.
- .3 Supply two (2) Digital Wireless Configuration Tool for owner at end of construction.
- .4 Use photosensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .5 Acceptable products:
 - Legrand Series LMLS-400 or approved equivalent.

2.1.15 Open Loop Digital Photosensor

- .1 Technical specifications:
 - Photodiode with an extended range of 1 to 6 553 footcandles;
 - Spatial response : 60°
 - 24VDC from DLM network;
 - 1 RJ45 Port
 - Infrared (IR) transceiver
 - Complete with auxiliary hardware and devices required for proper operation;
 - 5-year warranty;
- .2 Use photosensor and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .3 Acceptable products:
 - Legrand Series LMLS-500 or approved equivalent.

2.1.16 Emergency Lighting Control for 24H Fixture

- .1 Operates as a control device or as a shunt;
- .2 Senses local single circuit power failure;
- .3 Zero cross switching technology;

- .4 Supplies 24VDC source for dry contact closure.
- .5 Use emergency lighting control and all other interior lighting controls from the name and sole manufacturer in the same installation.
- .6 Acceptable products:
 - Legrand ELCU-200 or approved equivalent.

2.1.17 DLM Fixture Integrated 0-10V Load Controller

- .1 Operates on 24VDC from DLM local network;
- .2 Work with 120V LED Driver;
- .3 DLM Cable connector whip with two (2) RJ45 ports;
- .4 0-10V Dimming control signal;
- .5 Complete with auxiliary hardware and devices required for proper operation;
- .6 Use interior lighting controls from the name and sole manufacturer in the same installation.
- .7 Acceptable products:
 - Legrand LMFC-011 & LMFC-2RJ or approved equivalent.

2.1.18 Digital Single/Dual Relay Room Controller

- .1 Operates on 120V, 20 amp, feed and provide power to sensors and switches via the DLM local network;
- .2 On/Off button for each load;
- .3 Three (3) RJ45 ports;
- .4 Complete with auxiliary hardware and devices required for proper operation;
- .5 Use interior lighting controls from the name and sole manufacturer in the same installation.
- .6 Acceptable products:
 - Legrand LMRC-101/102 or approved equivalent

2.1.19 DLM Room Controller, 1 or 2 Relay

- .1 Operates on 120V, 10 amp, feed and provide power to sensors and switches via the DLM local network;
- .2 On/Off/Dim button for each load;
- .3 Two (2) RJ45 ports;
- .4 Complete with auxiliary hardware and devices required for proper operation;
- 5 Use interior lighting controls from the name and sole manufacturer in the same installation.
- .6 Acceptable products:
 - Legrand LMRC-111/112 or approved equivalent

2.1.20 Digital Single/Dual/Triple Relay Dimming Room Controller

- .1 Operates on 120V, 15 amp, feed and provide power to sensors and switches via the DLM local network;
- .2 On/Off/Dim button for each load;
- .3 For (4) RJ45 ports;
- .4 Complete with auxiliary hardware and devices required for proper operation;
- .5 Use interior lighting controls from the name and sole manufacturer in the same installation.
- .6 Acceptable products:
 - Legrand LMRC-211/212/213 or approved equivalent

2.1.21 Exterior photocells

- .1 Technical specifications:
 - Waterproof Lexan lens, shall not yellow over time;
 - Weatherproof enclosure;
 - Operating voltage: 120 V;
 - Measure illuminance (lux or fc);
 - Instant turn ON light level: 1.5 fc;
 - OFF light level : 2.25 fc;
 - Turn OFF to ON ratio 1.5:1 with 2-5 second delay;
 - Maximum load for Electronic Ballast(LED) 6 Amps;
 - Must fit standard electrical box or ½ rigid threaded conduit;
 - 8-year warranty.
- .2 Acceptable manufacturers:
 - Intermatic series EK4236S or EK4736S Or approved equivalent;
 - Complete with auxiliary hardware and devices required for proper operation.

PART 3 - EXECUTION

3.1 Wiring Devices

3.1.1 Wired and Wireless Switches

- .1 Install one-way wired switches such that the lever is up when the contacts are closed.
- .2 Install in multigang boxes when several switches are to be installed at one location.
- .3 The use of screw terminals only shall be accepted.

3.1.2 Outlet receptacles

- .1 Install in multigang boxes when more than one receptacle is to be installed at one location.
- 2 When receptacles are installed horizontally, locate neutral connections in the "up" position.

3.1.3 Lighting Control

- .1 Follow instruction from manufacturer for connection between all components and fixtures.
- .2 Install CAT5^E cable in EMT conduit in the wall. Support cable in the ceiling with J-Hook at 1.2 from each other. In gymnasium all cable will be in EMT conduit.
- .3 Install room controller in the ceiling on fireproof plywood near the entrance door.
- .4 Manufacturer or Authorized supplier will program all components for a complete working installation.
- .5 After installation and programmation are completed, give to owner two complete formation of height (8) hours each. The second formation will be given 6 months after the first one.
- .6 In all room where a sensor is combined with a switch, sensor will be programmed Manual ON.
- .7 Program all sensor to turn lights off after 30 minutes when occupants leave the room.
- .8 Program electronic timer to turn off exterior lights after midnight.
- .9 A third party contracted by electrical contractor will test functionality of all lighting control devices and systems. Fill a report, for all room controlled that list all lighting control device, their setting, and a confirmation of their functionality.

3.1.4 Cover plates

- .1 Install cover plates on all wiring devices.
- .2 Protect all stainless steel cover plates with a paper or plastic sheet cover, which shall be removed when all paint or other works are finished.
- .3 When devices are ganged, a common cover plate shall be used.
- .4 Cover plates designed for flush mounted boxes shall not be used on surface mounted boxes.
- 3.1.5 All wiring devices installed in the same room shall be of the same color.
- 3.1.6 When wiring devices are installed in walls that are covered with ceramic tiles, vitrified blocks or other similar material, they shall be centered with the tile or blocks. Wiring devices shall never be installed on a wall dado line.

