Fisheries and Oceans Canada - Canadian Coast Guard

Requisition Number: F1700-195560/A

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SPECIFICATIONS for:

Port Hardy
Logistics Depot

Project No: 8H500

Issued for Tender

January 20, 2020

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END OF SECTION 00 00 10

CONSULTANTS – SEAL & SIGNATURE

Discipline	**Seal/Signature/Date**
Architectural Chernoff Thompson Architects	
Structural Consultant Herold Engineering Ltd.	 2020-01-17
Mechanical Consultant Design Air Systems Ltd.	

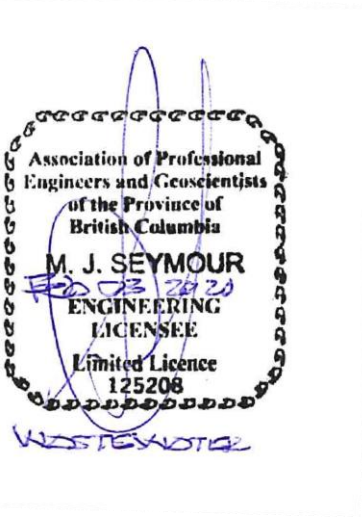
Electrical Consultant
RB Engineering Ltd.

2020-01-14

Civil Consultant
Herold Engineering Ltd.

2020-01-15

Wastewater Consultant
MSR Solutions Inc.



2020-01-20

Marine Structural Engineer
SNC-Lavalin

END OF SECTION 00 01 07

1.0 RELATED SECTIONS

.1 General Instructions Section 01 11 55

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises the demolition of existing building and construction of new Ocean Protection Plan Depot.

1.2 CONTRACT METHOD

1 Construct work under lump sum contract.

1.3 WORK BY OTHERS

.1 Co-operate with other Contractors on site in carrying out their respective works and carry out instructions from the Departmental Representative.

.2 Coordinate work with that of other Contractors. If any part of the work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of work.

1.4 WORK SEQUENCE

.1 Demolition and Construction of all buildings are to be carried out in in the following sequence:

.1 Phase 1: Demolition of existing building.

.2 Phase 2: Construction of new Ocean Protection Plan Depot.

Exact construction period of each phase to be referred to Section 01 11 55 General Instructions Clause 1.4.

.2 Do not close off usage of roadways, walkways and access to other buildings until alternate usage has been provided.

.3 Maintain fire truck and maintenance truck access throughout the construction period.

1.5 CONTRACTOR USE OF PREMISES

.1 Co-ordinate use of premises under direction of Departmental Representative.

.2 Obtain and pay for use of additional storage or work areas needed for work under this contract.

1.6 OWNER AND CONTRACTOR RESPONSIBILITIES

.1 Owner Responsibilities:

.1 Arrange for delivery of up-to-date utility location information, safety requirements, and any site specific work policies that may have changed or were not available at the time of specification and drawing preparation.

.2 Contractor Responsibilities:

.1 Designate Submittals and delivery date for major building components and equipment in progress schedule.

.2 Review all submittals and contract requirements. As soon as it becomes apparent, submit to Departmental Representative written and verbal notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.

.3 Provide any installation inspections required by public authorities and authority having jurisdiction.

.4 Receive and unload products and equipment at site.

.5 Review deliveries jointly with Departmental Representative, record shortages, and damaged or defective items.

.6 Handle product at site, including uncrating and storage.

.7 Protect product from damage.

.8 Repair or replace items damaged by Contractor or subcontractor on site (under their control).

1.7 EXISTING SERVICES

.1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission. Where work involves breaking into or connecting to existing services, contractor shall submit a request to the Departmental Representative a minimum of 48 hours prior to the event. The contractor will not proceed until approval has been granted. The Departmental Representative will make all reasonable efforts to accommodate the request; however the Departmental Representative will not accept delay charges should the request not be accepted.

.2 Minimize duration of interruptions, and where required, provide temporary services to maintain critical systems.

.3 Provide alternative routes for personnel and vehicular traffic where existing route is interrupted by construction work.

.4 Establish location and extent of service lines in area of work before starting work. Notify Departmental Representative of findings.

.5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including water, sewer, power and communication services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services, when directed by Departmental Representative to maintain critical systems.

.7 Provide adequate bridging over trenches which cross roads or walkways to permit normal traffic.

.8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by authorities having jurisdiction.

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

.11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.8 ARCHAEOLOGICAL MONITORING

.1 First Nations will provide a cultural monitor/observer for excavation activities.

.2 Guidelines for Archaeological Chance Find Management.

.1 If intact or disturbed archeological deposits or artifacts are encountered, stop work in the immediate vicinity of the archaeological site.

.2 Contact Don Storry (F&OC) (604-209-1148). If Don Storry is unavailable, contact Randy Burgin (Canadian Coast Guard) (250-508-8121).

.3 F&OC will contact the Project Archaeologist for further guidance.

.4 The Project Archaeologist will advise on further action. Based on a telephone description of the incident, it may be decided that there are no further concerns, allowing work to resume as planned. If artifacts or other archaeological material is observed, the Project Archaeologist may request that the Contractor send photographs by email. Subsurface work in the immediate area should not resume until further notice. Possible human remains should not be photographed. If observed or recovered materials cannot be identified remotely, a field visit by an archaeologist may be recommended. In this case, the Project Archaeologist will notify and coordinate with F&OC.

END OF SECTION 01 11 00

1.0 GENERAL

.1 ALL DESIGN HAS BEEN COMPLETED IN ACCORDANCE WITH THE 2015 EDITION OF THE NATIONAL BUILDING CODE, INCLUDING ALL ADDENDA.

.2 ALL CONSTRUCTION MUST BE IN ACCORDANCE WITH THE 2015 EDITION OF THE NATIONAL BUILDING CODE, INCLUDING ALL ADDENDA, ALL REFERENCED CODES AND ALL FEDERAL AND MUNICIPAL REGULATIONS AND BY-LAWS.

.3 ALL REFERENCED CODES AND STANDARDS SHALL BE AS REFERENCED IN THE 2015 EDITION OF THE NATIONAL BUILDING CODE.

4. DESIGN CRITERIA:

PORT HARDY, BC									
SNOW LOADS		WIND LOADS			SITE CLASS				
Ss	0.9 kPa (18.8 psf)	q10 0.40 kPa (8.40 psf)			C	SEE GEOTECHNICAL REPORT			
Sr	0.4 kPa (8.40 psf)	q50 0.52 kPa (10.85 psf)							
Is	ULS 1.0/SLS 0.90	Iw ULS 1.0/SLS 0.75							
SEISMIC LOADS		SPECTRAL ACCELERATION							
Rd	3.0	Sa (0.2)	Sa (0.5)	Sa (1.0)	Sa (2.0)	Sa (5.0)	Sa (10.0)	PGA	PGV
Ro	1.7	0.700	0.659	0.447	0.272	0.091	0.032	0.320	0.543
Ie	ULS 1.0								

SPECIFIED FLOOR LOADING		SPECIFIED ROOF LOADING	
OFFICE DL	= 1.6 kPa (33.4psf)	DEAD LOAD	= 1.0 kPa (20.9psf)
OFFICE LL	= 4.8 kPa (100psf)	SNOW LOAD	= 1.12 kPa (23.4psf)
CORRIDOR DL	= 1.6 kPa (33.4psf)	NET WIND UPLIFT	= 1.0 kPa (20.9psf)
CORRIDOR LL	= 4.8kPa (100psf)		
PARTITION LOADING	= 1.0 kPa (20.9psf)		
DEFLECTION CRITERIA		DEFLECTION CRITERIA	
LIVE LOAD = L/360 TOTAL LOAD = L/240		LIVE LOAD = L/360 TOTAL LOAD = L/240	

.5 THESE DRAWINGS, INCLUDING DIMENSIONS, SHALL BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS AND SPECIFICATIONS. CONTRACTOR SHALL REPORT ANY DISCREPANCIES TO THE STRUCTURAL ENGINEER FOR CLARIFICATION PRIOR TO COMMENCING CONSTRUCTION. CONTRACTOR SHALL BE FAMILIAR WITH ALL PROJECT DRAWINGS INCLUDING THOSE OF OTHER DISCIPLINES AND SHALL MAKE ALLOWANCES FOR ALL ITEMS SHOWN ON OTHER DRAWINGS THAT AFFECT THIS CONTRACTOR'S WORK.

.6 THESE DRAWINGS SHOW THE COMPLETED STRUCTURE ONLY. PROVIDE TEMPORARY BRACING AND SHORING FOR THE CONSTRUCTION LOADING CONDITIONS AND STABILITY OF THE STRUCTURE DURING CONSTRUCTION. CONSTRUCTION LOADS SHALL NOT EXCEED DESIGN LOADS.

.7 THE CONTRACTOR SHALL RETAIN A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA TO DESIGN AND TAKE RESPONSIBILITY FOR ANY TEMPORARY SHORING, BRACING OR OTHER DESIGNS REQUIRED TO COMPLETE CONSTRUCTION.

.8 THE CONTRACTOR SHALL SUBMIT WRITTEN RECOMMENDATIONS FOR FLATWORK PERFORMED DURING COLD (BELOW +5°C) AND HOT (ABOVE +25°C) WEATHER. THE RECOMMENDATIONS SHALL BE PREPARED, SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA. A SCHEDULE 'S' SHALL ALSO BE SUBMITTED UPON REQUEST. FLATWORK INCLUDES SLABS ON GRADE AND CONCRETE TOPPING.

.9 UNDER NO CIRCUMSTANCES SHALL DRAWINGS BE SCALED.

.10 CONTRACTOR AND ALL SUB-TRADES SHALL VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING FABRICATION.

2.0 REFERENCE PUBLICATIONS

THESE DRAWINGS REFER TO THE FOLLOWING PUBLICATIONS, AND WHERE SUCH REFERENCES ARE MADE, IT SHALL BE TO THE EDITION LISTED BELOW, INCLUDING ALL AMENDMENTS PUBLISHED THERETO.

- ACI SP-4-2005
- ACI 355.4-11
- ANSI/APA PRG 320-2012
- ANSI/NAAMM MBG 531-17
- ASTM A653/A653M-11
- ASTM A53/A53M-18
- ASTM A123/A123M-13
- ASTM A193/A183M-17
- ASTM A252-10 (2018)
- ASTM A307-12
- ASTM A325-10e1
- ASTM A416/A416M-12a
- ASTM A421/A421M-05
- ASTM A497/A497M-07
- ASTM A615/A615M-18e1
- ASTM A722/A722M-12
- ASTM A992/A992M-11 (2015)
- ASTM A1001/A1001M-12b
- ASTM A1064/A1064M-13
- ASTM C957/C957M-14
- ASTM D1751-18
- ASTM D5055-13e1
- ASTM D5456-13a
- ASTM F1136-11
- ASTM F1554-07ae1
- ASTM G109-07 (2013)
- ASTM G180-13
- ASME B18.6.1-1981 (R2016)
- CGSB 1.181-99
- CGSB 19.24-M90
- CGSB 27.50-M89
- CGSB 37.50-M89
- CISC/CPMA 2-75 (1975)
- CISC/CPMA 1-73a (1975)
- CSA B111-1974 (R2003)
- CSA B167-16
- CSA G30.14-M1983 (R1998)
- CSA G30.18-09 (R2014)
- CSA G40.20/G40.21-13
- CSA G164-M92 (R2003)
- CSA 056-10 (R2015)
- CSA 080-08 (R2012)
- CSA 086-14
- CSA 0112-M1977 (R2006)
- CSA 0112.7-M1977
- CSA 0112.9-10 (R2014)
- CSA 0121-08 (R2013)
- CSA 0122-06 (R2011)
- CSA 0122.6-M1977
- CSA 0141-05 (R2014)
- CSA 0151-09 (R2014)
- CSA 0153-13 (R2017)
- CSA 0177-06 (R2015)
- CSA 0325-07 (R2012)
- CSA 0437.0-93
- CSA S6-14
- CSA S16-14
- CSA S136-12
- CSA S269.1-1975
- CSA S269.3-M92 (R2013)
- CSA S413-14
- CSA W47.1-09 (R2014)
- CSA W48-14
- CSA W55.3-08 (R2018)
- CSA W59-13
- CSA W178.1-14
- CSA W178.2-14
- CSA W186-M1990 (R2016)
- CSA O112.10-08 (R2017)
- CSA A23.1-14
- CSA A23.2-14
- CSA A23.4-09
- CSA A165-14
- CSA A179-14
- CSA A370-14
- CSA A371-14
- CSA A3000-13
- CSSBI 10M-18/12M-18
- CSSBI 101M-84
- JAE J429-1999
- ULC S701-11

3.0 SUBMITTALS

.1 WHERE SHOP DRAWINGS ARE REQUESTED IN THE GENERAL NOTES, THE CONTRACTOR SHALL PROVIDE THEM IN EITHER HARD COPY OR DIGITAL FORMAT TO THE FOLLOWING REQUIREMENTS FOR THE ENGINEER'S REVIEW PRIOR TO FABRICATION. THE SHOP DRAWINGS SHALL INDICATE DETAILS, DIMENSIONS, MATERIALS AND DESIGN LOADS.

.2 IF HARD COPY FORMAT IS USED, FIVE PAPER COPIES SHALL BE SUBMITTED. UNLESS NOTED OTHERWISE, THEY SHALL BE SIGNED AND SEALED BY A SPECIALTY ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.

.3 DRAWINGS NOT SEALED BY THE SPECIALITY ENGINEER SHALL BE ACCOMPANIED BY A LETTER WITH A DRAWING LIST IDENTIFYING ALL DRAWING NUMBERS, TITLES, MOST RECENT REVISION NUMBERS AND DATES. THE LETTER AND DRAWING LIST ARE TO BE SIGNED AND SEALED BY THE SPECIALITY ENGINEER.

.4 IF A DIGITAL SUBMISSION IS MADE, THE FILES SHALL BE IN PDF FORMAT ON A DISC OR TRANSMITTED VIA E-MAIL. THE SUBMISSION SHALL CONTAIN A LETTER WITH A DRAWING LIST AS DESCRIBED ABOVE, SIGNED AND SEALED BY THE SPECIALITY ENGINEER. THE FINAL SUBMISSION SHALL BE MADE AS A HARD COPY BEARING THE ORIGINAL SEAL AND SIGNATURE OF THE SPECIALITY ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.

.5 THE FOLLOWING SUBMISSIONS ARE REQUIRED FOR THIS PROJECT:

- CONCRETE MIX DESIGNS STRUCTURAL STEEL SHOP DRAWINGS
- PREFABRICATED WOOD TRUSS SHOP DRAWINGS*
- PREFABRICATED WOOD JOIST SHOP DRAWINGS*
- STRUCTURAL COMPOSITE LUMBER SHOP DRAWINGS*
- HOLD-DOWN/TIE-DOWN PROPOSALS
- PROPOSALS FOR ALL PROPRIETARY PRODUCTS
- FALL PROTECTION SHOP DRAWINGS

* INDICATES THE REQUIREMENT THAT THE SUBMISSION BE SEALED BY A SPECIALTY ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA AND THAT A SCHEDULE 'S' BE PROVIDED UPON COMPLETION OF THE WORK.

.6 SHOP DRAWINGS WHICH ARE REQUIRED TO, BUT DO NOT HAVE THE APPROPRIATE ENGINEERS SEAL AND SIGNATURE, WILL NOT BE REVIEWED.

.7 SHOP DRAWINGS WILL BE REVIEWED ONLY FOR GENERAL CONFORMITY WITH THE PROJECT DRAWINGS AND SPECIFICATIONS. QUANTITIES AND DETAILED DIMENSIONS ARE THE CONTRACTORS RESPONSIBILITY. THE REVIEW SHALL NOT RELIEVE THE CONTRACTOR FROM COMPLYING WITH ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, INCLUDING COORDINATION WITH OTHER TRADES AND DISCIPLINES. THE CONTRACTOR IS RESPONSIBLE FOR ERRORS AND OMISSIONS ON THE SHOP DRAWINGS.

.8 SHOP DRAWING SUBMISSIONS FOR THE WORK OF SPECIALTY ENGINEERS SHALL BE AS SET OUT IN THIS SECTION.

.9 THE QUALITY ASSURANCE FOR MATERIALS, FABRICATION AND INSTALLATION IS THE RESPONSIBILITY OF THE CONTRACTOR AND HIS SPECIALTY ENGINEER.

.10 THE SPECIALTY ENGINEER OR HIS REPRESENTATIVE SHALL VISIT THE SITE AND REVIEW THE COMPLETED WORK DESIGNED AND DETAILED ON HIS SHOP DRAWINGS TO SATISFY HIMSELF THAT THE

FINISHED COMPONENTS AND ASSEMBLIES ARE IN COMPLIANCE WITH THE ENGINEERED DESIGN. THE SPECIALTY ENGINEER SHALL THEN PROVIDE THE PROJECT ENGINEER OF RECORD WITH A COMPLETED SCHEDULE 'S' FOR HIS WORK ALONG WITH ANY SKETCHES SHOWING FIELD MODIFICATIONS. THESE SKETCHES SHALL BEAR THE SEAL AND SIGNATURE OF THE SPECIALTY ENGINEER.

4.0 BUILDING INFORMATION MODELING (BIM) EXECUTION

THE REQUIREMENTS OF THIS SECTION SHALL APPLY TO THE STRUCTURAL BIM MODEL AND THE 2D OUTPUT:

.1 CONTRACT DOCUMENTS CREATED FROM THE BIM MODEL UNLESS A BIM EXECUTION PLAN HAS BEEN PROVIDED WITHIN THE PROJECT CONTRACT BY THE ARCHITECT AND APPROVED BY HEROLD ENGINEERING BIM MANAGER. ANY CHANGE OF BIM MODEL SCOPE MUST BE APPROVED BY THE BIM MANAGER PRIOR TO 50% CD SUBMISSION AND MAY BE SUBJECT TO ADDITIONAL FEES.