- 3.1.7 Verify the opening direction of doors on the drawings and on site. Place switches and dimmers near doors on the lock side or as shown on the drawings.
- 3.1.8 Demonstrate the proper operation of each wiring device.

END OF SECTION

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PART 1 - GENERAL

1.1 General

1.1.1 Section 20 05 00 – "General Requirements Concerning Common Work Results" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - Forced air heaters;
 - Hand dryers.

1.3 Shop Drawings to be Submitted

- 1.3.1 The following shop drawings shall be submitted regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 The following shop drawings shall be submitted:
 - Forced air heaters;
 - Hand dryers.

PART 2 - PRODUCTS

2.1 Heating Equipment

2.1.1 Reference standards

- .1 Heating equipment conforming to CSA C22.2 no. 46 standard.
- .2 Electric baseboard efficiency to comply with requirements of CSA C273.2 standard.
- .3 Efficiency of wall mounted line voltage, to comply with requirements of CSA C273.4 standard.

2.1.2 Forced air heaters

- .1 Wall mounted unit heaters, surface or recessed mounted as shown.
- .2 Heavy duty enclosure and front panel with knockouts on left, right, bottom and rear for 16 mm (½") conduit. Air flow louvers designed to prevent the penetration of foreign objects.
- .3 Nichrome element.
- .4 Thermal protection, automatic reset.
- .5 Completely enclosed, life lubricated motor with voltage identical to that of the heating elements or as shown.
- .6 Access to controls through a dissimulated latch.

2.1.3 Hand dryers (Gymnasium Area)

- .1 White Polymer BMC housing.
- .2 Brush or brushless type motor, thermally protected.
- .3 Maximum noise level of 81 dBA with hands.
- .4 Hand dryers unit shall be complete with all mounting accessories for an appropriate installation.
- .5 Voltage as indicated on drawings.
- .6 Manufacturer and models as indicated on drawings.

2.1.4 Hand dryers (Other Area)

- .1 Die cast aluminum housing.
- .2 Brush or brushless type motor, thermally protected.
- .3 Maximum noise level of 85 dBA with hands.
- .4 Hand dryers unit shall be complete with all mounting accessories for an appropriate installation.
- .5 Voltage as indicated on drawings.
- 6 Manufacturer and models as indicated on drawings.

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- 2.1.5 List of heating devices: see drawings.
- 2.1.6 Acceptable manufacturers:
 - Heating devices: Ouellet, Stelpro or approved equal.

PART 3 - EXECUTION

3.1 Heating Apparatus

- 3.1.1 Forced flow heaters: installed forced flow heaters according to manufacturer's recommendations.
- 3.1.2 Hand Dryer: installed Hand Dryer according to manufacturer's recommendations see architect drawing for mounting height.
- 3.1.3 Tests:
 - .1 Execute tests on heating apparatus.
 - .2 Insure the proper operation of the heating equipment and control devices.
 - .3 Check the operation of the thermal cut out by blocking the airflow.
 - .4 Check the operation of the tripping device once the motor overload relay has operated.

END OF SECTION

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PART 1 - GENERAL

1.1 General

- 1.1.1 Section 20 05 00 "General Requirements Concerning Common Work Results" applies.
- 1.1.2 Section 20 05 02 "Specific Requirements Concerning Common Work Results for Electrical" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned and/or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - Lighting fixtures;
 - Emergency lighting.

1.3 Shop Drawings and Technical Data

- 1.3.1 Submit shop drawings and technical data regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 Submit shop drawing and technical data of the following items:
 - Lighting fixtures (one (1) per fixture type);
 - Poles:
 - Battery operated emergency lighting;
 - "Exit" fixtures.

PART 2 - PRODUCTS

2.1 Lighting Fixtures

- 2.1.1 Reference standards
 - .1 Lighting fixtures conforming to applicable standards.
- 2.1.2 Shop drawings
 - .1 Submit for approval all lighting fixtures photometric data, physical and electrical characteristics. Data to be established by an independent testing laboratory.
 - .2 Submit one separate shop drawing including all required information of each lighting fixture type.
- 2.1.3 Manufacturing standards is given through the manufacturers catalog numbers in the list of lighting fixtures given on the drawings.
- 2.1.4 Approved manufacturers: As defined in the list of lighting fixtures.

2.2 Battery Operated Emergency Lighting

- 2.2.1 Battery operated emergency lighting unit conforming to CSA C22.2 no. 41 standard
- 2.2.2 Battery and charger unit:
 - Gauge 18 manufacturer's white finish steel enclosures;
 - For wall mounting;
 - 120 Volts supply with cab-tire and plug,
 - Sealed maintenance free lead batteries;
 - Five (5) years life expectancy;
 - 12 Volts d.c. output;
 - Output power for a 30 minutes duration as shown on the drawings. Should the rating of the supplied lamps be greater than the specified rating, the battery capacity shall be increased accordingly;
 - Auto-test:
 - AC/DC Terminal Block;
- 2.2.3 Lamps
 - Type and finish as indicated on drawings;
- 2.2.4 Electric metallic tubing behind false ceiling for access to the battery unit.
- 2.2.5 Size no. 12 minimum type RW-90 wiring.
- 2.2.6 Acceptable manufacturers: As defined in the list of lighting fixtures.

PART 3 - EXECUTION

3.1 Lighting Fixtures

3.1.1 Fixture installation

- .1 Locate fixtures as shown.
- .2 Connect fixtures to lighting circuits as shown.
- .3 Install lighting fixtures after all other works, which may damage or soil them have been finished.
- .4 Electrical, mechanical and architectural drawings shall be examined when installing lighting fixtures.
- .5 Where there are no suspended ceilings, hang lighting fixtures with appropriate length rods and install them between pipes, ducts, girders or other obstacles in such a manner as not to obstruct the light flux from the fixture.
- .6 Check the nature of the ceiling when installing recessed fixtures and use proper anchors. Plaster rings shall be installed in plaster or gypsum ceilings.
- .7 When a fixture is surface mounted, the outlet box shall be of a type, which will be completely covered by the fixture after its installation.
- .8 Consult the architect's suspended ceiling drawings for the exact location of the lighting fixtures and consult the Engineer if discrepancies are noted.
- .9 Wait until the equipment in electrical and mechanical rooms is installed before installing lighting fixtures. Take into account the location of all obstacles when installing lighting fixtures.
- .10 Fixtures installed from an inclined surface shall be suspended with adjustable rods and ball joints unless noted otherwise.
- .11 Lighting fixtures weighting 7 kg. (15 lb.) and more which are anchored to exterior walls shall be anchored to the building structure.
- .12 Permanent lighting fixtures shall be used for temporary lighting with proper authorization only.
- .13 Lighting fixtures installed on acoustic tiles shall be suspended from the metallic "T" ceiling grid using metal supports supplied by the lighting fixture supplier.
- .14 Lighting fixtures, shall be cleaned, at the end of the work, to remove any construction dust which may have accumulated.

3.2 Battery Operated Emergency Lighting

3.2.1 Battery Operated Emergency Lighting installation

- .1 Locate Battery Operated Emergency Lighting as shown.
- .2 Connect Battery Operated Emergency Lighting to lighting circuits as shown.
- .3 Install Battery Operated Emergency Lighting after all other works, which may damage or soil them have been finished.
- .4 Electrical, mechanical and architectural drawings shall be examined when installing Battery Operated Emergency Lighting.

- .5 Where there are no suspended ceilings, hang Battery Operated Emergency Lighting with appropriate length rods and install them between pipes, ducts, girders or other obstacles in such a manner as not to obstruct the light flux from the fixture.
- .6 Check the nature of the ceiling when installing recessed fixtures and use proper anchors. Plaster rings shall be installed in plaster or gypsum ceilings.
- .7 Wait until the equipment in electrical and mechanical rooms is installed before installing Battery Operated Emergency Lighting. Take into account the location of all obstacles when installing Battery Operated Emergency Lighting.
- .8 Battery Operated Emergency Lighting installed on acoustic tiles shall be suspended from the metallic "T" ceiling grid using metal supports supplied by the Battery Operated Emergency Lighting supplier.
- .9 Battery Operated Emergency Lighting, diffusers and lamps shall be cleaned, at the end of the work, to remove any construction dust which may have accumulated.

3.2.2 Lamps

- .1 Supply and install all lamps required for each Battery Operated Emergency Lighting.
- .2 Lamp rating shall be as shown in the list of lighting fixtures. Rating not to exceed manufacturer recommended value.
- .3 All lamps shall be in place and in good condition at the time of substantial achievement of the work.
- .4 All lamps which fail in the 4 months period following the substantial achievement of the work shall be replaced.

END OF SECTION

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PART 1 - GENERAL

1.1 General

- 1.1.1 Section 20 05 00 "General Requirements Concerning Common Work Results" applies.
- 1.1.2 Section 20 05 02 "Specific Requirements Concerning Common Work Results for Electrical" applies.

1.2 Scope of Work

- 1.2.1 Works of this section include, but are not limited to: the supply, handling, transportation, set up and installation of all systems and their accessories hereafter mentioned and/or shown on the drawings and which are to be operational. In general, all major parts of the works consist of, but are not limited to:
 - Fire alarm system;
 - Detection devices:
 - Signaling devices.

1.3 Shop Drawings and Technical Data

- 1.3.1 Submit shop drawings and technical data regarding Section 20 05 00 "General Requirements Concerning Common Work Results".
- 1.3.2 Submit shop drawing and technical data of the following items:
 - Fire alarm panel and components;
 - Detection devices;
 - Signaling devices;
 - A list of all components and equipment proposed;
 - Large scale drawing of alarm central station showing all components;
 - Network wiring diagram showing interconnection between alarm, extinguishing devices, auxiliary systems;
 - A table showing the detail of each zone supplied by each amplifier and showing the wattage connected on each zone and the total amplifier load.

1.4 Operation and maintenance manuals

- 1.4.1 Submit operation and maintenance manuals according to the requirements of Section 20 05 02. Manuals to at least include:
 - Information operation and maintenance manuals of the complete fire alarm system to facilitate operation and routine maintenance and repair to the system;
 - All technical data with illustration showing modules and catalog number;
 - One (1) copy of all shop drawings;
 - Hard copy of system programming code including logic function;
 - Verification by a CFAA certified technician and report signed on a CFAA report form;
 - A table showing the detail of each zone supplied by each amplifier and showing the wattage connected on each zone and the total amplifier load.

1.5 Quality Control

1.5.1 Material and equipment shall meet CSA C22.2, NEMA, IEEE and all other appropriate standard, it shall be ULC listed and it shall bear the ULC label.

PART 2 - PRODUCTS

2.1 Fire Alarm System

2.1.1 Generalities

- .1 The work included in this article is for the supply, installation and commissioning of:
 - A microprocessor based main fire alarm panel capable of operating in a degraded mode;
 - A remote annonciator panel;
 - Battery backed-up power supplier for each panel;
 - Trouble signaling devices;
 - Manual pull stations;
 - Automatic fire detectors;
 - Ionization detectors:
 - Photoelectric smoke detectors;
 - End of line resistors;
 - Programmable relays;
 - Auxiliary devices;
 - Interface module with Fire Station;
 - System function selectors and indicators;
 - Auxiliary selectors;
 - Horns;
 - Strobes:
 - Cabling, conduits and boxes;
 - Interface with the elevator control panel.

.2 Reference standards

- CAN/ULC-S524; installation of fire alarm system;
- CAN/ULC-S525; audible signal appliances, fire alarm;
- CAN/ULC-S527; control units, fire alarm;
- CAN/ULC-S528; manual pull station, fire alarm;
- CAN/ULC-S529; smoke detectors, fire alarm;
- CAN/ULC-S530; heat actuated fire detectors, fire alarm;
- CAN/ULC-S531; smoke alarm;
- CAN/ULC-S536; inspection and testing of fire alarm system;
- CAN/ULC-S537; verification of fire alarm system;
- Ontario Building Code;
- Provincial Electrical Code.
- .3 Control panels shall be housed in a wall mounted enclosure with front access. All LEDs and alphanumeric read outs shall be visible through the closed door.
- .4 All alarms and troubles from addressable alarm devices, signaling devices, control panel or system activity shall be recorded.
- .5 Operation of any alarm initiating device shall:
 - Cause an audible tone signal to sound;
 - Display system status on the alphanumeric read out, light a visible LED on the control panel;
 - Stop the air conditioning and ventilation system;
 - Perform functions as described in the alarm function schedule table for the fire alarm system.