.2 LEVEL OF DEVELOPMENT (LOD)

- LOD 100: THE MODEL ELEMENT MAY BE GRAPHICALLY REPRESENTED IN THE MODEL WITH A SYMBOL OR OTHER GENERIC MODEL REPRESENTATION.
- LOD 200: THE MODEL ELEMENT IS GRAPHICALLY REPRESENTED WITHIN THE MODEL AS A GENERIC SYSTEM, OBJECT, OR ASSEMBLY WITH THE APPROXIMATE QUANTITIES, SIZE, SHAPE, LOCATION AND ORIENTATION. NON-GRAPHIC INFORMATION MAY ALSO BE ATTACHED TO THE MODEL.
- LOD 300: THE MODEL ELEMENT IS GRAPHICALLY REPRESENTED WITH THE MODEL AS A SPECIFIC SYSTEM, OBJECT OR ASSEMBLY IN TERMS OF QUANTITY, SIZE, SHAPE, LOCATION, AND ORIENTATION. NON-GRAPHIC INFORMATION MAY ALSO BE ATTACHED TO THE MODEL.
- LOD 400: THE MODEL ELEMENT IS GRAPHICALLY REPRESENTED WITH THE MODEL AS A SPECIFIC SYSTEM, OBJECT OR ASSEMBLY IN TERMS OF QUANTITY, SIZE, SHAPE, LOCATION, AND ORIENTATION WITH DETAILING, FABRICATION, ASSEMBLY, AND INSTALLATION INFORMATION. NON-GRAPHIC INFORMATION MAY ALSO BE ATTACHED TO THE MODEL.
- LOD 500: THE MODEL ELEMENT IS A FIELD VERIFIED REPRESENTATION IN TERMS OF SIZE, SHAPE, LOCATION, QUANTITY, AND ORIENTATION. NON-GRAPHIC INFORMATION MAY ALSO BE ATTACHED TO THE MODEL.

STRUCTURAL ELEMENT	LOD
FLOORS, WALLS, AND ROOFS	300
FOOTINGS, GRADE BEAMS, PILES, PIERS AND PEDESTALS	300
BEAMS AND COLUMNS	300
JOISTS, TRUSSES, AND PRE-ENG STRUCTURES	200
BASE PLATES, GUSSET PLATES, EMBED PLATES, PERIMETER ANGLES, SHEAR BLOCKING, STAIRS, STEEL CONNECTIONS, DRAG STRUTS, STIFFENERS, HANGERS, BRIDGING, HORIZ. BRACING, MISC METALS AND FASTENERS	100
OPENINGS IN FLOORS, WALLS, AND ROOFS	200

NOTE: THE LEVEL OF DEVELOPMENT (LOD) CHART FOR STRUCTURAL ELEMENTS IS AN APPROXIMATION OF HEROLD ENGINEERING BIM STANDARDS AND EACH ELEMENT MAY NOT MEET THESE LEVELS. REPRESENTATION OF EACH ELEMENT IN THE BIM MODEL IS IN KEEPING WITH INDUSTRY STANDARDS FOR DESIGN CONTRACT DRAWINGS AND AS REQUIRED TO COMPLETE THE 2D DOCUMENTATION OF STRUCTURAL PLANS, ELEVATIONS, AND DETAILS THAT MAKE UP THE CONTRACT DRAWINGS.

.3 REVISIONS AND ADDITIONS TO THE MODEL UPON RECEIPT OF SHOP DRAWINGS WILL NOT BE COMPLETED UNLESS PREVIOUSLY SPECIFIED IN THE PROJECT CONTRACT OR BIM EXECUTION PLAN.

.4 REVISIONS AND ADDITIONS TO THE MODEL TO AS BUILT CONDITIONS WILL NOT BE COMPLETED UNLESS PREVIOUSLY SPECIFIED IN THE PROJECT CONTRACT OR BIM EXECUTION PLAN.

.5 NON-STRUCTURAL ITEMS AND INDIVIDUAL STEEL/WOOD STUDS WILL NOT BE INCLUDED IN THE BIM MODEL.

.6 STRUCTURAL ELEMENTS SUCH AS PRECAST CONCRETE, PRE-ENG FRAMES, OPEN WEB STEEL JOISTS, TRUSSES, AND ANY STRUCTRUAL ELEMENT DESIGNED BY OTHERS, WILL BE GRAPHICALLY REPRESENTED IN THE MODEL, HOWEVER EXACT LOCATION, DIMENSIONS, AND GEOMETRY OF THESE ELEMENTS MUST BE COORDINATED VIA THE SUPPLIERS SHOP DRAWINGS.

5.0 NON-STRUCTURAL ELEMENTS

.1 THESE DRAWINGS DO NOT INCLUDE NON-STRUCTURAL ELEMENTS WHICH ARE TO BE DESIGNED, DETAILED AND FIELD REVIEWED BY A SPECIALTY ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA, WHO SHALL ALSO PROVIDE LETTERS REQUIRED BY THE AUTHORITY HAVING JURISDICTION. THE SPECIALTY ENGINEER SHALL COORDINATE HIS WORK WITH THESE DOCUMENTS AND THOSE OF THE OTHER DISCIPLINES ON THE PROJECT.

NON-STRUCTURAL ELEMENTS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:

- MASONRY VENEER AND GLASS BLOCK AND THEIR ATTACHMENT TO THE BUILDING STRUCTURE,
- NON-LOADBEARING MASONRY,
- ARCHITECTURAL PRECAST CONCRETE AND PRECAST CLADDING,
- EXTERIOR AND INTERIOR STUD WALLS, GLAZING SYSTEMS, SIDING AND CLADDING,
- TIMBER AND STEEL STAIRS,
- HANDRAILS AND GUARDRAILS AND OTHER ARCHITECTURAL COMPONENTS SUCH AS CANOPIES, CEILINGS, MILLWORK, SKYLIGHTS AND FLAG POLES, NON-STRUCTURAL CONCRETE TOPPINGS,
- FALL RESTRAINT ANCHORS AND THEIR ATTACHMENT,
- ELEVATORS, ESCALATORS AND CONVEYING SYSTEMS,
- WINDOW WASHING EQUIPMENTS,
- MECHANICAL AND ELECTRICAL EQUIPMENT, THEIR ATTACHMENT TO THE BUILDING STRUCTURE AND SEISMIC RESTRAINT,
- LANDSCAPING ELEMENTS SUCH AS LIGHT POLES, BENCHES AND FREE-STANDING PLANTERS.

.2 SHOP DRAWINGS FOR NON-STRUCTURAL ELEMENTS SHALL BE SUBMITTED TO THE PROJECT ENGINEER FOR REVIEW OF THE ITEMS IMPACT ON THE BUILDING STRUCTURE ONLY.

6.0 FIELD REVIEWS

.1 THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A MINIMUM OF 48 HOURS (2 WORKING DAYS) ADVANCE NOTICE FOR FIELD REVIEWS.

.2 THE FOLLOWING FIELD REVIEWS ARE CONSIDERED TO BE THE MINIMUM NUMBER OF STRUCTURAL FIELD REVIEWS REQUIRED FOR THE PROJECT:

CONCRETE: REINFORCING STEEL SHALL BE REVIEWED PRIOR TO PLACING CONCRETE. REINFORCING IN CONCRETE SHALL BE REVIEWED PRIOR TO “BUTTONING UP” WALL FORMS.

TIMBER: FRAMING SHALL BE REVIEWED PRIOR TO COVERING ANY FRAMING AND BEFORE ADDITIONAL LOADS SUCH AS CONCRETE TOPPING AND MECHANICAL EQUIPMENT ARE APPLIED.

STEEL: STRUCTURAL STEEL SHALL BE REVIEWED AFTER THE MEMBERS HAVE BEEN FABRICATED AND ARE IN THEIR FINAL POSITION WITH ALL CONNECTIONS COMPLETE AND ALL BOLTS INSTALLED AND TIGHTENED.

.3 IF THE ENGINEER IS NOT PROVIDED WITH THE OPPORTUNITY TO PERFORM THE REQUIRED FIELD REVIEWS, FINAL CERTIFICATION OF THE PROJECT WILL NOT BE ISSUED.

7.0 FOUNDATIONS

.1 REFER TO GEOTECHNICAL REPORT PREPARED BY:

LEWKOWICH ENGINEERING ASSOCIATES LTD
FILE#: F6903.02
DATED: JULY 12, 2019

.2 DESIGN VALUES:

FACTORED BEARING RESISTANCE	BEARING PRESSURE FOR SETTLEMENT
325 kPa (6787 psf)	250 kPa (5221 psf)

.3 CENTRE ALL FOOTINGS UNDER COLUMNS AND WALLS UNLESS NOTED OTHERWISE.

.4 FOUNDATION BEARING MATERIAL SHALL BE PROTECTED FROM RAIN, FROST, SNOW AND WATER INFILTRATION. NO FOUNDATIONS SHALL BE POURED BEFORE BEARING MATERIAL HAS BEEN REVIEWED AND APPROVED BY GEOTECHNICAL ENGINEER. THE GEOTECHNICAL ENGINEER SHALL BE PROVIDED WITH NOTICE PRIOR TO CONCRETE POURS AS DESCRIBED IN "FIELD REVIEWS".

.5 FOOTING DEPTHS INDICATED ON THE DRAWINGS AND IN GEOTECHNICAL REPORT ARE GENERAL AND REPRESENT MINIMUM VALUES TO BE USED. FIRM BEARING DEPTHS FOR FOOTINGS AND FILL SHALL BE ESTABLISHED FROM THE GEOTECHNICAL REPORT AT THE TIME OF TENDERING. ANY QUERIES REGARDING THE ESTABLISHMENT OF THESE DEPTHS SHALL BE DIRECTED TO THE GEOTECHNICAL ENGINEER. VARIABLE SITE SOIL CONDITIONS, UNDERGROUND SERVICES AND EXISTING STRUCTURES MAY REQUIRE ADJUSTMENT OF FOOTING DEPTHS. THE CONTRACTOR SHALL MAKE ALLOWANCES FOR MINOR VARIATIONS IN FOOTING DEPTHS IN HIS BID. CONTACT GEOTECHNICAL AND STRUCTURAL ENGINEER FOR INSTRUCTIONS REGARDING SITE CONDITIONS THAT DIFFER FROM WHAT IS SHOWN ON DRAWINGS AND INDICATED IN THE GEOTECHNICAL REPORT.

.6 CONTRACTOR SHALL COORDINATE CONSTRUCTION OF FOUNDATIONS WITH UNDERGROUND SERVICES AS SHOWN ON CIVIL, MECHANICAL, ELECTRICAL, AND ARCHITECTURAL DRAWINGS. CONFLICTS SHALL BE REPORTED TO THE ARCHITECT FOR RESOLUTION.

.7 UNLESS NOTED OTHERWISE, THE MINIMUM ASSUMED COMPACTION UNDER ALL FOOTINGS AND SLABS FOR COMPACTED GRANULAR FILLS IS 98% CORRECTED STANDARD PROCTOR DENSITY. GEOTECHNICAL ENGINEER OR TESTING AGENCY TO CONFIRM PRIOR TO PLACING CONCRETE.

.8 THE BASE COURSE BELOW SLABS ON GRADE SHALL BE COMPOSED OF INERT, CLEAN, TOUGH, DURABLE CRUSHED AGGREGATE, UNIFORM IN QUALITY AND FREE FROM SOFT OR DISINTEGRATED PIECES. THE AGGREGATE PARTICLES SHALL BE UNIFORM IN QUALITY AND FREE FROM AN EXCESS OF FLAT OR ELONGATED PARTICLES. IN THE ABSENCE OF SATISFACTORY PERFORMANCE RECORDS OVER A 5 YEAR PERIOD OF THE PARTICLE SOURCE OF AGGREGATE, ITS SOUNDNESS SHALL BE TESTED IN ACCORDANCE WITH ASTM C88 USING MAGNESIUM SULPHATE. MAXIMUM WEIGHTED AVERAGE LOSSES FOR COURSE AGGREGATE SHALL BE 20% AND FOR FINE AGGREGATE 25%. THE SAND EQUIVALENT VALUE WHEN TESTED IN ACCORDANCE WITH ASTM D2419 SHALL NOT BE LESS THAN 40. THE LOS ANGELES ABRASION VALUE WHEN TESTED IN ACCORDANCE WITH THE ASTM C131 SHALL HAVE A MAXIMUM LOSS BY MASS OF 25%. THE AGGREGATE GRADATION SHALL FALL WITHIN THE FOLLOWING LIMITS WHEN TESTED IN ACCORDANCE WITH ASATM C136:

SIEVE SIZE (US STD.):	25mm	19mm	9.5mm	4.75mm	2.36mm	1.18mm	0.3mm	0.075mm
% PASSING BY WEIGHT:	100	80-100	50-100	35-70	25-50	15-35	5-20	0-5

SUB-BASE BELOW THE BASE COURSE SHALL BE PIT RUN GRAVEL, AS SPECIFIED BY THE GEOTECHNICAL ENGINEER

END OF SECTION 01 11 01

PART 1 - GENERAL

1.1 Section Includes

.1 Location of site.

.2 Site conditions.

.3 Work covered by contract documents.

.4 Time of completion.

.5 Use of site.

1.2 Precedence

.1 Division 1 Sections take precedence over technical specification sections in other Divisions of these Project Specifications.

1.3 Related Sections

.1 Section 35 05 51 - Marine General Site Work.

1.4 Site Conditions

.1 Visit site before submitting tender. Make inquiries or investigations necessary to become thoroughly acquainted with site, soil, climatic and tidal conditions along with the nature and extent of the work.

.2 Submission of a tender will be deemed confirmation that the Contractor is familiar with the site and is conversant with all relevant conditions.

.3 All known discrepancies are to be brought to the attention of the Departmental Representative and are to be accounted for in the Contractor's Bid Price.

1.5 Location of Site

.1 The work is located at 6270 Jensen Cove Rd, Port Hardy, BC.

1.6 Work covered by Contract Documents

.1 The principal works to be executed and for which all materials, plant and labour are to be supplied by the Contractor as shown on in the plans and in the specifications:

- .1 Mobilization to site.
- .2 Receiving, transportation to site and installation of concrete float and vehicular steel ramp.
- .3 Supply, fabrication and installation of abutment structure.
- .4 Supply, fabrication and installation of steel pipe mooring piles, pile wells and fendering for concrete float.
- .5 Supply and installation of revetment.

.2 See Section 35 05 51 for Method of Measurement.

1.7 References

.1 National Research Council of Canada (NRC):

- .1 National Building Code of Canada (NBC) 2018.

.2 See Section 01 35 33 for additional references.

1.8 Codes and Standards

.1 Perform work in accordance with the National Building Code, the Workers' Compensation Board of B.C., and any other code of provincial or local application provided that, in any case of conflict or discrepancy, the most stringent requirements shall apply.

.2 Meet or exceed requirements of specified standards, codes and referenced documents.

.3 Use latest edition of standards and codes.

.4 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.

1.9 Documents Required

.1 Maintain at job site one copy of the following:

.1 Contract Drawings
.2 Contract Specifications
.3 Addenda
.4 Reviewed Shop Drawings, product data and samples;
.5 Change orders
.6 Other modifications to contract
.7 Field Test Reports
.8 Copy of all permits from Authorities Having Jurisdiction
.9 Permit Drawings (where applicable)
.10 Industrial Health and Safety Regulations of WorkSafe BC
.11 Copy of approved work schedule
.12 Manufacturer's installation and application instructions
.13 Health and Safety Plan and Fire Safety plan
.14 Environmental Emergency Response Plan (including Spill Response Plan)
.15 Record Drawings (working marked print)
.16 Site Instructions
.17 Site Reports
.18 WHMIS Documentation

.2 Departmental Representative may furnish additional drawings to assist proper execution of work. These documents will be issued for clarification only. Such documents will have the same meaning and intent as if they were included in the plans referred to in the Contract documents.

1.10 Record Drawings

.1 As work proceeds, maintain accurate records to show all deviations from the contract drawings. Note on as-built drawings as changes occur. At completion of work supply one set of all drawings and specifications clearly marked. Supply one set in CAD and pdf format.

1.11 Geotechnical Report

.1 Geotechnical investigation has been carried out by Lewkowich Engineering Associates Ltd. and the results are summarized in report "GEOTECHNICAL EVALUATION-WATERSIDE", File no. F6903.02, dated October 4th, 2019. Refer to relevant drawings and specifications for pile embedment information.

1.12 Datum

.1 All elevations or soundings used in the drawings and specifications refer to CGVD2013(CGG2013a), unless noted otherwise.

1.13 Layout of Work

.1 Departmental Representative may set stakes and establish bench marks to indicate the location, alignment and reference elevations for the work.

.2 Lay out work on the ground and execute the work to the Departmental Representative's satisfaction.

1.14 Assistance by the Contractor

.1 Place work vessels at the Departmental Representative's disposal as required for the Departmental Representative to perform his duties and inspections.

1.15 Time of Completion

.1 Complete works as stipulated in Invitation to Tender. Commence work immediately upon official notification of acceptance of offer and complete the project within TBD (##) weeks after contract award.

1.16 Work Schedule

.1 Within 10 days of Contract award, provide a schedule of work. Observe the following requirements:

.1 Whenever a variation from the schedule in excess of 5 working days occurs or is expected to occur, notify Departmental Representative of the change.

.2 Provide information as indicated below:

Materials Assembly Phase:

Materials	Supplier	Date of Delivery
Steel Piling		
Hardware		
Cast-in-place concrete		
Steel reinforcement		
Miscellaneous steel		
Fenders		
Revetment Rock		

Construction Phase:

Activity on site	Start	Complete
Start of Work at Site		
Taking over Owner supplied materials		
Supplying of Materials		
Revetment Installation		
Pile Fabrication and Installation		

Abutment Installation
Float Installation
Ramp Installation
End of Work at Site

.3 Notify Canadian Coast Guard – Department of Fisheries and Oceans, Regional Operation Centre no less than 5 days before start and completion of proposed activities at the site in order that they may issue Notices to Shipping.

Contact information is:
CCG
Regional Operational Centre Alerting Desk
Email: Notship.western@innav.gc.ca
Tel. 1-800-889-8852

1.17 Use of Site

.1 The Contractor will not have exclusive site access. The Contractor's activity must be coordinated with other users for a minimum operation disruption. The Contractor must coordinate and maintain access to site.

.2 Use of site: limited to immediate area of the work and areas assigned by the Department Representative for office storage, equipment, stock piles, sanitary facilities, etc.