- .6 The fire alarm panel shall allow:
 - The stopping of the alarm by pressing the corresponding push-button.;
 - The stopping of the general alarm timer;
 - The manual sounding of the general alarm.
- .7 Acceptable manufacturers:
 - Edwards, Series EST-3X;
 - Notifier, series NFS2.
 - Siemens:
 - Chubb Edwards.

2.1.2 Operation of the system

.1 The system shall display an alarm or fault condition for any addressable detection device. The display shall occur simultaneously on an 80 characters (min.) alphanumeric display.

Status visual indications shall show the conditions of all major panel components.

- .2 The system shall detect any number of alarms, from addressable devices, simultaneously.
- .3 The panel internal power supply shall have ample capacity to supply all system function, detection devices and signaling devices.
- .4 The alphanumeric display shall show all new alarms or faults, which have not been acknowledged and shall differentiate between acknowledged and new alarms.
- .5 The system shall show automatically the total number of alarms or faults, which have occurred before system reset.
- .6 Any alarm or fault may not be reset before it has been acknowledged and it shall not be possible to reset the system before having acknowledged all alarms and faults.
- .7 The system shall allow the visualization of all alarms or faults on the alphanumeric display, one at a time.
- .8 The system shall have the capability to:
 - To count the number of addressable detectors which are in the alarm state on a single zone loops:
 - To count the number of zones which are generating an alarm;
 - To count the total number of detectors which are in the alarm state on the whole system;
 - Permit the creation of priorities by detector type, by zone or by detector groups.
- .9 All detection devices shall be connected in parallel on single pair cable loops having a minimum capacity of 60 detection devices per loop. Each loop to be loaded to a maximum 80% capacity to permit 20% user spare capacity on each loop.

2.1.3 Power Supply

- .1 The panel to be powered from one 20 A, 1 pole, 120 Volts circuit and have the capacity to supply all its circuits, including supervision current for all devices, from this supply.
- .2 The power supply shall have the capacity to supply up to 1,000 addressable early warning detection devices and 50 signaling devices. All expansion modules shall connect though card edge connectors and shall require no intermodule wiring.

2.1.4 Control Panels

- .1 All fire alarm control panels, main or remote, shall be labeled ULC.
- .2 The control panel shall supply power to all modules, zones and circuits in order to have a completely operational system.
- .3 Custom messages to be shown on the alphanumeric display.
- .4 Each device to be continuously checked to verify its sensitivity, response, status, functionality, open, short or ground fault condition. The control to report on the failure of any component of any initiating circuit. Upon the failure of one device, all other devices to function normally.
- .5 All devices to be recognized by location within an initiating circuit.
 - Control to report by specified device number any device removed from the initiating circuit. The circuit shall continue to operate even with the removal of one (1) device from the circuit.
- .6 It shall be possible to change the status of configured circuits from the control panel (arming and resetting and relay status change). Should a status change cause a system degrade, a trouble condition shall be initiated and maintained until the system is returned to the configured parameters.
- .7 Control panel to perform multiple operations simultaneously. These operations shall include, but are not limited to, timed functions and multiple configured sequences.
- .8 The panel shall have a port for the connection of a laptop computer and a port for the connection of a printer.
- .9 The control panel to be of modular design allowing stage-by-stage expansion of capacity.
- .10 The control panel shall include the following basic modules:
 - · Central processor module;
 - · Configuration module;
 - Addressable input module limited to 90 addressable devices per zone;
 - Programmable relay module;
 - Fire station interface module conforming to standard CAN/ULC-S561;
 - All other modules required to operate the system.
- .11 The control panel shall be fully bilingual in English and in French and all standard identifications and control buttons shall be clearly labeled in English and in French.
- .12 The control panel shall be surface or recess mounted as indicated on drawings. The panel front door to be mounted with a steel piano hinge and fitted with a key locking arrangement. Opening of the panel door must not expose live components or wiring. They shall be accessible only through the hinged cover plates after releasing a locking mechanism.

2.1.5 Operating Mode

.1 The system shall operate under a single stage mode. Upon activation of fire detection device or a manual pull station the general alarm shall sound throughout the building. Alarm signal shall be transmitted to the Fire Station upon activation.

2.1.6 Multisensor (Photoelectric and Heat) detector

.1 Addressable type smoke detectors with a L.E.D. alarm state indicator. The reference chamber shall compensate for sensitivity changes caused by gradual changes to the environment, humidity, pressure and temperature.

- .2 The addressable detector shall be self adjusting against aging and dirt accumulation and fully supervised against component failure.
- .3 The detector shall be dynamically tested and uniquely identifiable by the control panel. Should the detector sensitivity voltage shift beyond an acceptable level a discrete detector trouble signal and display shall appear at the control panel.
- .4 The detector shall have the capability of operating one remote alarm or auxiliary relay. The remote alarm indicator or auxiliary relay is normally operated by the associated detector. However, the system shall be capable of being programmed to operate the alarm indicator or relay independently of the associated detector. All detectors and/or relays connected to the circuit can be in alarm or activated simultaneously.
- .5 All hidden detectors to have a remote LED indicator mounted as shown.
- .6 Acceptable product:
 - SIGA-PHS from Chubb Edwards c/w standard detector base
 - FAPT-851A from Notifier c/w standard detector base or equivalent product from Mircom, Siemens or Simplex Grinnell

2.1.7 Heat detector

- .1 Addressable type heat detectors with two (2) ionization chambers and an LED alarm state indicator. The reference chamber shall compensate for sensitivity changes caused by gradual changes to the environment, humidity, pressure and temperature.
- .2 The heat detector shall be compatible with all other equipment.
- .3 The detector shall be dynamically tested and uniquely identifiable by the control panel. Should the detector sensitivity voltage shift beyond an acceptable level a discrete detector trouble signal and display shall appear at the control panel.
- .4 Acceptable product:
 - SIGA-HRS from Chubb Edwards c/w standard detector base
 - FST-851RA from Notifier c/w standard detector base or equivalent product from Mircom, Siemens or Simplex Grinnell

2.1.8 Duct mounted detectors

- .1 The addressable duct detector shall be complete with an addressable relay used to shut down the ventilation system when the detector is in the alarm condition, when there is a generator specifies alarm. Duct detector shall be listed for air velocities between 300 and 1,200 FPM.
- .2 Acceptable product:
 - SIGA-SD from Chubb Edwards c/w standard detector base
 - DNRA/FSP-851A from Notifier c/w standard detector base or equivalent product from Mircom, Siemens or Simplex Grinnell

2.1.9 Manual pull-station

.1 The addressable manual pull-station shall be single stage, English inscription, metal or polycarbonate body and semi recessed mounting.

.2 Acceptable product:

- SIGC-270 from Chubb Edwards c/w surface mounting box 276B-RSB(where required)
- N-MPS-SC from Notifier c/w surface mounting box MPS-DBB(where required) or equivalent product from Mircom, Siemens or Simplex Grinnell

2.1.10 Addressable interface module (MIA)

- .1 Addressable interface module shall provide supervision of devices with short-circuiting contacts.
- .2 Acceptable product:
 - SIGA-CT1/SIGA-CT2 from Chubb Edwards:
 - FMM-101A/FMM-1A/FDM-1A from Notifier or equivalent product from Mircom, Siemens or Simplex Grinnell.

2.1.11 Addressable relay module (MRA)

- .1 Control relays used to interface the fire alarm system with other systems shall have 2 A minimum, 120Vac/24Vdc dry type C contacts.
- .2 Acceptable product:
 - SIGA-CR from Chubb Edwards;
 - FRM-1A from Notifier or equivalent product from Mircom, Siemens or Simplex Grinnell.

2.1.12 Loop isolation modules

- .1 Loop isolation modules shall be installed to isolate the zones or floors shown on the drawings. Under a short circuit on one part of the loop, these devices shall maintain the unaffected part of the loop in operation on the other zones and floors.
- .2 The loop isolation modules shall be compatible with the chosen fire alarm system.
- .3 All loop isolation modules shall be installed in the fire alarm cabinet.
- .4 Acceptable product:
 - SIGA-IM from Chubb Edwards;
 - ISO-XA from Notifier or equivalent product from Mircom, Siemens or Simplex Grinnell.

2.1.13 End of line devices

.1 End of line devices for non addressable circuits shall be approved for this particular use and mounted on ULC listed back-plate.

2.1.14 Horns

- .1 Horns with integral protective covering for an optimal sound efficiency. They shall be painted red.
- .2 Horns shall have the following characteristics:

Taps: High and Low;Initial setting: Low tap;

• Sound level at 3mm: minimum 90 dBA on high tap.

.3 Horns shall be made from plastic material and shall be treated against moisture, corrosion and fungus.

- .4 Acceptable product:
 - G1-HD from Chubb Edwards
 - HR from Notifier or equivalent product from Mircom, Siemens or Simplex Grinnell

Fire Detection and Alarm

2.1.15 Strobe light

- .1 Visual signaling device having the following characteristics:
 - Universal mounting plate with red cover;
 - Flashing rate of 1 flash per second;
 - In-field adjustable intensity level:
 - 15/75 candelas:
 - 30/75 candelas;
 - 75 candelas:
 - 110 candelas.
- .2 Acceptable product:
 - G1R-HDVM from Chubb Edwards
 - P2R-B from Notifier or equivalent product from Mircom, Siemens or Simplex Grinnell

2.1.16 Supplementary signaling devices.

.1 In addition to the signaling devices shown on the drawing, the tender price shall include the supply, installation, connection, supply from the nearest signal loop, the verification and testing of 10 horns and 10 strobes. These devices shall be installed in areas where the fire alarm signal is insufficient. Include noise level measurement after installations.

2.1.17 Cabling

- .1 Normal power for the fire alarm system shall be provided by the 120 V, 60 Hz building supply circuits.
- .2 All cabling shall comply with the Canadian Electrical Code and provincial regulations in force. When specified, conductors shall be twisted and/or shielded with on aluminium ribbon and a tinned copper drain wire. Minimum requirements shall be:
 - Detection circuits: no. 16 AWG twisted and shielded pairs;
 - Horns and strobe circuits: no. 14 AWG;
 - Command circuits and combustion product detector power circuits: no. 12 AWG;
 - Interface circuits with ventilation control cabinets and ventilation motor starters: no. 12 AWG;
 - Interface circuits with ventilation motor starters and ventilation control cabinets: no. 12 AWG.
- .3 Cables or conductors shall be mechanically protected by metallic conduit or aluminium armor.
- .4 Cables or conductors protected by metallic conduit do not require a bounding conductor.
- .5 Cables or conductors protected by metallic armor require a bounding conductor that shall be bare copper or green jacketed and insulated copper. If circuit voltage is less than 50 V, a bounding conductor is not required.