.3 As there will be NO ACCESS to any of the buildings, the Contractor will provide sanitary facilities for the work force in accordance with governing regulations and ordinances.

.4 Delays and disruption suffered by the Contractor in the performance of the Work that are due to the facility remaining in operation, shall be considered incidental to the Work and no claims for additional financial compensation outside of the Contract Price shall be accepted.

.5 Vehicles entering and left in the designated work area must have the Contractor's logo/name clearly marked on the vehicle.

.6 Arrange parking in areas directed by Department Representative. Maintain construction parking area clean and free of construction related debris. Make good damage resulting from the Contractor use of parking areas, at no cost to the Contract.

.7 Confine work and operations of employee to areas defined by the Contract Documents unless directed otherwise in writing by the Department Representative. Do not unreasonably encumber premise with products.

.8 Hours of work.

.1 Perform work between normal hours of 07:00 to 18:00, Monday to Friday, except holidays and in accordance with local noise bylaws.

.2 Work may be performed after working hours, on weekends and holidays as approved by Departmental Representative.

.9 Temporary power and light.

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, and any other power requirements necessary for completion of the Work.

.2 Provide and maintain temporary lighting necessary for the performance of the Work under this contract. Illumination levels shall be in accordance with WorkSafe BC requirements.

1.18 Project Meetings

.1 Meet with Departmental Representative within 5 days of Award of Contract date, to establish scope of Work and approach to project construction operations

.2 The Departmental Representative will arrange project meetings and assume responsibility for setting times. The Contractor will be responsible for recording and distributing minutes.

1.19 Location of Equipment and Fixtures

.1 Location of existing equipment and fixtures indicated or specified is to be considered as approximate.

1.20 Material and Equipment

.1 Metric-Sized Products:

.1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.

.2 The Contractor is required to provide metric products where specified in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

.3 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric-sized products which are available on the Canadian market will not be considered sufficient reasons claiming that they cannot be provided.

.4 Claims for additional costs due to provision of specified modular metric-sized products will not be considered.

.2 Material and Equipment:

.1 Use new material and equipment unless otherwise specified.

.2 Within ten (10) days of written request by Departmental

Representative, submit following information for any or all materials and products proposed for supply:

.1 Name and address of manufacturer.

.2 Trade name, model and catalogue number.

.3 Performance, descriptive and test data.

.4 Manufacturer's installation or application instructions.

.5 Evidence of arrangements to procure.

.3 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.

.4 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.

.5 Specifications for materials supplied by Owner are shown in Appendices F, G and H.

.3 Manufacturer's Instructions:

.1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.2 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental will designate which document is to be followed.

.4 Fastenings, General:

.1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.2 Obtain Departmental Representative's approval before using explosive-actuated fastening devices.

.3 Comply with CAN3-Z166-M85 Series when using explosive-actuated fastening devices.

.5 Fastenings, Equipment:

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

.6 Delivery and Storage:

.1 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.

.2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.

.3 Store material and equipment in accordance with suppliers'

instructions.

.4 Touch up damaged factory-finished surfaces to Departmental Representative's satisfaction. Use primer or enamel to match original. Do not paint over name plates.

.6 Owner supplied materials will be available for transportation by the Contractor at the following locations:

Owner Supplied Material	Pick-up Location
Concrete Float	On the water at the Fraser River, Annacis Island, Delta, BC.
Steel Ramp	On land at the Institute of Ocean Sciences, Sidney, BC.

.7 The Contractor will take over Owner supplied equipment and materials, will inspect all supplies and will report any damages and shortages within 5 working days. The Contractor will be responsible for all loading, handling, transportation and storing on the site.

.8 The Contractor to have representative present on site to accept all deliveries to site and is responsible for unloading.

.7 Construction Equipment and Plant:

.1 On request, prove to the satisfaction of Departmental Representative that the construction equipment and plant are adequate to manufacture, transport, place and finish work to quality and production rates specified. If inadequate, replace or provide additional equipment or plant as directed.

.2 Maintain construction equipment and plant in good operating order.

1.21 Shop Drawing Review

.1 The review of shop drawings by Departmental Representative is for the sole purpose of ascertaining conformance with the general concept.

.2 This review shall not mean that Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents.

.3 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to

techniques of construction and installation and for co-ordination of the work of all sub-trades.

1.22 Testing and Inspected Services

.1 Particular requirements for inspection and testing to be carried out by testing service or in laboratory approved by Departmental Representative are specified under various sections.

.2 Contractor will appoint and pay for services of testing laboratory including the following:

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

.2 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.

.3 Mill tests and certificates of compliance.

.4 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.

.5 Additional tests specified in paragraph following.

.3 Where tests or inspections performed by the testing service reveal work is not in accordance with the contract requirements, Contractor shall pay costs for additional tests or inspections as Departmental Representative may require, to verify acceptability of corrected work.

.4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.

.5 Provide Departmental Representative with a copy of testing laboratory reports as soon as they are available.

1.23 Sleeves, Hangers and Inserts

.1 Provide and set sleeves where conduits pass through masonry or concrete. Pack sleeves with glass or mineral wool. Obtain Departmental Representative's approval before cutting for sleeves. Provide and install hangers and inserts where required.

1.24 Interpretation

.1 In interpreting the Contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.

.2 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between:

.1 the Plans and Specifications, the Specifications govern;

.2 the Plans, the Plans drawn with the largest scale govern; and

.3 figured dimensions and scaled dimensions, the figured dimensions govern.

.4 the Plans and Specifications govern over the appendices.

PART 3 - EXECUTION

Not applicable

END OF SECTION 01 11 05

1.0 GENERAL

1.1 CODES

.1 Perform work in accordance with National Building Code of Canada (NBCC) 2015, BCBC 2018 and other indicated Codes, Construction Standards and/or any other Code or Bylaw or local application.

.2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.

.3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.

.4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

1.2 DESCRIPTION OF WORK

.1 Work under this Contract comprises, but is not limited to, the provision of all labour, materials, services and equipment necessary for the demolition and construction of: The DFO Ocean Protection Plan Depot at 6270 Jensen Cove Road

1.3 CONTRACT DOCUMENTS

.1 The Contract documents, drawings and specifications are intended to complement each other.

.2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.4 CONTRACT DOCUMENTS

.1 Submit preliminary construction schedule to Departmental Representative during Pre-Construction meeting.

.2 After review, revise and resubmit schedule. Submit final full schedule within 2 weeks after Pre-Construction meeting.

.3 During progress of Work revise and resubmit with the monthly progress payment draw to the Departmental Representative.

1.5 TIME OF COMPLETION

.1 Commence work immediately upon official notification of acceptance of offer and complete the project within fifty-seven (57) weeks after contract award.

1.6 HOURS OF WORK

.1 Hours of work:

.1 Carry out noise generating work Monday to Friday from 07:00 to 17:00.

1.7 WORK SCHEDULE

.1 Carry out work as follows:

.1 Within 10 working days after Contract award, submit Bar (GANTT) chart as per specification sections 01 32 16.07 Construction Progress Schedule Bar (GANTT) chart. Indicate the following:

.1 Submission of shop drawings, product data, MSDS sheets and samples.

.2 Commencement and completion of work of each section of the specifications or trades for each phase as outlined.

.3 Final completion date within the time period required by the Contract documents.

.2 Do not change approved Schedule without notifying Departmental Representative.

.3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative. A copy of the updated schedule will be provided with the monthly progress payment.

1.8 WALK THROUGH FIELD REVIEW BY DEPARTMENTAL REPRESENTATIVE

.1 Departmental Representative will carry out the following:
- .1 Walk-through field review of the work with contractor's representatives.
- .2 Preparation and distribution of the Walk-through field review Reports. Reports will be distributed after field review

1.9 SUBMITTALS

.1 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative utilizing Request for Information forms.

.2 Process substitutions through Departmental Representative.

.3 Deliver closeout submittals for review and inspections, for transmittal to Departmental Representative.

1.10 DIVISION OF SPECIFICATIONS

.1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.

.2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.

.3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.11 DOCUMENTS REQUIRED

.1 Maintain one copy each of the following at the job site:
- .1 Contract drawings.
- .2 Contract specifications.
- .3 Addenda to Contract documents.
- .4 Copy of work schedule.
- .5 Reviewed shop drawings.
- .6 Change orders.
- .7 Other modifications to Contract.
- .8 Field test reports.
- .9 Reviewed samples.
- .10 Manufacturer's installation and application instructions.
- .11 One set of record drawings and specifications for "as-built" purposes.
- .12 National Building Code of Canada 2015.
- .13 Current construction standards of workmanship listed in technical Sections.
- .14 Building Safety Plan.
- .15 Building Permit
- .16 Request for Information (RFI)
- .17 Contemplated Change Notices

.18 WHMIS Documents
.19 Site Instructions
.20 Contractor's Health and Safety Plan, including map to nearest hospital.

1.12 REGULATORY REQUIREMENTS

.1 Building Permit
.1 Building permit is not required for this project. Obtain other trades permits required by regulatory municipal and provincial authorities to complete the work.

.2 Provide inspection authorities with plans and information required for issue of acceptance certificates.

.3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.

.4 Comply with conditions as stated in Standard Acquisition Clauses and Conditions (SACC) Manual.

1.13 CONTRACTOR'S USE OF SITE

.1 Use of site:
.1 Exclusive and complete for execution of work.
.2 Assume responsibility for assigned premises for performance of this work.
.3 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
.4 Provide security of Contractor's work site and all Contractors and Subcontractor's equipment and material. Secure Contractor's work site at the end of each work day.
.5 Perform work in accordance with the Contract documents. Ensure work is carried out in accordance with indicated phasing.
.6 Do not unreasonably encumber site with material or equipment
.7 Any area of the property to which access is restricted by sign is a secured or restricted area and shall not be entered.
.8 Do not obstruct access to PWGSC property outside of the Contractor's work site. Maintain overhead clearances, keep roadways and walkways clear, and maintain routes for emergency response vehicles.

.2 Perform work in accordance with Contract documents. Ensure work is carried out in accordance with approved schedules.

.3 Do not unreasonably encumber site with material or equipment.

.4 Coordinate with Departmental Representative for material storage on site which belongs to the project but waiting to be installed.

1.14 EXAMINATION

.1 Examine site and be familiar and conversant with existing conditions likely to affect work.

1.15 EXISTING SERVICES

.1 Where Work involves breaking into or connecting to existing services, carry out work as directed by Departmental Representative or the authority having jurisdiction.

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

.3 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.16 LOCATION OF EQUIPMENT AND FIXTURES

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

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative at least 48 hours prior to impending installation and obtain approval for actual location.

.4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

1.17 CUTTING AND PATCHING

.1 Cut existing surfaces as required to accommodate new work.

.2 Remove items so shown or specified.

.3 Do not cut, bore, or sleeve load-bearing members.

.4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.

.5 Fit work airtight to pipes, sleeves, ducts and conduits.

.6 Conceal pipes, ducts and wiring in raised floors, wall and ceiling construction of finished areas except where indicated otherwise.

.7 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.

.8 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.

1.18 SETTING OUT OF WORK

1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.

.2 Provide devices needed to lay out and construct work.

.3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

1.19 ACCEPTANCE OF SUBTRADES

1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the General Contractor. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.20 QUALITY OF WORK

.1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.

.2 The workmanship, erection methods and procedures to meet minimum standards set out in the National Building Code of Canada 2015 and Construction Standards as specified herein.

.3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

1.21 WORKS COORDINATION

.1 Coordinate work of sub-trades:
- .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.

.2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
- .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
- .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
  - .1 Pay particularly close attention to overhead work above ceilings and within or near to building structural elements.
  - .2 Identify on coordination drawings, building elements, services lines, rough-in points and indicate location services entrance to site.
- .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
- .4 Publish minutes of each meeting.
- .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
- .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.

.3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.

.4 Work cooperation:
- .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
- .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
- .3 Ensure disputes between subcontractors are resolved.
- .4 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
- .5 Maintain efficient and continuous supervision.

1.22 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 In accordance with Section 01 33 00, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.

.2 Allow sufficient time for the following:
- .1 Review of product data.
- .2 Approval of shop drawings.
- .3 Review of re-submission.
- .4 Ordering of approved material and/or products. Refer to individual technical sections of specifications.

1.23 PROJECT MEETINGS

.1 Contractor will arrange project site meetings and assume responsibility for setting times and recording and distributing minutes. Refer to section 01 31 19.

1.24 TESTING AND INSPECTION

.1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified in Sections 01 45 00.

.2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.
  - .1 Mill tests and certificates of compliance.
  - .2 Tests specified in the contract documents to be carried out by Contractor which may be under the Departmental Representative's supervision.

.3 Within 15 working days after Contract award provide a list of proposed testing services or testing laboratories for Departmental Representative’s approval.

.4 The Departmental Representative may require, and pay for, additional inspection and testing services not included in paragraph 1.24.2.

.5 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.

.6 Contractor shall furnish labour and facilities to carry out specified testing and notify Departmental Representative in advance of planned testing.

.7 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.8 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.

.9 Provide Departmental Representative with 2 copies of testing laboratory reports as soon as they are available.

1.25 SURVEYING

.1 All construction layout and final accurate construction records shall be the responsibility of the contractor and shall be set by a licensed land surveyor in the Province of British Columbia.

.2 Contractor to submit name of licensed land surveyor to PWGSC during first project meeting (startup meeting).

1.26 AS-BUILT DOCUMENTS

.1 The Departmental Representative will provide 8 sets of drawings and 4 sets of specifications and PDF files, including 2 sets of drawings and specification and original AutoCAD files for “as-built” purposes.

.2 Keep one set of current white prints of all contract drawings and all addenda, revisions, clarifications, change orders, and reviewed shop drawings in the site office; and have them available at all times for inspection by the Consultant.

.3 As the work progresses, maintain accurate records to show all deviations from the Contract

documents. Note on as-built specifications, drawings and shop drawings as changes occur.

.4 Provide accurate as-built drawings by a qualified professional surveyor identifying the various elements shown on the drawings in the requested format. As-built survey is to be provided in UTM/Geodetic coordinates compatible with NAD83.

.5 At completion of the Work, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings and change order, to a set of Issued for Construction drawings. Submit the 'red-marked' as-built set to the Departmental Representative in hard copy with contractor's review stamp and date confirming that the set submitted are a true record of "as-built" information.

.6 Refer to Section 01 78 00 – Close-out Submittals.

1.27 CLEANING

.1 Refer to Section 01 74 00 – Cleaning and Waste Management.

1.28 DUST CONTROL

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

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

1.29 ENVIRONMENTAL PROTECTION

.1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.

.2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.

.3 Ensure proper disposal procedures in accordance with all applicable territorial regulations.

1.30 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

.1 Specific requirements for maintenance materials, tools and spare parts are specified in individual technical sections of specifications.

.2 Also refer to Appendix for complete list of spare parts, fixtures, and equipment required for this project.

1.31 ADDITIONAL DRAWINGS

.1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with drawings referred to in the Contract Documents.

.2 Departmental Representative will furnish up to a maximum of eight (8) sets of Contract drawings and four (4) sets of specification for use by the Contractor at no additional cost. PDF files of all documents will be provided. Should more documents be required, the Departmental Representative will provide them at additional cost.

1.32 BUILDING SMOKING ENVIRONMENT

.1 Smoking within the building and within 7.5m of all air intakes is not permitted.

1.33 SYSTEM OF MEASUREMENT

.1 The metric system of measurement (SI) will be employed on this Contract.

1.34 FAMILIARIZATION WITH SITE

.1 Before submitting tender, visit site as indicated in tender documents and become familiar with all conditions likely to affect the cost of the work.

1.35 SUBMISSION OF TENDER

.1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

1.36 COST BREAKDOWN

.1 Before submitting the first progress claim, submit a breakdown of the Contract price in detail as directed by the Departmental Representative and aggregating Contract price. After approval, the cost breakdown will form the basis of progress payments.

.2 Within 2 weeks after award of contract, provide a monthly cash flow projection for the whole contract period in detail as directed by Departmental Representative. Contractor should provide a monthly update of the cash flow projection according to the actual work schedule.

1.37 RELICS & ANTIQUITIES

.1 Relics and antiquities and items of historical or scientific interest shall remain property of Department. Protect such articles and request directives from Departmental Representative.

.2 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during excavation/construction, and await Departmental Representative's written instructions before proceeding with work in this area.

.3 Departmental Representative may assign a qualified archaeologist to monitor the site during ground disturbing activities.

1.38 TREE REMOVAL

.1 Any tree removal required to complete the project shall be performed by an experienced tree services company with fallers and buckers that are certified in the province of British Columbia.

1.39 BUSINESS LICENSES FOR CONSTRUCTION PROJECTS

.1 Contractor and all subcontractors must maintain a valid business license as required by any agency having jurisdiction for the duration of their work on site.

1.40 STOCKPILE MATERIAL

.1 The contractor must inform Departmental Representative of the area required for the stockpile area so as to ensure access is maintained. Departmental Representative will make the final decision if the contractor's proposed stock pile area is acceptable or not.

1.41 SUBSTANTIAL COMPLETION

1. Substantial completion includes commissioning and functional use of the project in addition to the requirements under the terms and conditions of the Contract listed in the Standard Acquisition Conditions and Clauses. Substantial completion of the project will only be achieved upon completion of both phases of work.

1.42 CLOSEOUT PROCEDURES

.1 Notify Departmental Representative when Work is considered Substantially Complete. Contractor to prepare list of defects, deficiencies and incomplete work prior to inspection by Departmental Representative. Follow procedures as outlined in Section 01 78 00 – Closeout Submittals.

.2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.

.3 Comply with Departmental Representative's instructions for correction of items of Work listed in deficiency list.

.4 Notify Departmental Representative of completion of items of Work determined in Departmental Representative's final inspection.

END OF SECTION 01 11 55

1.0 GENERAL

1.1 ADMINISTRATIVE

.1 Schedule and administer site meetings throughout the progress of the work on a regular basis or at the call of Departmental Representative.

.2 Prepare and distribute agenda at least three (3) days prior to the meetings.

.3 Distribute written notice of each meeting seven (7) days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within five (5) days after meetings and transmit to meeting participants and affected parties not in attendance, Departmental Representative and Consultants.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRE-CONSTRUCTION MEETING

.1 Within 15 days after award of Contract: Departmental Representative will request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Attendance will include, but is not limited to, the Departmental Representative, members of the Canadian Coast Guard and Department of Fisheries and Oceans.