- .6 Trouble signaling device circuits outside the building shall be protected by temporary suppression of gas discharge zinc oxide varistors.
- .7 Do not wire up any 120 VA.C. circuit in the same conduit than low voltage, trouble signaling device or alarm device circuit conduit.
- .8 Main fire alarm panel shall be connected to an appropriate grounding electrode located inside the building. Raceway is not acceptable

PART 3 - EXECUTION

3.1 Fire Alarm System

3.1.1 Installation

- .1 Installation to conform to latest edition of Standard no. CAN-ULC-S524 and to the manufacturer's requirements.
- .2 Install the main control panel as shown on the drawings. Connect them to the assigned ircuits.
- .3 Submit shop drawings of the physical installation after coordination with other trades which are installing equipment in the same room.
- .4 Install the horns and strobes as shown on the drawings.
- .5 Install the thermal detectors, manual pull stations, ionization and photoelectric detectors as shown on the drawings and connect them to the fire alarm circuits.
- .6 Connect all signaling devices to the main control panel circuits.
- .7 Install end of line devices on signaling or other circuits, which require them.
- .8 Install and connect the appropriate number of control relays to perform the required functions as shown on the drawings
- .9 Duct detectors shall be supplied with sampling tubes which cover the whole width of the ventilation ducts or shafts. Tube ends to be capped and care should be taken to seal the tubes where they penetrate the duct walls and prevent outside air from entering the tubes. A 300 mm x 300 mm (12" x 12") access door, near the smoke detector shall be provided for its maintenance.
- .10 Adjust all horn levels to obtain a minimum signal of 10 dBA above ambient but not less than 65 dBA, everywhere in the building at a frequency of 100 to 8,000 Hz.

3.1.2 Tests, adjustments and calibration.

- .1 Tests, adjustments and calibration shall be done under the supervision of a representative from the manufacturer of the system, with the Engineer as a witness, with all required specialized tools and instruments.
- .2 Verify all connections on each component (detectors, pull-stations, relays, annunciators etc.) and insure that:
 - The system is installed according to plans and specifications;
 - The system is installed according to the manufacturers requirements;
 - Supervision current specifications are satisfied (each conductor shall be disconnected to verify this);
 - Each device including ionization detectors shall be made to operate;
 - Each ionization detector is properly calibrated on site with an appropriate calibration device or directly from the panel;
 - Measure the ambient noise and the sound level in each room when the horn is driven by the alarm signal;
 - Should the readings indicate a sound level below the required level, adjust the amplification to meet these levels, take new sound level readings and resubmit the results;
 - Measure the sound level of each signal in closed areas with the door open and with the door closed.

- .3 Place at the manufacturer's disposal one (1) qualified electrician and one (1) apprentice for the duration of the test, calibration and verification period.
- .4 Immediately after the test, calibration and verification period, submit the following to the Engineer:
 - A certificate attesting that the work has been done to his satisfaction;
 - An insurance certificate, specific to this project, good for one (1) year, to the amount of \$1,000,000 for injuries, personal liabilities and damages;
 - A complete list showing the exact location (room number) of each component;
 - A complete list enumerating the quantity and model number of each component on the site;
 - A printout of the address of each component connected to the system, of the analog voltage
 of addressable devices, of calibration voltages for ionization detectors and the identification
 voltage value for each addressable detector;
 - A table of sound levels showing the ambient noise, the alert signal, the alarm signal and the spoken message for each room and with the door open and closed when applicable.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM D 698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lb.) (600kN-m).
- .2 CSA International:
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A3000-08, Cementitious Materials Compendium.
- .3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation:
 - .1 OPSS 1004-05, Material Specification for Aggregates Miscellaneous.
 - .2 OPSS 1010-04, Material Specification for Aggregates Base, Subbase, Select Subgrade, and Backfill Material.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
- .2 Pay costs of relocating services

1.3 SUB-SURFACE INVESTIGATION

.1 Refer to Division 01 for the geotechnical report prepared by DST.

1.4 EXAMINATION

- .1 Prior to construction, examine site and note all characteristics and features affecting the work.
- .2 Ensure in examination that all possible factors concerning work are investigated, and that following are known in particular:
 - .1 Methods and means available for material handling, disposal, storage and transportation.
 - .2 Physical conditions of site, including ground water table and drainage courses.
 - .3 Conformation and condition of ground surfaces.

1.5 UTILITY LINES

- .1 Before commencing work, establish location and extent of underground utility lines in area of excavation. Notify Consultant of findings. Known underground and surface utility lines are indicated on drawings.
- .2 Buried Services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.

- .2 The Contractor will be responsible for hiring and arranging for the location of any underground services and utilities in the areas of work.
- .3 The Contractor will be responsible for any costs as a result of damage caused by the Contractor to any underground services or utilities.
- .4 Before commencing work, conduct, with Owner, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, paving, survey bench marks, and monuments which may be affected by work.

1.6 SHORING

- .1 Notify Bell Canada, Rogers, Ontario Hydro, Ottawa Gas and Municipal Authorities of work and cooperate with them in location and protection of their services.
- Maintain existing services in areas of excavation outside the building that must remain active. Relocate utilities within area of building and pay costs for this work.
- .3 Remove abandoned utility lines to 6' outside of new foundations and cap or seal at cut-off points.
- .4 Record locations of maintained, rerouted and abandoned underground utility lines.
- .5 Make good damage to existing utility lines resulting from work.
- .6 Submit detailed drawings and design calculation of shoring scheme for as directed by consultant.

 Drawings to indicate sizes, strengths, spacing and connection details. Drawings and calculations to be stamped and signed by the registered Engineer responsible for the shoring design.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Granular B Type I to OPSS 1010. Sand to OPSS 1004.
- .2 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 hours.
 - .4 Concrete aggregates: to CSA A23.1/A23.2.
 - .5 Cement: to CSA A3000, Type GU.
 - .6 Slump: 160 to 200 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Evaluation and Assessment:
 - .1 Examine soil report. Refer to Division 01 for geotechnical report prepared by DST.
 - .2 Before commencing work verify locations of buried services on and adjacent to site.

3.2 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Protect excavations from freezing.
 - .2 Keep excavations clean, free of standing water, and loose soil.
 - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Consultant's approval.
 - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
 - .5 Protect buried services that are required to remain undisturbed.

.2 Removal:

- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
- .2 Remove stumps and tree roots below footings, slabs, and paving, and to 24in below finished grade elsewhere.
- .3 Grub out roots of cleared vegetation to at least 18" below existing grade.
- .3 Remove from site and dispose of cleared items.
- .4 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

3.3 DEWATERING

- .1 Provide all labour and equipment necessary to draw and pump all excavations free of water under any circumstances, and take all necessary measures to prevent flow of water into excavation.
- .2 Seal or divert any springs found on site in a manner acceptable to Consultant.
 - .1 Keep excavations free of water while Work is in progress.
 - .2 Provide for Consultant's approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cutoffs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 Environmental Procedures in a manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.4 EXCAVATION

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial, Territorial and Municipal regulations whichever is more stringent.