.3 Departmental Representative to establish time and location of preconstruction meeting, Contractor to notify parties concerned a minimum of 4 working days before meeting.

.4 Departmental Representative will chair the meeting, record minutes and issue minutes.

.5 Agenda to include:

- .1 Introduction of official representative of participants in the Work.
- .2 Start date on site.
- .3 Communication Protocol for submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00 - Temporary Facilities.
- .5 Site safety in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .6 Communication Protocol for proposed changes, change orders, procedures, approvals required.
- .7 Owner’s Work.
- .8 Record drawings in accordance with Section 01 78 00 - Closeout Submittals.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.

1.3 PROGRESS MEETINGS

.1 During course of Work and two weeks prior to Project Completion, schedule progress meetings bi-weekly.

.2 Attendance to include but is not limited to Departmental Representative, Canadian Coast Guard, DFO, Contractor, and major subcontractors.

.3 Contractor responsible to record minutes of meetings and circulate to attending parties and affected parties not in attendance within five (5) days after meeting.

.4 Record next meeting dates in the meeting minutes or notify parties minimum of seven (7) days in advance for other ad-hoc meetings.

.5 Agenda to include, at a minimum, the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of Health and Safety including any incidents, near misses, and WorkSafe BC visits.
- .3 Review of Work progress since previous meeting.
- .4 Coordination discussions with Canadian Coast Guard, DFO.
- .5 Construction schedule review.
- .6 Review of off-site fabrication delivery schedules.
- .7 Corrective measures and procedures to regain projected schedule.
- .8 Request for Information (RFI) log review.
- .9 Engineering Disciplines Reviews.
  - .1 Architectural
  - .2 Structural
  - .3 Mechanical
  - .4 Electrical
  - .5 Civil
  - .6 Marine
- .10 Change order log review.
- .11 Review submittal schedule.
- .12 Review updated as built.
- .13 Review and resolve site issues.
- .14 New business.

END OF SECTION 01 31 19

1.0 GENERAL

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 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 Departmental Representative 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 10 working 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.

.5 Clearly show sequence and interdependence of construction activities and indicate:

- .1 Start and completion of all items of Work, their major components and interim milestones completion dates.
- .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
  - .1 Time for submittals, re-submittal and review.
  - .2 Time for fabrication and delivery of manufactured products for Work.
  - .3 Interdependence of procurement and construction activities.
- .3 Include sufficient detail for project activities to assure adequate planning and execution of

work. Activities should generally range in duration from 3 to 15 days each.

.4 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated to allow coordination and control of project activities. Show continuous flow from left to right.

.5 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being whenever possible, continuous series of activities throughout length of project to form critical path.

1.3 SUBMITTALS

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

.2 Submit to Departmental Representative within 28 working days after Award of Contract Project schedule in form of Bar (GANTT) Chart for planning, monitoring and reporting of project progress.

1.4 REVIEW OF THE SCHEDULE

.1 Allow 10 working days for Departmental Representative to review proposed schedule. Make necessary changes to proposed schedule within 5 days.

.2 Submit letter ensuring the schedule has been prepared in coordination with major subcontractors and suppliers.

.3 Promptly provide additional information to validate practicability of schedule as required by Departmental Representative.

.4 Submittal of Schedule indicates that it meets Contract Requirements and will be executed generally in sequence.

1.5 COMPLIANCE WITH SCHEDULE

.1 Comply with reviewed schedule.

.2 Proceed with significant changes and deviations from schedule sequence of activities which cause delay only after review by Departmental Representative.

.3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.

.1 Corrective measures may include:

.1 An increase of personnel on the site for effective activities or work packages.

.2 An increase in materials and equipment.

.3 Additional work shifts, longer hours.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule that shows milestone and activity types and expand from the following items:

.1 Award.

.2 Shop Drawings, Samples and Approvals.

.3 Permits.

.4 Mobilization.

.5 Mock-ups and Approvals.

.6 Procurement.

.7 Construction.

.8 Installation.

.9 Site Works.

.10 Training.

1.7 PROJECT SCHEDULE REPORTING

.1 On an ongoing basis, schedule on job site must show “progress to date”. Arrange participation on and off site of subcontractor and suppliers, as and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once monthly to establish progress on each current activity shown on applicable networks.

.2 Maintain a daily log of progress of the work:

.1 Submit daily force report to Departmental Representative daily prior to noon the following day indicating:

.1 Total number of personnel on site.
.2 Major subcontractors on site listed by trade.
.3 Major equipment on site, i.e. excavators, cranes, drills.
.4 Concrete volumes.
.5 Visitors to site.
.6 Weather
.7 Documents required from Departmental Representative to Contractor to maintain.

.3 Perform schedule update monthly dated on last working day of the month. Update to reflect activities completed to date, activities in progress, logic and duration changes.

.4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.

.5 Requirements for monthly progress monitoring and reporting are basis for progress payment request.

.6 Submit monthly schedule updates with the progress payment request.

.7 Submit monthly written reports based on schedule, showing Work to Date performed, comparing work progress planned and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work Schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:

.1 Description of progress made.
.2 Pending items and status of: Permits, shop drawings, samples, mockups, deliveries, change orders, possible time extension.
.3 Status of Contract Completion Date and Milestones.
.4 Current and Anticipated problem areas, potential delays and corrective measures.

.8 Submit weekly 3 week look ahead schedule to Departmental Representative on each Friday of the Week indicating the planned tasks of the next three week period.

1.8 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.

1.0 GENERAL

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative 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 SI Metric units.

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

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

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

.11 Do not proceed with work until relevant submissions are reviewed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 When specified in the Contract document, submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia of Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 10 days for Departmental Representative's review of each submission, unless noted otherwise.

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

.6 Make changes in shop drawings as Departmental Representative may require consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

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

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

.9 After Departmental Representative's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification sections and as Departmental Representative may reasonably request.

.11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .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 3 years of date of contract award for project.

.13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
- .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.

.14 Submit electronic copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Departmental Representative.
- .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.

.15 Submit copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

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

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

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

.22 Shop drawings format larger than 11” x17” (275mm x 430mm) must be submitted with hardcopies together with electronic format. Submit sufficient copies such that Departmental Representative will keep 5 copies plus contractor’s distribution and maintenance manual.

.23 Electronic submissions will only be reviewed and returned electronically. No hardcopies will be returned to contractor.

.24 All electronic submissions to be uploaded to Document Control System Collaborative site hosted by PWGSC. Contractor will be responsible for becoming familiar with and utilizing the system.

1.3 SAMPLES

.1 Submit for review samples in duplicate as required in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

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

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

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

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

1.4 MOCK-UPS

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

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Viewpoints and their locations as reasonably determined by Departmental Representative.

.4 Provide photographic documentation of adjacent existing conditions prior to commencement of construction for determining and accidental damage as a result of contractor’s work.

.5 Frequency of photographic documentation: monthly as directed by Departmental Representative.

.1 Upon completion of: demolition, framing and services before concealment of Work, and as directed by Departmental Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Submit electronic copies of test results and inspection reports required as noted in each section of specifications.

END OF SECTION 01 33 00

PSPC Update on Asbestos Use
Effective April 1, 2016, all Public Service and Procurement Canada (PSPC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html

1.0 GENERAL

1.1 REFERENCES

.1 Government of Canada.
- .1 Canada Labour Code - Part II
- .2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC):
- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 The Canadian Electric Code (as amended)

.4 Canadian Standards Association (CSA) as amended:
- .1 CSA Z797-2009 Code of Practice for Access Scaffold
- .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
- .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 CSA Z1006-10 Management of Work in Confined Spaces.
- .5 CSA Z462- Workplace Electrical Safety Standard

.5 National Fire Code of Canada 2015 (as amended)
- .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.

.6 American National Standards Institute (ANSI):
- .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.7 Province of British Columbia:
- .1 Workers Compensation Act Part 3-Occupational Health and Safety.
- .2 Occupational Health and Safety Regulations

1.2 RELATED SECTIONS

.1	Construction progress schedule:	Section 01 32 16
.2	Submittals procedures:	Section 01 33 00
.3	Temporary utilities:	Section 01 51 00
.4	Construction facilities:	Section 01 52 00
.5	Temporary barriers and enclosures:	Section 01 56 00
.6	Structure demolition:	Section 02 41 16
.7	Asbestos Remediation:	Section 02 82 00

1.3 WORKERS' COMPENSATION BOARD COVERAGE

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

.1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 013300.

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

.3 Submit the following:

.1 Site Specific Health and Safety Plan.

.2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Complete set of current Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.

.5 Emergency Procedures.

.4 The Departmental Representative will review the Contractor's Site Specific Health and Safety Plan and emergency procedures, and provide comments to the Contractor within [5] days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Represe

.6 Submission of the Site Specific Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:

.1 Be construed to imply approval by the Departmental Representative.

.2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

.3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

.1 Assume responsibility as the Prime Contractor for work under this contract.

.2 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.

.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.

1.7 HEALTH AND SAFETY COORDINATOR

.1 The Health and Safety Coordinator:

.1 Be responsible for completing all health and safety training and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, revising, daily enforcing, and monitoring the Site Specific Health and Safety Plan.

.3 Be on site during execution of work.

1.8 GENERAL CONDITIONS

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site at night time [or provide security guard] as deemed necessary to protect site against entry.

1.9 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Multi-employer work site.

.2 Federal employees and general public.

.2 Other safety hazards or risks which may be encountered include, but are not limited to:

.1 Contact with traveling and mobile cranes, forklifts, manlifts and other motorized vehicles.

.2 Overhead hazards such as that created by material transported by cranes.

.3 Fall hazards.

.4 Drowning hazards.

.5 Confined space hazards.

.6 Electrical hazards.

.7 Contact with operating mechanical, electrical, electronic, pneumatic, thermal, and hydraulic machinery and equipment.

.8 Fire hazards.

1.10 UTILITY CLEARANCES

.1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work

.2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

1.11 REGULATORY REQUIREMENTS

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.12 WORK PERMITS

.1 Obtain specialty permit[s] related to project before start of work.

1.13 FILING OF NOTICE

.1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

1.14 HEALTH AND SAFETY PLAN

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
- .1 Primary requirements:
  - .1 Contractor's safety policy.
  - .2 Identification of applicable compliance obligations.
  - .3 Definition of responsibilities for project safety/organization chart for project.
  - .4 General safety rules for project.
  - .5 Job-specific safe work procedures.
  - .6 Inspection policy and procedures.
  - .7 Incident reporting and investigation policy and procedures.
  - .8 Occupational Health and Safety Committee/Representative procedures.
  - .9 Occupational Health and Safety meetings.
  - .10 Occupational Health and Safety communications and record keeping procedures.
- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
- .3 List hazardous materials to be brought on site as required by work.
- .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Site Specific Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 EMERGENCY PROCEDURES

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
- .1 Designated personnel from own company.
- .2 Regulatory agencies applicable to work and as per legislated regulations.
- .3 Local emergency resources.
- .4 Departmental Representative.

.2 Include the following provisions in the emergency procedures:
- .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
- .2 Evacuate all workers safely.
- .3 Check and confirm the safe evacuation of all workers.
- .4 Notify the fire department or other emergency responders.
- .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
- .6 Notify Departmental Representative and site staff.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:
- .1 Work at high angles.
- .2 Work in confined spaces or where there is a risk of entrapment.
- .3 Work with hazardous substances.

.4 Underground work.
.5 Work on, over, under and adjacent to water.
.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

1.16 HAZARDOUS PRODUCTS

.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 the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:
.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.
.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
.3 Provide adequate means of ventilation in accordance with Section 01 51 00.
.4 The contractor shall ensure that the product is applied as per manufacturers recommendations.
.5 The contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

1.17 ASBESTOS HAZARD

.1 Carry out any activities involving asbestos in accordance with applicable Provincial regulations.

.2 Removal and handling of asbestos will be performed as indicated in Section 02 82 00.

1.18 PCB REMOVALS

.1 Mercury-containing fluorescent tubes and ballasts which contain polychorinated biphenyls (PCBs) are classified as hazardous waste.

.2 Remove, handle, transport and in accordance with applicable provincial regulations.

1.19 REMOVAL OF LEAD-CONTAINING PAINTS

.1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.

.2 Carry out demolition activities involving lead-containing paints in accordance with applicable Provincial regulations.

1.20 ELECTRICAL SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.
.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.21 ELECTRICAL LOCKOUT

1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.22 OVERLOADING

1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.23 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1- 1975 (R2003).

1.24 SCAFFOLDING

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 and B.C. Occupational Health and Safety Regulations.

1.25 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with Provincial regulations

1.26 POWDER-ACTUATED DEVICES

.1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.27 FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.28 FIRE SAFETY REQUIREMENTS

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the DR is required prior to any gas or diesel tank be brought onto the work site.

1.29 FIRE PROTECTION AND ALARM SYSTEM

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut off.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.30 UNFORESEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.31 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:

.1 Site Specific Health and Safety Plan.
.2 Sequence of work.
.3 Emergency procedures.
.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
.5 Notice of Project.
.6 Floor plans or site plans.
.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
.8 Workplace Hazardous Materials Information System (WHMIS) documents.
.9 Material Safety Data Sheets (MSDS).
.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.32 MEETINGS

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.33 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

END OF SECTION 01 35 33

PART 1 - GENERAL

1.1 References

.1 Government of Canada
- .1 Canada Labour Code, Part II
- .2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC):
- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 Canadian Standards Association (CSA):
- .1 CSA S269, Falsework for Construction Purposes.
- .2 CSA Z797, Code of Practice for Access Scaffold.
- .3 CSA-S350, Code of Practice for Safety in Demolition of Structures.

.4 Fire Protection Engineering Services, HRSDC:
- .1 FCC No. 301, Standard for Construction Operations.
- .2 FCC No. 302, Standard for Welding and Cutting.
- .3 HRSDC website: http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/commissioner/index.shtml

.5 American National Standards Institute (ANSI):
- .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.6 Province of British Columbia:
- .1 Workers Compensation Act. Part 3 Occupational Health and Safety.
- .2 Occupational Health and Safety Regulation.

1.2 Related Sections

.1 Refer to the following as required:
- .1 Marine General Instructions: Section 01 11 05.
- .2 Marine General Site Work: Section 35 05 51.

1.3 Workers' Compensation Board

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 Compliance with Regulations

1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 Submittals

.1 Make submittals in accordance with Sections 01 11 05 and 01 33 00.

.2 Submit the following:
- .1 Health and Safety Plan.
- .2 Copies of reports or directions issued by federal and provincial health and safety inspectors.
- .3 Copies of incident and accident reports.
- .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
- .5 Emergency procedures.

.3 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review upon request.

.4 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.5 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
- .1 Be construed to imply approval by the Departmental Representative.
- .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
- .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 Responsibility

.1 Assume responsibility as the Prime Contractor under this contract.

.2 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.

.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.

1.7 General Conditions

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
- .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
- .2 Secure site at night time [or provide security guard] as

deemed necessary to protect site against entry.

1.8 Project/Site Conditions

.1 Work at site will involve:
- .1 Construction on floats during high and low tides.
- .2 Slippery and unstable surfaces.
- .3 Preservative treated wood.
- .4 Pile removal and pile driving

1.9 Regulatory Requirements

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.10 Filing of Notice

.1 The Contractor is to complete and submit a Notice of Project as required by provincial authorities.

.2 Provide the Departmental Representative with a copy of all notices.

1.11 Health and Safety Plan

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
- .1 Primary requirements:
  - .1 Contractor's safety policy.
  - .2 Identification of applicable compliance obligations.
  - .3 Definition of responsibilities for project safety/organization chart for project.
  - .4 General safety rules for project.
  - .5 Job-specific safe work, procedures.
  - .6 Inspection policy and procedures.
  - .7 Incident reporting and investigation policy and procedures.
  - .8 Occupational Health and Safety Committee/Representative procedures.
  - .9 Occupational Health and Safety meetings.
  - .10 Occupational Health and Safety communications and recordkeeping procedures.
- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
- .3 List hazardous materials to be brought on site as required by work.
- .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility of errors and omissions in the Final Health and Safety Plan or of responsibility for meeting all requirements of construction and the Contract documents.

1.12 Emergency Procedures

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
- .1 Designated personnel from own company.
- .2 Regulatory agencies applicable to work and as per legislated regulations.
- .3 Local emergency resources.
- .4 Departmental Representative.

.2 Include the following provisions in the emergency procedures:
- .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
- .2 Evacuate all workers safely.
- .3 Check and confirm the safe evacuation of all workers.
- .4 Notify the fire department or other emergency responders.
- .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
- .6 Notify Departmental Representative.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:
- .1 Work with hazardous substances.
- .2 Work on, over, under and adjacent to water.

.4 Revise and update emergency procedures as required and re-submit to the Departmental Representative.

1.13 Hazardous Products

.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 the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:
- .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per.

1.14. Electrical Safety Requirements	.1	Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation. .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative. .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.
1.15. Electrical Lockout	.1	Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
	.2	Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
	.3	Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.
1.16 Overloading	.1	Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.
1.17 Falsework	.1	Design and construct falsework in accordance with CSA S269.1.
1.18 Scaffolding	.1	Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CAN/CSA-S269.2.
1.19 Powder-Actuated Devices	.1	Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.
1.20 Fire Safety and Hot Work	.1	Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
	.2	Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.
1.21 Fire Safety Requirements	.1	Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
	.2	Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
1.22 Unforeseen Hazards	.1	Should any unforeseen or peculiar safety-related factor, hazard or

condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.23 Posted Documents

.1 Post legible versions of the following documents on site:
- .1 Health and Safety Plan.
- .2 Emergency procedures.
- .3 Notice of Project.
- .4 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
- .5 Workplace Hazardous Materials Information System (WHMIS) documents.
- .6 Material Safety Data Sheets (MSDS).

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, protected from inclement weather, visible to all workers and in locations accessible to users of the facility when work of this Contract includes construction activities adjacent to occupied areas.

1.24 Meetings

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.25 Correction of Non-Compliance

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

END OF SECTION 01 35 33

PART 1 - GENERAL

1.1 Environmental Factors

.1 Ensure that operations meet all applicable environmental regulations and standards.

.2 Comply with mitigation requirements as noted in the plans and specification and, in Appendix A and E.

.3 The contractor is responsible for the completion of the Notice of Project Application and must submit a copy to the Departmental Representative within two days of submission.

1.4 Submittals

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental protection plan: include:

.1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan.

.2 Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from site.

.3 Name(s) and qualifications of person(s) responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan which identifies 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. 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. Plan to include measures for marking limits of use areas including 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, do not become air borne and travel off project site.

.12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste water management plan that identifies 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.

1.2 Vessels

.1 Vessels and floating equipment must not come to rest on the intertidal or sub-tidal zones unless specified otherwise.

1.3 Fires

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

1.4 Disposal of Wastes

.1 For specific waste disposal requirements see Section 35 05 51

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

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

1.5 Drainage

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

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

.3 Control disposal or runoff of water containing suspended materials

or other harmful substances in accordance with local authority requirements.

1.6 Work Adjacent to Waterways

.1 Do not operate land-based construction equipment within waterways.

.2 Do not use waterway beds for borrow material.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.7 Do not blast under water or within 100 m of indicated spawning beds.

1.7 Pollution Control

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

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

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

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

.5 Spill kits and containment are to be maintained on site and ready for deployment in case of spills.

.1 Spill kits are to contain sufficient quantities of absorbent material on site in close proximity to working machinery.

.2 During the work there are to be trained and qualified personnel on site that are ready to deploy spill kits when necessary.

1.8 Protection of Wildlife

.1 Make every effort to minimize disturbance to the benthic and upland wildlife communities.

.2 Any large invertebrates adhering to the portion of the wharf or jetty under construction must be removed and replaced in the nearby marine environment.

.3 Do not disturb eel grass or kelp beds.

1.9 Pile Driving

.1 Install protective barrier curtains.

.2 Barrier curtains shall comply with DFO requirements.

PART 2 – PRODUCTS

Not applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION 01 35 43

1.0 GENERAL

1.1 RELATED

.1 General Instructions Section 01 11 55

1.2 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2015 and Natural Energy Code of Canada (NEC) 2015

.2 Meet or exceed requirements of:

.1 Contract Documents.

.2 Specified standards, codes and referenced documents.

1.3 BUILDING SMOKING ENVIRONMENT

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

2.0 PRODUCTS

2.1 NOT USED

.1 Not Used.

3.0 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION 01 41 00

1.0 GENERAL

1.1 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

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

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Contractor.

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

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

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

1.3 ACCESS TO WORK

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

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

1.4 PROCEDURES

.1 Notify appropriate agency and Departmental Representative 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.

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative 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 Departmental Representative.

1.6 REPORTS

.1 Submit electronic copy of inspection and test reports to Departmental Representative. Testing and Inspection companies engaged by the Contractor will furnish paper copies of reports on site to allow for work to proceed in a timely manner.

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

1.7 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 Departmental Representative and may be authorized as recoverable.

1.8 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 acceptable to Departmental Representative as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 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 allowed.

.5 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.

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

1.9 MILL TESTS

.1 Submit mill test certificates as requested.

1.10 EQUIPMENT AND SYSTEMS

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

.2 Refer to Divisions 22, 23, 25, 26, 27 and 28 for definitive requirements.

END OF SECTION 01 45 00

1.0 GENERAL

1.1 ACTION AND INFORMATION 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 If water supply is available at site, there is no guarantee that the supply will meet construction demand.

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 Permanent heating system of building, not to be used when available. Be responsible for damage to heating system if use is permitted.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

- .1 Conform with applicable codes and standard.
- .2 Enforce safe practices.

.3 Prevent abuse of services.
.4 Prevent damages to finishes.
.5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER AND LIGHT

.1 Department Representative will not provide temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.3 Provide and maintain temporary power and lighting throughout project.

1.7 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.

2.0 PRODUCTS

3.0 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 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.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION 01 51 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

.1 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 (R2001), Access Scaffolding for Construction Purpose.

.4 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Proceedures.

1.4 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.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

1.6 HOISTING

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

.2 Hoists cranes to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

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

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

.3 Clean runways and taxi areas where used by Contractor’s equipment.

1.9 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 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 laydown table.

.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.

1.11 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.

1.12 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.

1.13 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning signs, are permitted on site.

.2 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 (Departmental Representative).

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger and direction signs.

.4 Protect travelling public from damage to person and property.

.5 Contractor’s traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control: adequate to ensure safe operations at all times.

.11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

.12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.13 Provide snow removal during period of Work.

.14 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.15 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.

2.0 PRODUCTS

2.1 NOT USED

.1 Not used.

3.0 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 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.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION 01 52 00

1.0 GENERAL

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 HOARDING

.1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Sub-contractors for their use of hoists.

.2 Erect and maintain safety barricades around all openings and other danger areas as required by Building Code and WCB.

1.3 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, and open edges of floors and roofs,

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

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

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

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

1.5 DUST TIGHT SCREENS

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

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

1.6 ACCESS TO SITE

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

1.7 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.

1.8 FIRE ROUTES

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

.2 Maintain clearance for all egress routes.

1.9 PROTECTION OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF EXISTING PROPERTY

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

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

1.11 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

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

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

END OF SECTION 01 56 00

1.0 GENERAL

1.1 PRODUCTS/MATERIAL AND EQUIPMENT

.1 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.

.2 Use products of 1 manufacturer for material and equipment of the same type or classification unless otherwise specified.

.3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.

- .1 Prevent electrolytic action between dissimilar metals.
- .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.
- .3 Fastenings which cause spalling or cracking are not acceptable.
- .4 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .5 Use heavy hexagon heads, semi-finished unless otherwise specified.
- .6 Bolts may not project more than 1 diameter beyond nuts.
- .7 Types of washers as follows:
  - .1 Plain type washers: use on equipment and sheet metal.
  - .2 Soft gasket lock type washers: use where vibrations occur.
  - .3 Resilient washers: use with stainless steel.
- .8 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.
- .9 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.
- .10 Store products in accordance with suppliers' instructions.
- .11 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction.
  - .1 Use primer or enamel to match original.
  - .2 Do not paint over nameplates.

1.2 QUALITY OF PRODUCTS

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

.2 Defective products will be rejected regardless of previous inspections.

- .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
- .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.

.3 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.

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

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

1.3 AVAILABILITY OF PRODUCTS

.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.

.2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.

.3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.4 MANUFACTURER'S INSTRUCTIONS

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

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

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and reinstallation at no increase in either the Contract price or the Contract time.

1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

.1 Products are specified by "Prescriptive" specifications: select any product meeting or exceeding specifications.

.2 Products specified under "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.

.3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.

.4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".

.5 When products are specified by a referenced standard or by or Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 SUBSTITUTION AFTER CONTRACT AWARD

.1 No substitutions are permitted without prior written approval of the Departmental Representative.

.2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by the Departmental Representative if:

.1 Products selected by tenderer from those specified are not available;

.2 Delivery date of products selected from those specified would unduly delay completion of Contract, or

.3 Alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative and the Contract price will be reduced accordingly.

END OF SECTION 01 61 00

1.0 GENERAL

1.1 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in the province of British Columbia, acceptable to Departmental Representative.

1.2 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Contractor is responsible to provide GPR Survey of existing services as required to verify existing underground condition prior to excavation.

1.3 LOCATION OF EQUIPMENT AND FIXTURES

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

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

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

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.4 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.

1.5 SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, 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.

1.6 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.

1.0 GENERAL

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - 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 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces

to receive patching and finishing.

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

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

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

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

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

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

.13 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 recycling in accordance with Section 01 74 19 - Waste Management And Disposal.

END OF SECTION 01 73 00

1.0 GENERAL

1.1 REFERENCES

.1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: 2020, Title: General Conditions. In Effect as Of: April 25, 2013.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

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

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

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

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.3 FINAL CLEANING

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

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

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

.4 Remove waste products and debris including that caused by Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by

Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

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

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

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

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

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep gutters.

.16 Sweep and wash clean paved areas.

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

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

.19 Remove snow and ice from access to buildings.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management And Disposal.

END OF SECTION 01 74 11

1.0 GENERAL

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.

.2 Accomplish maximum control of solid construction waste.

.3 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

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

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.8 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.

.9 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.

.10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.11 Separate Condition: refers to waste sorted into individual types.

.12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.3 DOCUMENTS

.1 Maintain at job site, one copy of following documents:
- .1 Waste Audit.
- .2 Waste Reduction Workplan.
- .3 Material Source Separation Plan.
- .4 Schedules A, B, C, D, E completed for project.

1.4 SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:
- .1 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
- .2 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
- .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.

.3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
- .1 Failure to submit could result in hold back of final payment.
- .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
- .3 For each material reused, sold or recycled from project, include amount quantities by number, type and size of items and the destination.
- .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.5 WASTE AUDIT (WA)

.1 Conduct WA prior to project start-up.

.2 Prepare WA: Schedule A.

.3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare WRW prior to project start-up.

.2 WRW should include but not limited to:
- .1 Destination of materials listed.
- .2 Deconstruction/disassembly techniques and sequencing.
- .3 Schedule for deconstruction/disassembly.
- .4 Location.
- .5 Security.
- .6 Protection.
- .7 Clear labelling of storage areas.
- .8 Details on materials handling and removal procedures.
- .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

.3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.4 Describe management of waste.

.5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.

.6 Post WRW or summary where workers at site are able to review content.

.7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.7 DEMOLITION WASTE AUDIT (DWA)

.1 Prepare DWA prior to project start-up.

.2 Complete DWA: Schedule C.

.3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

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

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

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

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

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

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
.1 Transport to approved and authorized recycling facility.

1.9 STORAGE, HANDLING AND PROTECTION

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

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

.3 Protect surface drainage, mechanical and electrical from damage and blockage.

.4 Separate and store materials produced during dismantling of structures in designated areas.

.5 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.
.3 Provide waybills for separated materials.

1.10 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 Keep records of construction waste including:
- .1 Number and size of bins.
- .2 Waste type of each bin.
- .3 Total tonnage generated.
- .4 Tonnage reused or recycled.
- .5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.11 USE OF SITE AND FACILITIES

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

.2 Provide temporary security measures approved by Departmental Representative.

1.12 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2.0 PRODUCTS

2.1 NOT USED

.1 Not Used.

3.0 EXECUTION

3.1 APPLICATION

.1 Do Work in compliance with WRW.

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

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

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

3.3 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
- .1 Mark containers or stockpile areas.
- .2 Provide instruction on disposal practices.

.2 On-site sale of salvaged recovered reusable and/or recyclable materials is not permitted.

.3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Acoustical Insulation	100	
Doors and Frames	100	
Electrical Equipment	80	
Mechanical Equipment	100	
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

.4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

3.4 WASTE AUDIT (WA)

The following pertains to Schedule A - Waste Audit (WA). Column-1 refers to the category of waste, and a physical description of the material (e.g. off-cuts, clean drywall, etc.). Column-2 refers to the total quantity of materials received by the Contractor. Measurement units must be specified. Column-3 refers to the estimated percentage of material that is waste. Column-4 refers to the total quantity of waste (column-2 x column-3). Column-5 refers to the areas(s) in which the waste was generated. Column-6 refers to the total percentage of recycled material from the specified total quantity of waste (column-4). Column-7 refers to the total percentage of reused material from the specified total quantity of waste (column-4).

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit %	(3) Estimated Waste	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood & Plastics						
Material Description						
Off-Cuts						
Warped						
Plastic						
Cardboard						
Other						
Doors & Windows						

Material Description						
Frames						
Glass						
Wood						
Metal						
Other						

3.6 WASTE REDUCTION WORKPLAN (WRW)

The following pertains to Schedule B - Waste Reduction Workplan (WRW). Column-1 refers to the category and type of waste materials. Column-2 refers to the persons responsible for completing the WRW. Column-3 refers to Column-4 of Schedule A. Column-4 refers to the amount of reused waste predicted and realized. Column-5 refers to the amount of recycled waste predicted and realized. Column-6 refers to the approved recycling facility.

.1 Schedule B:

(1) Material Quantity Category	(2) Person Amount Responsible Waste	(3) Total of Project (unit)	(4) Reused Actual (units)	(5) Recycle Actual (s) Amount	(6) Material Destination (s)
Wood & Plastics					
Material Description					
Chutes					
Warped					
Plastic					
Cardboard Packaging					
Other					
Doors & Windows					
Material Description					
Painted					
Frames					
Glass					
Wood					
Metal					
Other					

3.7 DEMOLITION WASTE AUDIT (DWA)

The following pertains to Schedule C - Demolition Waste Audit (DWA). Column-1 refers to the type of material salvaged. Column-2 refers to the material quantity shown in column-1. Several columns may be required to identify specific demolition areas. Column-3 refers to the unit of measurement used to describe Column-2. Column-4 refers to the total quantity of salvaged material. Column-5 refers to the cumulative volume of salvaged material. Column-6 refers to the total weight in kilograms. Column-7 refers to remarks and assumptions made about the specified material.

.1 Schedule C - Demolition Waste Audit (DWA):

(1) Material Description	(2) Quantity	(3) Unity	(4) Total	(5) Volume	(6) Weight	(7) Remarks &

Assumptions				(cum)	(cum)	Assumptions
Wood						
Wood						
Stud						
Plywood						
Baseboard -wood						
Door						
Trim-Wood						
Cabinet						
Doors & Windows						
Panel						
Regular						
Slab Regular						
Wood						
Laminate						
Byfold-Closet						
Glazing						

3.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule E - Government Chief Responsibility for the Environment:

.1 Ministry of Environment Lands and Parks
810 Blanshard Street, 4th Floor
Victoria, BC V8V 1X4
604-387-1161 / 604-356-6464

.2 Waste Reduction Commission Soils and Hazardous Waste
770 South Pacific Blvd, Suite 303
Vancouver BC, V6B 5E7
604-660-9550 / 604-660-9596

END OF SECTION 01 74 19

1.0 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 78 00 - Closeout Submittals.

1.3 INSPECTION AND DECLARATION

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

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

.2 Request Departmental Representative's Inspection.

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

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

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

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

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

.4 Certificates required by authorities having jurisdiction.

.5 Commissioning of all systems: Final commissioning reports have been submitted to the Departmental Representative.

.6 Operation of systems have been demonstrated to Owner's personnel.

.7 Work is complete and ready for Final Inspection.

.2 Submit required forms as described in General Conditions and Standard Acquisition Contract Clause (SACC) manual.

END OF SECTION 01 77 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1	Quality Control	Section 01 45 00
.2	Examination and Preparation	Section 01 71 00
.3	Closeout Procedures	Section 01 77 00
.4	Demonstration and Training	Section 01 79 00
.5	General Commissioning Requirements	Section 01 91 31
.6	Building Management Manual (BMM)	Section 01 91 51

1.2 SUBMISSION

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

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

.3 Two weeks prior to Substantial Completion of the Work, submit to the Departmental Representative, four draft copies of operating and maintenance manuals in English.

.4 Copy of maintenance manual will be returned after substantial completion inspection, with Departmental Representative's comments.

.5 An electronic copy Interactive Operating and Maintenance Manual System is required as specified under clause 1.3. Provide 4 sets of the Electronic Interactive Operating and Maintenance Manual System to the Departmental Representative.

.6 Hard copies of the Operating and Maintenance Manual System is required as specified under clause 1.4. Provide 4 sets of the Hard Copy of Interactive Operating and Maintenance Manual System to the Departmental Representative.

.7 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

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

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

.10 Pay costs of transportation.

1.3 INTERACTIVE OPERATING AND MAINTENANCE MANUAL SYSTEM

.1 In addition to the printed copies, submit provide an Interactive Operating and Maintenance Manual System as specified herein.

.2 System Description and Requirements

.1 All as constructed drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.

.2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.

.3 Program shall be capable of storing separately and independently data of multiple buildings and shall be expandable for addition of new buildings and systems.

.4 Data of each building shall be accessible by the input of either the building name or building number as defined by the Departmental Representative.

.5 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:

.1 Architectural
.2 Structure
.3 Mechanical
.4 Electrical
.5 Security
.6 Civil
.7 Data & Communication
.8 BSCS
.9 Elevator
.10 Landscape
.11 Marine
.12 Under each discipline, data shall be grouped into the following four major categories:

.1 Basic Documents

.1 'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the Departmental Representative:

.1 Introduction
.2 Consultant/Contractor/Suppliers List
.3 System Description
.4 Maintenance and Lubrication Schedules
.5 Testing and Commissioning (T&C) Reports
.6 Misc. Reports
.7 Specifications
.8 Equipment and/or point schedules as identified in the hard copy documents
.9 Others as stipulated by the Departmental Representative

.2 All Basic Documents PDF files shall be enhanced with appropriate bookmarks to facilitate searching of information within the document or linking to other relevant documents for references.

.2 'As-Constructed' Drawings

.1 'As-Constructed' drawings shall be provided in CAD format and PDF format. PDF files of the 'As-Constructed' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:

.1 Drawing Number and Title
.2 Drawing Notes

.3 Major Equipment Locations
.4 Cross-links to other related drawings
.5 Revisions

.3 System Data
.1 Building systems shall be identified by their services, disciplines, function, nature and specific scope. System data shall be classified into the following categories:
.1 System Description
.2 Schematic (where applicable)
.3 Equipment List
.2 Provide hot key buttons, where applicable, for direct access to drawings/data referenced on the schematics. The same shall be applied to listed equipment for direct links to the corresponding equipment data.

.4 Equipment Data
.1 Equipment data shall be classified into the following categories:
.1 Equipment submittals
.2 T&C Report
.3 Maintenance Data
.4 Maintenance Records
.5 Photo
.2 Provide a summary screen to list all equipment classified under a specific system. On the summary screen, provide direct links to the corresponding equipment data under each category with addition links to the relevant ‘As Constructed’ drawings.

.6 The system shall be executed by Professional Engineers with a minimum of 10 years post qualification experience in the field of Building Services Engineering.

.7 The Contractor shall provide a minimum of 3 past job references as proven record of similar undertakings.

.8 The Contractor shall provide a demonstration of the system to the Departmental Representative to provide verification that the requirements of the specification are fulfilled.

1.4 FORMAT HARD COPY MANUALS

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

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

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

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

.5 Arrange content by 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. Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in .dwg format on CD. Provide 2 sets of full size hard copy drawings.