- .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
 - .1 Stockpile topsoil on site for later use.
- .3 Excavate as required to carry out work.
 - .1 Do not disturb soil or rock below bearing surfaces.
 - .2 Notify Consultant when excavations are complete.
 - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
 - .4 Excavation taken below depths shown without Consultant's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .4 Protect from freezing excavated surfaces against which concrete or fill is to be placed.
- .5 Do not leave excavated bearing surfaces exposed to weather for more than 24 hours. Program operations to ensure that concrete mud slabs will be poured over same within this time period but do not conceal bearing surfaces before they have been inspected and approved by the Consultant.
- .6 Excavate trenches to provide uniform continuous bearing and support for 6 in thickness of pipe bedding material on solid and undisturbed ground.
 - .1 Trench widths below point 6 in above pipe not to exceed diameter of pipe plus 24 in.
- .7 Shoring designer to visit site and submit a written report to Consultantstating shoring is in accordance with requirements.
- .8 Excavate for slabs and paving to subgrade levels.
 - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.5 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Consultant.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in PART 1 ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Do not begin backfilling or filling operations until material has been approved for use by Consultant.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify Consultant to allow compaction tests to be carried out by designated testing agency.

3.6 BACKFILLING

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Ensure backfilling operations are fully compliant with recommendations from geological report.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

- .4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
 - .1 Fill excavated areas with selected subgrade material, gravel or sand compacted as specified for fill. Refer to Geotechnical Report.
- .5 Placing:
 - .1 Place backfill, fill and base course material in 6 inlifts: add water as required to achieve specified density.
 - .2 Place unshrinkable fill in areas as indicated: consolidate and level unshrinkable fill with internal vibrators.
- .6 Compaction: compact each layer of material to following densities for material to ASTM D 698:
 - .1 To underside of base courses: 98%.
 - .2 Base courses: 100%.
 - .3 Elsewhere: 90%.
- .7 Under slabs and paving:
 - .1 Use Granular A up to bottom of granular base courses.
 - .2 Use [] for base courses.
- .8 In trenches:
 - .1 Up to 12 in above pipe or conduit: sand placed by hand.
 - .2 Over 12 in above pipe or conduit: [_____] [native material approved by Consultant.
- .9 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 24 in of foundations.
- .10 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material
- .11 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 4" in diameter within 24" of structures.

3.7 GRADING

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Consultant.
- .2 Grade to be gradual between finished spot elevations shown on drawings

3.8 ADDITIONAL EXCAVATION

- .1 Carry excavations to levels shown on drawings. If excavation to levels shown disclose unsatisfactory bearing conditions, Consultant may order further excavation to a point where satisfactory bearings can be obtained.
- .2 Excavation below levels indicated on drawings, or called for or implied in this specification, done under Consultant's orders will be classed as additional work, and determined on basis of unit prices agreed upon at time of signing of contract.

3.9 SHORTAGE AND SURPLUS

- .1 Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.
- Dispose of surplus material off site, as directed by Consultant, to a location on the CFB Kingston Base. Backfill must be sorted into types (concrete, asphalt, rock, soil, etc.) prior to disposal.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 Cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Standards listed below govern minimum quality of work required under this Section:
 - .1 ASTM International Inc.:
 - .1 ASTM A 307-14 "Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength"
 - .2 ASTM A 325-14 "Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength"
 - .3 ASTM A 325M-14 "Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric)"
 - .4 ASTM A 490M-14a "Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)"
 - .5 ASTM A 1011/A 1011M-14 "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength"
 - .6 ASTM D 3966/D 3966M-07(2013)E1 "Standard Test Methods for Deep Foundations Under Lateral Load"
 - .7 ASTM D 3689/D 3689M-07(2013)E1 "Standard Test Methods for Deep Foundations Under Static Axial Tensile Load]
 - .8 ASTM D 3740-12a "Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction"
 - .9 ASTM D 4945-12 "Standard Test Method for High-Strain Dynamic Testing of Deep Foundations".
 - .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-85.10-99, "Protective Coatings for Metals".
 - .3 Canadian Standards Association (CSA International):
 - .1 CSA G30.18-09 (R2104) "Carbon Steel Bars for Concrete Reinforcement"
 - .2 CSA G40.20-13]/G40.21-13 "General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel"
 - .3 CSA-S16-14 "Limit States Design of Steel Structures"
 - .4 CSA W47.1-09 (R2014) "Certification of Companies for Fusion Welding of Steel"
 - .5 CSA W48-14 "Filler Metals and Allied Materials for Metal Arch Welding"
 - .6 CSA W59-13 "Welded Steel Construction (Metal Arch Welding)"
 - .4 Master Painters Institute:
 - .1 MPI-INT 5.1-08 "Structural Steel and Metal Fabrications"
 - .2 MPI-EXT 5.1-08 "Structural Steel and Metal Fabrications"
 - .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
 - .1 SSPC-SP 5/ NACE No.1-Latest Edition "While Metal Blast Cleaning"

1.2 MEASUREMENT PROCEDURES

- .1 Measure supply of steel sheet piling in square metres of piling authorized by Consultant delivered to site.
 - .1 Calculate area by multiplying lengths of piles by widths.
 - .2 Width of steel sheet pile section is defined as centre to centre distance between pile interlocks measured along a plane parallel to finished wall.

- .2 Measure supply and installation of sheet piling in square metres of piling remaining in place after cutoff.
 - .1 Piling will be measured in plane of bulkhead, calculated by multiplying straight horizontal centre line of bulkhead measured at top of piles by average vertical length of piles installed and left in work.
- .3 Measure splicing of piles by number of slices made.
- .4 Measure tie rods, nuts, sleeve nuts, turnbuckles, pipe sleeves, bearing plates, washers, transfer bolts, steel wales and other associated hardware supplied and incorporated in Work, as indicated, in kilograms.