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;
- .1 date of submission;
- .2 names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
- .3 schedule of products and systems, indexed to content of volume.
- .4 copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.
- .5 all extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification.
- .6 complete set of all final reviewed shop drawings.
- .7 certificates of inspection by authorities having jurisdiction.
- .8 test reports and certificates as applicable.
- .9 complete set of as constructed drawings.

.2 For each product or system:
- .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.6 'AS CONSTRUCTED' DRAWINGS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site one record copy of:
- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to the Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

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

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

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

.5 Keep record documents and samples available for inspection by Departmental Representative.

.6 Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring. Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed. Use different colour waterproof ink for each service.

.7 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings. Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.8 Provide an electronic copy of as constructed drawings.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, provided by Departmental Representative.

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

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

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

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission; leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

END OF SECTION 01 78 00

1.0 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: 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 Division.
- .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 23 05 93 Commissioning of Mechanical Systems.

.4 Demonstration and Instructions:

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon 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 Time Allocated for Instructions: ensure adequate amount of time required for instruction of each item of equipment or system.

1.2 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 Departmental Representative'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 electronic & hard copies (Refer to Section 01 78 00 Closeout Submittals) 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.

END OF SECTION 01 79 00

1.0 GENERAL

1.1 SECTION INCLUDES

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to Performance Verification of components, equipment, sub-systems, systems, and integrated systems.

1.2 RELATED SECTIONS

.1	Submittal Procedures	Section 01 33 00
.2	Quality Control	Section 01 45 00
.3	Common Product Requirements	Section 01 61 00
.4	Closeout Submittals	Section 01 78 00
.5	Demonstration and Training	Section 01 79 00
.6	Commissioning Forms	Section 01 91 33
.7	Commissioning Training	Section 01 91 41
.8	Building Management Manual (BMM)	Section 01 91 51
.9	Common Work Results for Plumbing	Section 22 05 00
.10	Domestic Water Heaters	Section 22 30 05
.11	Common Work Results – for HVAC	Section 23 05 00
.12	Installation of Pipework	Section 23 05 05
.13	Testing, Adjustment & Balancing for HVAC	Section 23 05 93
.14	HVAC Fans	Section 23 34 00
.15	Common Work Results for Electrical	Section 26 05 01
.16	Wire and Box Connectors (0-1000 V)	Section 26 05 20
.17	Wires and Cables (0-1000 V)	Section 26 05 21
.18	Grounding – Secondary	Section 26 05 28
.19	Conduits, Conduit Fastenings and Conduit Fittings	Section 26 05 34
.20	Installation of Cables in Trenches and in Ducts	Section 26 05 44

1.3 ACRONYMS

.1 AFD – Alternate Forms of Delivery, service provider.

.2 BMM – Building Management Manual.

.3 Cx – Commissioning.

.4 EMCS – Energy Monitoring and Control Systems.

.5 O&M – Operation and Maintenance.

.6 PI – Product Information.

.7 PV – Performance Verification.

.8 TAB – Testing, Adjusting and Balancing.

1.4 REFERENCE

.1 Public Works and Government Services Canada (PWGSC)
- .1 CSA Z320-11 Commissioning Standard.
- .2 ANSI/NETA Standard for Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.5 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.

1.6 COMMISSIONING OVERVIEW

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

.2 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.3 Cx is 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 includes transfer of critical knowledge to facility operational personnel.

.4 Complete all start-up and verification of systems prior to review by Commissioning Agent.
- .1 To bring mechanical, electrical and building architectural systems and components from a state of static completion to a state of dynamic operation.
- .2 To verify conformance to contract requirements.
- .3 To confirm installations meet requirements of Contract Documents.
- .4 To provide all testing documents and records.
- .5 To ensure completed facility meets contract requirements.
- .6 To provide a documented operator training program.
- .7 To verify accuracy of project record drawings and operating and maintenance manuals.

.5 Departmental Representative will issue Certificate of Substantial Completion when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
.2 Equipment, components and systems have been commissioned.
.3 O&M training has been completed.

1.7 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 unfunctional system, including related systems as deemed required by Departmental Representative, Departmental Representative 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 General Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.8 PRE-CX REVIEW

.1 Before Construction:
.1 Review contract documents, confirm by writing to Departmental Representative.
.1 Adequacy of provisions for Cx.
.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:
.1 Co-ordinate 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 Departmental Representative.
.7 Have Cx schedules up-to-date.
.8 Ensure systems have been cleaned thoroughly.
.9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.9 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.10 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
.1 Submit no later than 4 weeks after award of Contract:
.1 Name of Contractor's Cx agent.
.2 Draft Cx documentation.
.3 Preliminary Cx schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 4 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 4 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.11 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

.2 General Contractor to review and approve Cx documentation submitted by Cx Agent prior to submission to Departmental Representative for review.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.12 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16 Construction Progress Schedule Bar.

.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.

1.13 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: Section 01 32 16 Construction Progress Schedule 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 60% construction completion stage. Section 01 32 16 Construction Progress Schedule Bar. General Contractor to call a separate Cx scope meeting 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 General 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 General Contractor with their Commissioning 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.

1.14 STARTING AND TESTING

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

1.15 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days’ notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 General Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers

1.16 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and general 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 Startup: 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.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document requires tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following
- .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
- .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
- .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
  - .1 Rejected equipment to be removed from site and replace with new.
  - .2 Subject new equipment/systems to specified start-up procedures.

1.17 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before 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 Departmental Representative to repeat start-up at any time.

1.18 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 to Departmental Representative 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 Substantial Performance.

1.19 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.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.20 START OF COMMISSIONING

.1 Notify Departmental Representative at least 4 weeks prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.21 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative 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.

1.22 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:
- .1 Under 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 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.

1.23 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.24 AUTHORITIES HAVING JURISDICTION

.1 Where 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 Departmental Representative within 5 days of test and with Cx report.

1.25 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 Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.26 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.

1.27 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.28 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx, leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities, complete Cx prior to issuance of Certificate of Substantial Performance.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.29 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.30 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.31 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.32 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:
  .1 Accuracy complies with these specifications.
  .2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.33 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.

1.34 OWNER'S PERFORMANCE TESTING

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

1.35 SUMMARY OF DELIVERABLES FROM CONTRACTOR’S Cx AGENT TO PWGSC

.1 Cx Plan and Schedule.

.2 Accepted shop drawings.

.3 Completed PI forms.

.4 Approved TAB Report.

.5 Approved PV Forms.

.6 Approved O & M Manual.

.7 Approved System and Integrated System Test Report

.8 Approved Training and Attendance Form.

.9 Accepted “As-Built” Plans and Specifications.

.10 Certificate of Interim Acceptance.

.11 Final Certificate of Completion.

END OF SECTION 01 91 13

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative approval.

1.5 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Contractor provides project-specific Commissioning forms with Specification data included.
.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
.3 Confirm operation as per design criteria and intent.
.4 Identify variances between design and operation and reasons for variances.
.5 Verify operation in specified normal and emergency modes and under specified load conditions.
.6 Record analytical and substantiating data.
.7 Verify reported results.
.8 Form to bear signatures of recording technician.
.9 Submit immediately after tests are performed.
.10 Reported results in true measured SI unit values.
.11 Provide Departmental Representative with originals of completed forms.
.12 Maintain copy on site during start-up, testing and commissioning period.
.13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51 - Building Management Manual (BMM).

1.6 LANGUAGE

.1 To suit the language profile of the awarded contract.

END OF SECTION 01 91 33

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:
This Section specifies roles and responsibilities of Commissioning Training.

.2 Related Sections:

.1	General Commissioning Requirements	Section 01 91 13
.2	Commissioning Forms	Section 01 91 33

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Engineer will provide:
- .1 Descriptions of systems.
- .2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
- .1 Start-Up, operation, shut-down of equipment, components and systems.
- .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
- .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:
- .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:
- .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
- .2 Effective on-going inspection, measurements of system performance.
- .3 Proper preventive maintenance, diagnosis and trouble-shooting.
- .4 Ability to update documentation.
- .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:
- .1 "As-Built" Contract Documents.
- .2 Operating Manual.
- .3 Maintenance Manual.
- .4 Management Manual.
- .5 TAB and PV Reports.

.3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:
- .1 Transparencies for overhead projectors.
- .2 Multimedia presentations.
- .3 Manufacturer's training videos.
- .4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 8 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:
- .1 Implementation of training activities,
- .2 Coordination among instructors,
- .3 Quality of training, training materials.

.2 Commissioning Agent will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Commissioning Agent.

1.8 MECHANICAL SYSTEM TRAINING

.1 Organize and conduct training courses to instruct the Departmental Representative in the operation and preventative maintenance of equipment and systems provided at the completion of the project.

.2 Provide services of qualified personnel, including each sub-trade, each major equipment supplier and design engineer to and instruct on their equipment or systems.

.3 One-person day shall be eight hours including one half hour for breaks, and one person week shall be five person days.

.4 Submit sessions schedule and list of representatives to the Departmental Representative for approval 30 days prior to course starting date. Confirm attendance of course by written notification to all participants, followed by verbal confirmation just prior to course starting date.

.5 Submit final copies of record drawings and operating and maintenance manuals to Departmental Representative.

.6 Submit a written follow-up of all courses, complete with an attendants list to the Departmental Representative.

.7 Systems Course: Allow a minimum of 8 hours of instruction to conduct systems training courses addressing the following topics:

.1 Air Systems:
  .1 Review operation of systems and equipment:
    .1 Propane gas systems
    .2 All exhaust systems
  .2 Review equipment maintenance.
.2 Site Services:
  .1 Sanitary/storm/domestic water.

1.9 ELECTRICAL SYSTEM TRAINING

.1 Organize and conduct training courses to instruct the Departmental Representative in the operation and preventative maintenance of equipment and systems provided at the completion of the project.

.2 Provide services of qualified personnel, including each sub-trade, each major equipment supplier and design engineer to and instruct on their equipment or systems.

.3 One-person day shall be eight hours including one half hour for breaks, and one person week shall be five person days.

.4 Submit sessions schedule and list of representatives to the Departmental Representative for approval 30 days prior to course starting date. Confirm attendance of course by written notification to all participants, followed by verbal confirmation just prior to course starting date.

.5 Submit final copies of record drawings and operating and maintenance manuals to Departmental Representative. Submit a written follow-up of all courses, complete with an attendants list to the Departmental Representative.

.6 Systems Course: Allow a minimum of 4 hours of instruction to conduct systems training courses addressing the following topics:
  .1 Standard Power Systems:
    .1 Review operation of systems and equipment.

END OF SECTION 01 91 41

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.

.2 Acronyms:

.1 BMM - Building Management Manual.
.2 Cx - Commissioning.
.3 HVAC - Heating, Ventilation and Air Conditioning.
.4 PI - Product Information.
.5 PV - Performance Verification.
.6 TAB - Testing, Adjusting and Balancing.
.7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams and schematics to be professionally developed.

.4 Electronic copy of data to be in a PDF with hyperlink from content page to individual sections.

1.3 APPROVALS

.1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL INFORMATION

.1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:

.1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.
.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.
.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.
.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.
.8 Operating and maintenance manual - Section 3.2 of BMM.
.9 Final commissioning plan as actually implemented.
.10 Completed commissioning checklists.
.11 Commissioning test procedures employed.
.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.

.2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Record and organize for easy access and retrieval of information contained in BMM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:
- .1 Recommended maintenance procedures and schedule.
- .2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

.1 Samples of LSC Manual will be available from Departmental Representative.

.2 Content of Manual:
- .1 All possible Emergency situations modes including: presence of fire and smoke, power failure, lose of water or pressure, chemical spills and refrigerant release.
- .2 HVAC emergencies and fuel supply failures.
- .3 Intrusion and security breach.
- .4 Emergency provisions for natural disasters, bomb threats and other disruptive situations.
- .5 Dedicated emergency generators for high security projects, medical facilities and computer systems.
- .6 Emergency control procedures for fire, power and major equipment failure.
- .7 Emergency contacts and numbers.
- .8 Manual to be readily available and comprehensible to non- technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
- .1 General:
  - .1 Finalized commissioning plan.
  - .2 WHMIS information manual.
  - .3 Approved "as-built" drawings and specifications.

.4 Procedures used during commissioning.
.5 Cross-Reference to specification sections.

.2 Architectural and structural:
.1 Inspection certificates, construction permits.
.2 PV reports.

.3 Fire prevention, suppression and protection:
.1 Test reports.
.2 Smoke test reports.
.3 PV reports.

.4 Mechanical:
.1 Installation permits, inspection certificates.
.2 Piping pressure test certificates.
.3 Ducting leakage test reports.
.4 TAB and PV reports.
.5 Charts of valves and steam traps.
.6 Copies of posted instructions.

.5 Electrical:
.1 Installation permits, inspection certificates.
.2 TAB and PV reports.
.3 Electrical work log book.
.4 Charts and schedules.
.5 Locations of cables and components.
.6 Copies of posted instructions.

.2 Assist Departmental Representative with preparation of BMM.

1.8 LANGUAGE

.1 Provide documentation in English only.

1.9 IDENTIFICATION OF FACILITY

.1 When submitting information to Departmental Representative for incorporation into BMM, use following system for identification of documentation:
.1 As advised by Departmental Representative.

1.10 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.

.2 Obtain Departmental Representative's approval before starting Work.

END OF SECTION 01 91 51

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Asbestos Remediation — Section 02 82 00

.2 Lead Remediation — Section 02 83 00

1.2 REFERENCES

.1 Definitions:

.1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.

.2 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.3 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.

.4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

.2 Reference Standards:

.1 CSA International

.1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Demolition Meetings:

.1 Convene pre-demolition meeting 1 week prior to beginning work of this Section with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify project requirements.

.2 Verify existing site conditions adjacent to demolition work.

.3 Co-ordination with other construction subtrades.

.2 Ensure key personnel site supervisor, project manager and subcontractor representatives WMC attend.

.3 WMC must provide written report on status of waste diversion activity at each meeting.

.4 Departmental Representative 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.

1.4 ACTION & INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 19 - Waste Management Disposal.

.2 WMC is responsible for fulfilment of reporting requirements.

.3 Prior to beginning of Work on site submit detailed Waste Management Plan in accordance with Section 01 74 19 - Waste Management And Disposal and indicate:

.1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
.2 Schedule of selective demolition.
.3 Number and location of dumpsters.
.4 Anticipated frequency of tippage.
.5 Name and address of waste receiving organizations.

.4 Submit PDF copies of receipts from authorized disposal sites and reuse and recycling facilities for material removed from site on a bi-weekly basis upon request of Consultant.
.1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.

.5 Construction Waste Management:
.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.5 QUALITY ASSURANCE

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

1.6 SITE CONDITIONS

.1 Environmental protection:
.1 Ensure Work is done in accordance with Section 01 35 43 - Environmental Procedures.

.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 storm or sanitary sewers.
.1 Ensure proper disposal procedures are maintained throughout project.

.6 Do not pump water containing suspended materials into 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 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.

.9 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all interior and exterior public areas.

.2 Review "Pre-Construction Hazmat Survey” and take precautions to protect environment.

.3 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous is encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
.1 Proceed only after receipt of written instructions have been received from Consultant.

.4 Notify Departmental Representative before disrupting building access or services.

.5 Extent of Demolition – refer to drawings.

1.7 EXISTING CONDITIONS

.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 Departmental Representative immediately. Proceed only after receipt of written instructions has been received from Consultant.

.2 Structures to be demolished are based on their condition at time of examination prior to tendering.

2.0 PRODUCTS

2.1 EQUIPMENT

.1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

3.0 EXECUTION

3.1 EXAMINATION

.1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing utilities within the building where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and the Owner concerned in case of damage to any utility or service designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.1 Protection of in-place conditions:

.1 Work in accordance with Section 01 35 43 - Environmental Procedures.

.2 Prevent movement, settlement or damage of adjacent structures, services and parts of existing building to remain.

.1 Provide bracing, shoring and underpinning as required.

.2 Repair damage caused by demolition as directed by Departmental Representative

.3 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative

.4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

.1 Disconnect and cap mechanical services.

.2 Natural gas supply lines: remove in accordance with gas company requirements.

.3 Sewer and water lines: remove or provide temporary support if they are to remain as indicated on drawings.

.4 Other underground services: remove and dispose of as indicated on drawings.

3.3 DEMOLITION

.1 Do demolition work in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Blasting operations not permitted during demolition.

.3 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.

.4 Prior to start of Work, remove contaminated or hazardous materials as indicated in Hazardous Material Report from site and dispose of at designated disposal facilities in safe manner and in accordance with recommendation in report.

.5 Demolish structural work as indicated on drawings.

.6 Crush concrete generated due to demolition of concrete structure to size suitable for recycling
.1 Where possible identify markets which will accept crushed material as aggregate.

.7 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.

.8 At end of each day's work, leave Work in safe and stable condition.

.9 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.

.10 Use natural lighting to do Work where possible.
.1 Shut off lighting except those required for security purposes at end of each day.

3.4 CLEANING

.1 Develop Waste Management Plan related to Work of this Section.

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.3 Divert excess materials from landfill to site approved, by Departmental Representative.

.4 Designate appropriate security resources / measures to prevent vandalism, damage and theft.

END OF SECTION 02 41 16

1.0 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when removing any:
.1 Asbestos containing material from within the project area.

1.2 RELATED REQUIREMENTS

.1 Structure Demolition — Section 02 41 16

.2 Lead Remediation — Section 02 83 00

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.205- 94, Sealer for Application of Asbestos Fibre Releasing Materials.

.2 Department of Justice Canada (Jus)
.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.4 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Underwriters' Laboratories of Canada (ULC)

.6 BC Occupational Health and Safety Act, WorkSafe BC.

1.4 DEFINITIONS

.1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.2 Asbestos Containing Materials (ACMs): materials that contain 0.1 provincial regulated amount per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

.4 Authorized Visitors: Departmental Representative, Engineers, or designated representatives, and representatives of regulatory agencies.

.5 Competent worker person: in relation to specific work, means a worker who:
.1 Is qualified because of knowledge, training and experience to perform the work.
.2 Is familiar with the provincial federal laws and with the provisions of the regulations that apply to the work.
.3 Has knowledge of all potential or actual danger to health or safety in the work.