1.3 QUALITY PLAN

.1 The Quality Plan developed and implemented as part of Section 31 61 13 shall also apply to the work of this Section.

1.4 EXISTING CONDITIONS

.1 Notify Consultant in writing if subsurface conditions at site differ from those indicated and await further instructions from Consultant.

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittal Procedure.
- .2 Submit schedule of planned sequence of sheet pile installation to Consultant for review.
- .3 Format of shop drawings to be in accordance with Section 01 33 00. Multiple prints will not be reviewed. Reproductions of Contract Drawings will not be acceptable as shop drawings.
- .4 Submit shop drawings in a single, complete set in order that all details may be read in conjunction with plans, elevations and all other dependent details.
- .5 All submittals shall be made in English with any abbreviations clearly defined.
- .6 Where shop drawings are re-submitted, clearly illustrate all revisions from previous submissions using revision marks and "bubbles".
- .7 Pile shop drawings are to be stamped and signed by the Professional Engineer registered in the Province of Ontario who is responsible for their design.
- .8 Submit design calculations for the piles as requested by the Consultant.
- .9 Submit design details of splice connections.
- .10 Submit manufacturer's printed product literature, specifications and datasheets.
- .11 Submit list and details of equipment for use in installation of piles.

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- .12 Submit driveability analysis for approval of hammers.
- .13 Submit copies of certified test reports for sheet piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties, as follows:
 - .1 One tension test and one bend test from each heat for quantities of finished material less than 50 tonnes.
 - .2 Tension tests in accordance with CSA G40.20/G40.21.
- .14 Provide manufacturer's affidavit stating that materials and products used conform to specified performance characteristics and physical properties.

1.6 SCHEDULING

- .1 Install sheet piles as required to suit construction sequencing.
- .2 Provide schedule of planned sequence of sheet pile installation to Consultant for review, not less than two weeks prior to commencement of installation.

1.7 DESIGN

- .1 The sheet piles shall be designed to meet the specified loads and acceptance criteria shown on the Contract drawings. Provide submittals in accordance with this Section.
- .2 The sub-surface investigation report listed elsewhere in this Section, including bore hole logs listed therein, shall be considered to be representative of the in-situ subsurface conditions likely to be encountered on the project site. Said sub-surface investigation report shall be used as the basis for the design of the piles using generally accepted engineering judgment and methods.

1.8 PROTECTION

.1 Protection requirements shall be in accordance with Section 31 00 00.01 - Earthwork.

1.9 EXAMINATION

- .1 Prior to commencement of sheet pile installation, carefully examine all Contract Documents and shop drawings which affect this work. Report any discrepancies to the Consultant for their direction.
- .2 Examine all site conditions and work of other trades which may affect this work. Report any inconsistencies to the Consultant for their direction.

1.10 COORDINATION

.1 Cooperate with all other trades to fully coordinate all dimensions, etc. which may be required during installation.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Steel sheet piles: to CAN/CSA-G40.21, including chemical and mechanical requirements, grade 350W, and following.
- .2 Continuous interlocking flat web with minimum web thickness as required to suit application.
- .3 Structural steel for wales, bearing plates, wale splices, capping channels, support angles and miscellaneous steel: to CAN/CSA-G40.21, including chemical and mechanical requirements, grade 350W.
- .4 Tie rods: to CSA G30.18, Grade 400.
- .5 Sleeve nuts: to have load capacity in excess of capacity of tie rod.
- .6 Hexagon nuts, bolts, and washers: to ASTM A 307.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do welding in accordance with CSA W59 and CSA W59S1, except where specified otherwise.
- .2 Do not commence pile installation until all required quality control tests have been completed and test results approved by Consultant.
- .3 Submit full details of monitoring and method and sequence of installation of piling to Consultant for approval prior to start of pile installation work. Details must include guide frames, bracing, setting and driving sequence and number of piles in panels for driving.
- .4 When installing sheet piles in bulkhead wall, use following procedure:
 - .1 Provide temporary guide frames or bracing to hold piles in alignment during setting and driving.
 - .2 Drive piles two at a time. Drive first double pile to full depth, then place panel of five to eight double sheet piles in guide frames and secure last (end) double pile in location to prevent spreading of piles in panel.
 - .3 Drive end double pile in panel sufficiently deep into ground to ensure that it will remain plumb, then, drive remaining double piles in panel to full depth commencing with double pile next to end double pile and finishing with double pile next to double pile first driven.
 - .4 After one panel has been driven, place and drive succeeding panels in similar manner. Complete the driving of end double pile of first panel after double piles of second panel have been driven.
- .5 When installation is complete, face of wall at top of sheet piles to be within 3" of location as indicated and deviation from vertical not to exceed 1 in 100.

3.2 OBSTRUCTIONS

.1 If obstruction encountered during driving, leave obstructed pile and proceed to drive remaining piles. Return and attempt to complete driving of obstructed pile later.

.2 Advise Consultant immediately if impossible to drive pile to full penetration, and obtain direction from Consultant on further steps required to complete work.

3.3 SPLICING

.1 Use full length piles unless splicing is approved on site by Consultant.

3.4 TIE ROD ANCHORAGE

- .1 Do not place backfill behind anchored bulkhead or remove material from in front of bulkhead until piles have been completely driven, adjusted and secured in final position by anchorage system.
- .2 Support tie rods at intervals along their length as indicated on shop drawings.
- .3 Fit and adjust tie rod systems so that connections at waling and anchor end of tie rods are tight before backfilling.
- .4 Brace steel sheet piles with waling strips in accordance with shop drawings. Make wales one length between corners and bolt to piles.

3.5 TOE PINNING

- .1 Drive sheet piling at pinned sections to bedrock as required by the Design Engineer.
- .2 Pin sheet piling at toe in accordance with shop drawings.

3.6 BACKFILLING

- .1 Backfill in accordance with Section 31 00 00.01 Earthwork.
- .2 Protect piling tie rods and anchorage systems from damage or displacement during backfilling operations.

END OF SECTION