.6 Friable Materials: material that when dry can be crumbled pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.7 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.

.8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.11 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.

.12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.5 ACTION & INFORMATIONAL SUBMITTALS

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

.2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.

.3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.4 Submit proof of Contractor's Asbestos Liability Insurance.

.5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.

.6 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.8 Submit Worker's Compensation Board status and transcription of insurance.

.9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 Encapsulants;

.2 Amended water;

.3 Slow drying sealer.

.10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally

issued.

11. Submit Exposure Control Plan as per requirement in WorkSafe BC Part 6.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial 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 the time work is performed.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements and WorkSafe BC.

.2 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 Air purifying half-mask respirator with N-100, R-100 or P-100 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 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 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 to 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 to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker 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 to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to 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. It includes suitable footwear, and it to be repaired or replaced if torn.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are located as indicated on drawings.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.7 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.

1.7 WASTE MANAGEMENT & DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - 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.

.4 Separate for reuse and recycling and place in designated containers steel metal plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.8 EXISTING CONDITIONS

.1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project is appended in appendix A of this specifications.

.2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.9 SCHEDULING

.1 Hours of Work: perform work in accordance with Section 01 11 55 General Instructions

1.10 QUALIFICATIONS

.1 Asbestos Abatement Contractor must have at least 10 years of experience in similar scope and nature of work. Qualifications and resume of personnel involved must be submitted and approved by Departmental Representative.

2.0 PRODUCTS

2.1 MATERIALS

.1 Drop and Enclosure Sheets:
.1 Polyethylene: 0.15 mm thick.

.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.

.3 Waste Containers: contain waste in two separate containers.
- .1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.
- .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
- .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Glove bag:
- .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
- .2 The glove bag to be equipped with:
  - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
  - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
  - .3 A tool pouch with a drain.
  - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
  - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.

.5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.6 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.

.7 Encapsulant: surface film forming / penetrating type conforming to CAN/CGSB-1.205.

3.0 EXECUTION

3.1 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

.2 Before beginning Work, at each access to Asbestos Work Area, 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)'.

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

.4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
- .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
- .2 When removing suspended ceilings and walls themselves do not enclose work area and when removing asbestos containing material from piping or equipment and "glove bag" method is not used erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.

.5 Before removing suspended ceilings, remove friable material on upper surfaces using HEPA vacuum equipment.
- .1 Remove and clean surfaces of ceiling panels using HEPA vacuum, wrap clean panels in 0.10 mm thick polyethylene, and store in building as directed by Departmental Representative.
- .2 Clean "T" grid suspension system, disconnect, wrap in 0.10 mm thick polyethylene, and store in building as directed by Engineer.

.6 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
- .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
- .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.7 Pipe Insulation Removal Using Glove Bag:
- .1 A glove bag 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.
  - .2 The bag could become damaged for any reason 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 asbestos containing 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.

.8 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.9 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with Provincial/Territorial Occupational Health and Safety Regulations PWGSC requirements.

.1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.

.3 Ensure that respiratory safety factors are not exceeded.

.4 During the course of Work, Departmental Representative to measure fibre content of air outside Work areas by means of air samples analyzed by Phase Contrast Microscopy (PCM).

.1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.

END OF SECTION 02 82 00.02

1.0 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when removing any lead containing material from project area.

1.2 RELATED REQUIREMENTS

.1 Demolition — Section 02 41 16

.2 Asbestos Remediation — Section 02 82 00

1.3 REFERENCES

.1 Department of Justice Canada
- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 Health Canada
- .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

.3 Human Resources and Social Development Canada (HRSDC)
- .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.4 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 U.S. Environmental Protection Agency (EPA)
- .1 EPA 747-R-95-007- 1995, Sampling House Dust for Lead.

.6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
- .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).

.7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
- .1 Lead in Construction Regulation - 29 CFR 1926.62- 1993.

.8 BC Occupational Health and Safety Act, WorkSafe BC.

1.4 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Owner Departmental Representative or designated representatives and representatives of regulatory agencies.

.3 Occupied Area: areas of building or work site that is outside Work Area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another.

Typically constructed as follows:

.1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic meter of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic meter of air within Work Area.

.8 Competent person: Professionals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.9 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.

1.5 ACTION & INFORMAL SUBMITTALS

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

.2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.3 Provide: Provincial Territorial and local requirements for Notice of Project Form.

.4 Provide proof of Contractor's General and Environmental Liability Insurance.

.5 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that it has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.

.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.6 Product data:

.1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

.7 Submit Exposure Control Plan as per requirement in Worksafe BC Part 6.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial 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 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
.2 Safety Requirements: worker and visitor protection.
.1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:
.1 Respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.
.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.
.2 Requirements for workers:
.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
.2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.
.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.
.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.
.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.
.5 Ensure workers wash hands and face when leaving Work Area. Facilities for washing are located as indicated on drawings.
.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
.7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.
.8 Visitor Protection:
.1 Provide protective clothing and approved respirators to Authorized Visitors to 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 Work Area.

1.7 WASTE MANAGEMENT & DISPOSAL

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

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project is appended in Appendix A of this specifications.

.2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.9 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:
- .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
- .2 Provincial Ministry of Labour.
- .3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

.4 Hours of Work: perform work in accordance with Section 01 11 55 General Instructions. Include in Contract Sum additional costs due to this requirement.

1.10 QUALIFICATIONS

.1 Abatement Contractor must have at least 10 years of experience in similar scope and nature of work. Qualifications and resume of personnel involved must be submitted to Departmental Representative for approval.

2.0 PRODUCTS

2.1 MATERIALS

.1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: 0.15 mm reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - 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 paint residue.

.5 Lead waste containers: metal 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 Warning Lead clearly visible when ready for removal to disposal site.

3.0 EXECUTION

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead based paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.

.2 Work Area:

- .1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
- .2 Pre-clean fixed casework, and equipment within 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 method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.
- .4 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
- .5 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.
- .6 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.
- .7 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).
- .8 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.
- .9 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.
- .10 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.

.3 Worker Decontamination Enclosure System:

- .1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:
  - .1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.
  - .2 Clean Room: construct with curtained doorway to outside of enclosures. 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.

.4 Construction of Decontamination Enclosures:
- .1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.
- .2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas
- .1 Barriers between Work Area and occupied area to be constructed as follows:
  - .1 Construct floor to ceiling lumber metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply 9 plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.
  - .2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:
- .1 Maintain enclosures in clean condition.
- .2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.
- .3 Visually inspect enclosures at beginning of each work day.
- .4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD-BASE PAINT ABATEMENT

.1 Removal of lead based paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted plaster walls or building components by striking a wall with sledgehammer or similar tool.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean work area including equipment and access room, and equipment used in process. After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces. Do not disturb work for 8 hours with no entry, activity, ventilation or disturbance during this period.

.6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.

.2 Departmental Representative will inspect work for:
- .1 Adherence to specific procedures and materials.
- .2 Final cleanliness and completion.
- .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs Departmental 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.

3.5 LEAD SURFACE SAMPLING-WORK AREAS

.1 Final lead surface sampling to be conducted as follows:
- .1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed. Departmental Representative will perform lead wipe sampling in Work Area.
  - .1 Final lead wipe sampling results from horizontal and vertical surfaces where lead based paints have been removed must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples must be collected and analyzed in accordance with EPA 747-R-95-007.
  - .2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
  - .3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEAN-UP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labeled waste containers for transport.

.4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.

.5 Clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS & SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION 02 83 11

1.0 GENERAL

1.1 RELATED WORK

.1 Section 31 23 10 Excavating, Trenching and Backfilling
.2 Section 03 20 00 Concrete Reinforcing
.3 Section 03 30 00 Cast-In-Place Concrete

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA-A23.1-09/A23.2-09 (R2014), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-14, Engineering Design in Wood.
  .3 CSA O121-M2008 (R2013), Douglas Fir Plywood.
  .4 CSA O151-09 (R2014), Canadian Softwood Plywood.
  .5 CSA O153-13, Poplar Plywood.
  .6 CAN/CSA-O325-07 (R2012), Construction Sheathing.
  .7 CSA O437 Series-93 (R2011), Standards for OSB and Waferboard.
  .8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
  .9 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork, National Standard of Canada

.2 Underwriters' Laboratories of Canada (ULC)
  .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.

.2 Submit shop drawings for formwork and falsework.
  .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 33 – Health and Safety Requirements.

.4 Co-ordinate submittal requirements and provide submittals required by Section 01 33 00.

.5 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings and Comply with CAN/CSA-S269.3 for formwork drawings.

.6 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.7 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 01 51 00 – Temporary Facilities.

.2 Waste Management and Disposal:
  .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers.
.3 Divert wood materials from landfill to a recycling, reuse, composting facility as approved by Departmental Representative.
.4 Divert plastic materials from landfill to a recycling, reuse, composting facility as approved by Departmental Representative.
.5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

2.0 PRODUCTS

2.1 MATERIALS

.1 Materials and resources in accordance with Section 01 61 00 – Requirements.

.2 Formwork materials:
.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, CSA-O153.
.2 Rigid insulation board: to CAN/ULC-S701.SPEC NOTE: Drawings should designate areas requiring special architectural concrete features.

.3 Form ties:
.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.4 Form liners:
.1 Plywood: high density overlay, medium density overlay, Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151 or Poplar to CSA O153 grade, square edge, 20 mm thick.

.5 Form release agent: non-toxic, biodegradable, low VOC.

.6 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal 15 to 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.7 Falsework materials: to CSA-S269.1.

.8 Sealant: to Section 07 90 00 – Sealants.

3.0 EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.8 Align form joints and make watertight.
- .1 Keep form joints to minimum.

.9 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
- .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Line forms for following surfaces:
- .1 Outer face of outside girders beams and vertical edge of sidewalk slab.
- .2 Soffit of girders and underside of bridge decks if exposed.
- .3 Exposed faces of abutments, wingwalls, piers and pylons: do not stagger joints of form lining material and align joints to obtain uniform pattern. Secure lining taut to formwork to prevent folds.
- .4 Pull down lining over edges of formwork panels.
- .5 Ensure lining is new and not reused material.
- .6 Ensure lining is dry and free of oil when concrete is poured.
- .7 Application of form release agents on formwork surface is prohibited where drainage lining is used.
- .8 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
- .9 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND SHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.
- .1 Three days for walls and sides of beams.
- .2 Three days for columns.
- .3 Three days for beam soffits, slabs, decks and other structural members, or one days when replaced immediately with adequate shoring to standard specified for falsework.
- .4 One days for footings and abutments.

.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

.5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION 03 10 00

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

.1 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2018, Reinforcing Steel Manual of Standard Practice.

.2 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A143/A143M-03, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.3 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.4 ASTM A1064/A1064M-16, Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

.4 Canadian Standards Association (CSA International)

.1 CSA-A23.1- [04]/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.3-04, Design of Concrete Structures.

.3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.4 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

1.3 SUBMITTALS

.1 Submittals in accordance with Section describing Submittal Procedures.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacing, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacing and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide Class B tension lap splices unless otherwise indicated.

.5 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Consultant prior to its use.

.6 Quality Assurance: in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: upon request, provide Consultant with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.

.2 Upon request, submit in writing to Consultant proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials off ground 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Consultant.

.2 Reinforcing steel: billet steel, grade 400W, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.3 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m^2.

.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.

.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.

.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.

.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.

.1 In this case, no restriction applies to temperature of solution.

.4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.

.1 Provide product description as described in PART 1 - SUBMITTALS

.4 All reinforcement for abutment and mooring piles is 'black' (no galvanizing, no epoxy-coated bar).

.5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2. Only non-ferreous reinforcement bar supports (chairs) shall be used.

.6 Mechanical splices: subject to approval of Consultant.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

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

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

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.

.2 Upon request inform Consultant of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 ALL REINFORCING BARS SHALL BE TIED SECURELY TO PREVENT DISPLACEMENT.

2. UNLESS NOTED OTHERWISE ON PLANS, LAP LENGTHS FOR REINFORCING STEEL SHALL BE AS FOLLOWS:

REINFORCING BAR LAP LENGTHS

CONCRETE MPa	BAR SIZE					
	10M	15M	20M	25M	30M	35M
20	430 (17")	635 (25")	840 (33")	1320 (52")	1575 (62")	1855 (73")
25	380 (15")	560 (22")	760 (30")	1195 (47")	1370 (54")	1650 (65")
30	355 (14")	510 (20")	710 (28")	1065 (42")	1290 (51")	1500 (59")
35	330 (13")	480 (19")	660 (26")	990 (39")	1195 (47")	1395 (55")
40	305 (12")	455 (18")	610 (24")	940 (37")	1120 (44")	1320 (52")
45	280 (11")	430 (17")	560 (22")	890 (35")	1040 (41")	1245 (49")

NOTES:
1. MULTIPLY VALUES BY 1.3 FOR HORIZONTAL REINFORCING PLACED IN SUCH A WAY THAT MORE THAN 300 (12") OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE SPLICE.
2. MULTIPLY VALUES BY 1.5 FOR EPOXY COATED REINFORCEMENT WITH CLEAR COVER LESS THAN 3 BAR DIAMETERS OR BAR SPACING LESS THAN 7 BAR DIAMETERS.
3. MULTIPLY VALUES BY 1.2 FOR ALL EPOXY COATED REINFORCEMENT OTHER THAN IN NOTE 2. ABOVE.

.3 NO SPLICES OTHER THAN THOSE NOTED ON THE DRAWINGS ARE PERMITTED WITHOUT WRITTEN PERMISSION FROM THE STRUCTURAL ENGINEER.

.4 WHERE CONCRETE SURFACES ARE TO BE EXPOSED, ONLY NON-CORROSIVE TYPE REINFORCING CHAIRS SHALL BE USED TO SUPPORT THE REINFORCING STEEL.

.5 DOWELS ARE TO BE TIED IN PLACE PRIOR TO POURING CONCRETE - "WET DOWELING" OF ANY REINFORCING STEEL IS NOT PERMITTED WITHOUT THE WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER.

.6 HOOKS ON ALL TIES SHALL BE BENT AT LEAST 135° AND HAVE A MINIMUM LEG OF 6 TIMES THE TIE BAR DIAMETER.

.7 PROVIDE CORNER BARS TO MATCH HORIZONTAL WALL REINFORCEMENT.

.8 ALL VERTICAL REINFORCING TO FOUNDATION WALLS AND PIERS SHALL HAVE A STANDARD HOOK AND BE EMBEDDED IN THE FOOTING.

.9 ALL BARS SHALL BE BENT AT TEMPERATURES GREATER THAN 10°C.

.10 NO BARS WHICH ARE PARTIALLY EMBEDDED IN CONCRETE SHALL BE FIELD BENT EXCEPT AS SHOWN ON THE DRAWINGS OR APPROVED IN WRITING BY THE PROJECT STRUCTURAL ENGINEER.

.11 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.12 Prior to placing concrete, obtain Consultant’s approval of reinforcing material and placement.

.13 Ensure cover to reinforcement is maintained during concrete pour.

.14 Splice shall be staggered to avoid congestion.

3.4 FIELD WELDING

.1 No welding of reinforcement steel is permitted unless directed otherwise by the engineer in writing.

END OF SECTION 03 20 00

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing

1.2 DESIGN REQUIREMENTS

.1 Mix design shall be in accordance with CSA-A23.1/A23.2, as specified on drawings and as described in PART 2 - PRODUCTS.

1.3 SUBMITTALS

.1 Submittals in accordance with Section describing Submittal Procedures.

.2 At least 4 weeks prior to beginning Work, submit concrete mix design to Departmental Representative for review and approval.

.3 Submit testing and inspection results and reports for review by Consultant and do not proceed without written approval when deviations from mix design or parameters are found.

.4 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.5 Concrete hauling time: submit for review by Consultant deviations exceeding maximum allowable time of 90 minutes for concrete to be delivered to site of Work and discharged after batching.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section describing Quality Control.

.2 Submit to Consultant minimum 2 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.3 Ensure concrete supplier’s certification for both batch plant and materials meet CSA A23.1/A23.2 requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 90 minutes after batching.

.1 Modifications to maximum time limit must be agreed to by Consultant laboratory representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Consultant.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.3 Waste Management and Disposal:

.1 Separate waste materials in accordance with Section describing Construction/Demolition Waste Management and Disposal.

.2 Divert unused concrete materials from landfill to local facility approved by Owner.

.3 Provide an appropriate area on the job site where concrete trucks can be safely washed.

.4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Owner.

.5 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 Products

2.1 MATERIALS

.1 Cement: to CAN/CSA-A3001, Type GU for abutment and mooring piles.

.2 Blended hydraulic cement: to CAN/CSA-A3001.

.3 Supplementary cementing materials: to CAN/CSA-A3001.

.4 Water: to CSA-A23.1.

.5 Aggregates: to CAN/CSA-A23.1/A23.2.

.6 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 or ASTM C1017.

.7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate (2.5 mm max aggregate size), Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.

.1 Compressive strength: 50 MPa at 28 days.

.2 Net shrinkage at 28 days: maximum 2 % in any direction.

.8 Non premixed dry pack grout: composition of non-metallic aggregate (2.5 mm max aggregate size), and Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 45 MPa at 28 days.

.9 Curing compound: to CSA-A23.1/A23.2

.10 Mechanical waterstops: ribbed extruded PVC of sizes indicated with pre-welded corner and intersecting pieces with legs not less than 610 mm long:

.1 Tensile strength: to ASTM D412, method A, Die "C", minimum 12 MPa.

.2 Elongation: to ASTM D412, method A, Die "C", minimum 250%.

.3 Tear resistance: to ASTM D624, method A, Die "B", minimum 30 kN/m.

.11 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, flexible grade.

.3 Self-expanding cork: to ASTM D1752, Type II.

.12 Weep hole tubes: plastic.

.13 Damp-proof membrane:

.1 Kraft/polyethylene membrane:

.1 Plain: .75 mm thick polyethylene film bonded to asphalt treated creped kraft.

.2 Reinforced: two .10 mm thick polyethylene films bonded each side of asphalt treated creped kraft paper, reinforced with 13 x 13 mm fibreglass scrim.

.3 Membrane adhesive: as recommended by membrane manufacturer.

.14 Damp-proofing:

.1 Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2, and to Section 07 11 13 - Bituminous Damp proofing.

.15 Polyethylene film: 0.15 mm thickness to CAN/CGSB-51.34.

2.2 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet structural performance criteria in accordance with CAN/CSA-A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

.2 Provide concrete mix to meet following hard state requirements:

.1 Strip/pad footings, piers, pedestals, foundation walls: 35 MPa

.1 Durability and class of exposure: shall meet requirements for C-1 and S-3.
.2 Minimum compressive strength at 56 days: 35 MPa.
.3 Admixtures: as per mix design by Departmental Representative
.5 Special placement criteria: as per CSA A23.1
.6 Top Surface texture: see architectural drawings
.7 Geometrical requirements: not applicable.
.8 Curing: CSA A23.1 basic (3 days at ≥ 10o C to attain 40% of specified strength)

.2 Slabs on Grade: 32 MPa

.1 Durability and class of exposure: shall meet requirements for C-2 and S-3.
.2 Minimum compressive strength at 28 days: 32 MPa.
.3 Admixtures: as per mix design by Departmental Representative for surface finish require by architect
.4 Supplementary Cementing Material: as per mix design by Departmental Representative. A corrosion inhibitor meeting the criteria of CSA S413 Annex C is required.
.5 Special placement criteria: as per CSA A23.1 and mix design Departmental Representative
.6 Top Surface texture: See architectural drawings for finishes.
.7 Geometrical requirements: PART 3 TOLERANCES and to elevations on structural drawings.
.8 Curing: CSA A23.1 basic (3 days at ≥ 10o C to attain 40% of specified strength).

.3 Abutment and mooring piles: 35 MPa

.1 Durability and class of exposure: C-1 and S-3

.2 Minimum compressive strength 35 MPa at 28 days.
.3 Maximum aggregate size: 20 mm
.4 Maximum slump at point of discharge: 80 + 30mm
.5 Air content at point of discharge: 4% to 7%
.6 Density of air-dry concrete: 2300 + 150kg/m3
.7 Surface texture: broom non-skid finish on top deck, as-formed or steel trowel finish on all other surfaces.

.3 Provide quality management plan to ensure verification of concrete quality to specified performance.

Part 3 Execution

3.1 PREPARATION

.1 The Departmental Representative shall perform a field review of rebar prior to contractor placing concrete.

.1 Provide 48 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative’s approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout or epoxy grout as indicated to anchor and hold dowels in positions as indicated.

.11 Do not place load upon new concrete until authorized by Consultant.

.12 Pour joint locations shall be proposed by the contractor and are subject to prior approval by the departmental representative. All pour joints shall be roughened to 5mm amplitude and thoroughly cleaned.

3.2 CONSTRUCTION

.1 Perform cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Consultant.

.2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Consultant.

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

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor rods:

.1 Set anchor rods to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of, grout anchor rods in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100mm diameter. Drilled holes to be minimum 25 mm larger in diameter than rods used or as per manufacturers' recommendations.

.3 Protect anchor rod holes from water accumulations, snow and ice build-ups.

.4 Set rods and fill holes with shrinkage compensating grout or epoxy grout, as indicated or instructed by Consultant.

.5 Locate anchor rods used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.5 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.

.6 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.7 Dampproof membrane:

.1 Install dampproof membrane under concrete slabs-on-grade inside building.

.2 Lap dampproof membrane minimum 150mm at joints and seal.

.3 Seal punctures in dampproof membrane before placing concrete.

.4 Use patching material at least 150mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance in accordance with CSA-A23.1/A23.2 Table 19 Class C.

.2 Embedded Elements and Anchor bolts for abutment, float and mooring piles:

.1 Embedded elements shall be accurately located, both in plan and elevation, and so held in place that they will remain in location during placing and curing of concrete. Embedded metal shall be positioned within ± 3 mm unless otherwise indicated on the Drawings.

.2 Tolerances from the dimensions shown on the drawings for bolt settings, after the concrete has set, shall be as follows unless noted otherwise on the Drawings:

.1 Bolts within a group: ±3 mm

.2 Bolt group to adjacent bolt group: ±6 mm

.3 Maximum accumulation between two bolt groups: ±6 mm per 30 m, not to exceed ±25 mm

.4 Projection from designated surfaces: ±6 mm

.3 Anchor bolt threads shall be protected and inserts shall be kept free of any deleterious materials. After placing concrete, ensure nuts and bolts run freely.

.4 All exposed concrete edges to be chamfered 20mm unless noted otherwise.

.5 Concrete surfaces to have the following finish in accordance with CSA A23.1 unless noted otherwise.

.1 Broom finish for to surfaces exposed to traffic (vehicle or pedestrian)

.2 Rough-form finish for surfaces not exposed to public view

.3 Smooth-form finish for surfaces exposed to public view

3.4 COVER REQUIREMENTS

.1 Minimum cover to reinforcement:

.1 Cast against and permanently exposed to earth shall be 75mm of cover

.2 Soffits of elevated structures shall be 100mm of cover

.3 Elsewhere shall be 60mm of cover

.2 All formwork ties, bolts and other metal shall be removed or cut back 25mm from the concrete surface, all tie holes, honey combs and voids over 25mm in any direction shall be filled with "Sikatop 123 plus" or approved equivalent.

3.5 FIELD QUALITY CONTROL

.1 Site tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Air Content.

.2 Slump tests.

.3 Compressive Strength.

.2 Inspection and testing of concrete and concrete materials will be carried out by independent testing laboratory for review in accordance with CSA-A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.

.4 Contractor to pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

.5 Consultant may request additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.

.7 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.6 VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

END OF SECTION 03 30 00

1.0 GENERAL

1.1 RELATED WORK

.1 Cast-In-Place Concrete Section 03 30 00

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CSA International

.1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2005, Adhesive & Sealants Applications.

1.3 QUALITY ASSURANCE

.1 Standards: Conform to CAN/CSA-A23.1, for concrete finishes.

.2 Sandblasting installer operations shall conform to applicable codes and Regulations.

.3 Installer Qualifications:

.1 Work shall be carried out by personnel who are thoroughly trained and experienced in the floor treatment. The installer to provide a list of a minimum of 3 projects performed within 3 years of equivalent complexity and scope as this contract.

.4 Mock-ups:

.1 Sandblasting

.1 Prior to beginning full scale sandblasting operations, prepare a minimum 4’ x4’ 1200 x 1200 mm test area as selected by Departmental Representative to review sandblasting techniques and desired results for light, medium, and coarse sandblast finishes.

.2 Maintain Mock-up during construction in an undisturbed condition as a standard for judging the work. Accepted Mock-up may remain as part of the work.

.5 Pre-installation Meeting:

.1 Prior to commencement of Work on site, convene a pre-installation conference to be attended by the Contractor, Coating Subcontractor, Manufacturer's Technical Representative, Consultant and Owner to review:

.1 Convey proper installation and placement of concrete slabs to ensure proper concrete finishing requirements in order to achieve adequate floor polishing application.

.2 Convey to Contractor Requirements for protection of concrete slabs to receive concrete floor polishing and to coordinate sequence of work and application during construction.

1.4 SUBMITTALS

.1 Submittals to be in accordance with 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 33-Health & Safety Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.

.2 Include application instructions for concrete floor treatments.

.3 Submit maintenance instructions for insertion in operations and maintenance manuals. Instructions shall give specific warning of maintenance or cleaning practices or materials, which may damage installed work.

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 and storage requirements:

.1 Deliver materials to site in manufacturer's original factory packaging, labelled with manufacturer's name and address.

.2 Store materials in a clean dry area in accordance with manufacturer's instructions.

.3 Keep product from freezing.

.4 Avoid direct contact with this product as it may cause mild to moderate irritation of the eyes and/or skin.

.5 Protect materials during handling and application to prevent damage or contamination.

.3 Dispense special concrete finish material from sealed containers.

.4 Packaging Waste Management: Comply with requirements of Section 01 74 19 Waste Management and Disposal.

.5 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

1.6 ENVIRONMENTAL REQUIREMENTS / PROJECT CONDITIONS

1. Do not apply product when air, surface, or material temperature is below 35°F (2°C) or above135°F (57°C).

2. Do not apply to frozen concrete.

3. Do not use on highly dense or non-porous surfaces.

4. Allow concrete to cure a minimum of 45 days, or as otherwise acceptable by product manufacturer before commencement of work.

5. Do not commence with polishing until Work has been sufficiently advanced, whereby Work yet to be performed will not adversely affect polished concrete floors. Application of products shall take place a minimum of 21 days prior to fixture and trim installation and Substantial Performance of Work.

6. Limit and control dust generated by grinding and polishing procedures in order to prevent potential damage to adjacent surfaces and equipment.

7. Control the use of water. Remove standing water from completed floor surfaces.

8. Ensure that penetrating sealers are not applied to concrete floors that are to be polished.

1.7 EXTENDED WARRANTY

1. Provide two (2) year manufacturer's warranty on products and installation against fading and delamination of finished surfaces.

2.0 PRODUCTS

2.1 MATERIALS

.1 Concrete materials shall conform to requirements of Section 03 30 00-Cast-In-Place Concrete Short Form and CAN/CSA-A23.1.

.2 Slip-Resistant Additive:
- .1 Finely ground polymer material for addition to concrete sealers.
- .2 Compatible with the applied acrylic sealer.
- .3 Polymer suspended in a sealer material.
- .4 Sure-Step by WR Meadows or approved equal.

.3 Bonding Agent: Formulated for bonding new concrete to cured concrete. Acceptable Products:
- .1 "Polymer Bonding Agent" by Target Products Ltd.
- .2 "710 Flex-Con" by Else Construction Products.
- .3 "K-710 Krystobond" by Kryton International Inc.
- .4 "Fabribond-A" by Fabrikem Manufacturing Ltd.
- .5 Or approved alternative.

.4 Curing and Sealing Compound:
- .1 Conforms to ASTM C309-11, Type 1, Class B.
- .2 ASTM C1315, Type 1, Class A.
- .3 30% solid concrete curing and sealing compound formulated of acrylic polymers in true water base carrier.
- .4 Compound dries clear to provide a transparent sheer finish.
- .5 Provide impermeable seal for maximum moisture protection.
- .6 VOC Content < 50g/L
- .7 VOCOMP-30 water-based, acrylic concrete curling and sealing compound or approved equal.

.5 Natural Hardener: Premixed, abrasion resistant non-metallic hardener (Type 1). Acceptable Products:
- .1 "Mastercron" by Master Builders Company Limited.
- .2 "Diamag 7" by Sternson Limited.
- .3 "Non-Metallic Floor Hardener" by Target Products Ltd.
- .4 "785 Genflor Non-Metallic Floor Hardener" by Elsro Construction Products.
- .5 Or approved alternative.

.6 Non-Shrink Grout (for patching): Acceptable Products:
- .1 "Embeco Mortar" by Master Builders Company Limited.
- .2 Pre-mixed "Fast-Set Patching Concrete" by Target Products Ltd
- .3 "810 Gengrout" by Elsro Construction Products.
- .4 "K-510 Krystol Patch/Grout" by Kryton International Inc.
- .5 Or approved alternative.

.7 Densifier: Non-flammable non-toxic,water-based formulation used on Portland Cement materials utilizing Quartz-Litium based products. Acceptable Products:
- .1 "Crenz Protect" by Crenz Concrete.
- .2 "Pentra Sil" by Convergent Concrete.
- .3 "Euco Diamond Hard" by The Euclid Chemical Company.
- .4 "Liquihard Ultra" Surface Hardener
- .5 Or approved alternative.

.8 Seeding Aggregates: Aggregate shall be small round, brown pebbles size around 10 mm and be hard, sand, durable and free of all deleterious materials and staining quality.

.9 Aggregate for Polished Concrete: 10 mm pea gravel in salt and pepper color.

2.2 FINISHES

.1 Sandblasted finish (light to medium sandblasting): typical for all exposed exterior concrete walls and for pedestals at entry structure.

.2 Trowelled finish with wood trowel: typical for all exposed interior concrete floors with surface hardener.

.3 Broom Finish: typical for all exterior concrete.

3.0 EXECUTION

3.1 FINISHING-GENERAL

.1 Do concrete finishing work in accordance with CAN/CSA-A23.1-M01, unless otherwise indicated.

.2 Tops of Walls and Columns to be level and true. Allowable tolerance 6 mm in 3,000 mm.

3.2 FORMED SURFACES

.1 Inspect concrete surfaces for defects immediately after removal of formwork.

.2 Remove or cut back to a depth of 3/4" (19 mm) from the surface of the concrete all bolts, ties, nails, or other metal that is not required and repair immediately. Patch all cone and sleeve holes flush with concrete surface in strict accordance with manufacture's printed instructions. Grout all steel inserts in strict conformance with grout manufacturer's printed instructions.

.3 Remove imperfections such as bulges, fins, lips, and stains to permanently exposed surfaces as directed by Departmental Representative by chipping or grinding and patch to match adjacent surfaces. Do not proceed with grinding until the concrete has sufficiently hardened to prevent dislodgment of coarse aggregate particles. Allowable limits of grinding to be 1/16" so as to not expose aggregate.

.4 Repair to exposed surfaces or surfaces to receive paint type finishes: Repairs to be carried out under the direction of the Departmental Representative. Blend cement and aggregate so that, when dry, patching mortar will match colour of surrounding. Provide test areas at inconspicuous location to verify mixture and colour match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface. Patch and fill all concrete imperfections such as "blow holes", "honeycomb" and voids as directed.

.5 Strike off smooth and finish tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces with a texture matching the adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown.

3.3 HORIZONTAL SURFACES

.1 Where floor drains occur, floors to be level around walls and have a minimum 1:50 uniform pitch to drains, unless indicated otherwise. Stairs and landings shall have positive slopes to provide complete water drainage with no ponding.

.2 Finish horizontal concrete surfaces as follows:

- .1 Exposed horizontal surfaces not intended to receive additional concrete: Smooth steel trowel finish or as indicated on the drawings.
- .2 Horizontal concrete surfaces intended to receive waterproofing membrane or applied floor finishes: Smooth, steel trowel finish. Floors to be finished flat, free from defects which would telegraph through finish material.
- .3 Horizontal concrete surfaces intended to receive additional concrete toppings, quarry tile or ceramic tile: Screeded off to true lines and levels shown, roughened to an amplitude of 3/16" (5 mm), cleaned of laitance and loose concrete and left ready to receive finish. Depress slabs to accommodate finish where indicated.
- .4 Broom Finish: After completion of floating and when excess moisture of surface sheen has disappeared, complete surface finishing by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Consultant.

3.4 PLAIN FLOOR FINISH (TROWELED)

.1 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed.

.2 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.

.3 Trowel to smooth and even surface.

.4 Follow with second trowelling to produce smooth burnished surface to within tolerance described in CAN/CSA-A23.1-M90, Cause 22.1.2-Straight-Edge Method for Very Flat Classification Finish 1/8" (3 mm) in 10'-0" (3000 mm) to all floors receiving carpet, resilient flooring, liquid applied flooring, thin-set ceramic tile. All other floors shall be finished to Flat Classification Finish 3/16" (5 mm) in 10'-0" (3000 mm). Floors shall be true to plane as determined by a 10'-0" (3.0 meter) straight-edge placed anywhere on the surfaces in any direction. Check conformance to tolerance limits at any time after the curing period. Where this Section conflicts with other Sections in Division 3, this Section shall govern.

.5 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.

.6 Apply curing compound in accordance with manufacturer's instructions to all areas not scheduled to receive further floor finish.

.7 Protect surfaces which will be exposed to direct sunlight during the curing period in accordance with manufacturer's instructions.

3.5 HARDENED FLOOR FINISH

.1 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed and apply non-metallic hardener to manufacturer's instructions.

.2 Apply first shake of aggregate (one half of amount) after floating.

.3 Float first shake and apply second shake.

.4 Float second shake.

.5 Flat trowel to produce fine texture non-slip finish. Use wood trowel for all air-entrained concrete mixes.

.6 Apply two coats of curing and sealing compound in accordance with manufacturer's directions.

3.6 BONDING AGENT

.1 Apply bonding agent to all concrete when new concrete will be applied against it under the following conditions:
- .1 Patching.
- .2 Feathering.
- .3 Construction joints.
- .4 Bonding of topping slabs.

3.7 DEFECTIVE WORK

.1 Repair honeycombing, rock packets, chips, spalls and other voids in exposed concrete surfaces, using patching materials as specified to provide a smooth surface. Remove fins and other protrusions in concrete surfaces. Maximum allowable depth of grinding to be 1/16".

.2 Consult with Departmental Representative on the repair of defective concrete surfaces prior to execution of the work.

.3 Patch form tie holes in all exposed concrete surfaces and surfaces designated to receive waterproofing unless otherwise directed.

.4 Where in the opinion of Departmental Representative, material or workmanship fails to meet the requirements of the specification, such work may be rejected. Work rejected shall be replaced or repaired to the approval of the consultant at no additional cost to the owner.

3.8 POLISHED CONCRETE FLOOR FINISH

.1 Use a troweling machine (diameter of blades max. 915mm) with plastic blades to finish the concrete.

.2 Use a water-based acrylic curing & sealing compound formulated using special polymers in a true-water based carrier; sealer to provide an impermeable seal for superior moisture protection. Apply the sealer to manufacturer's guidelines.

.3 Proceed with construction/work, finish everything except installation of fixtures & washroom partitions.

.4 Doing a final sweep cleaning followed by a light sanding of the floor surface with 180 & 200 grit sand paper to remove foreign materials, etc. that may have penetrated the sealed concrete surface. Vacuum & wash clean, let dry.

.5 Add Sip-Resistant Additive with final application of sealer.

3.9 CONCRETE FOR BOAT MAINTENANCE AND RACK STORAGE AREAS

.1 ALL DESIGN, CONSTRUCTION, AND MAINTENANCE BE IN ACCORDANCE WITH CSA S413.

.2 THE COORDINATING REGISTERED PROFESSIONAL SHALL BE RESPONSIBLE FOR ENSURING THAT AN ACCEPTABLE PROTECTION SYSTEM TO PREVENT CORROSION HAS BEEN IMPLEMENTED.

.3 WHERE NECESSARY, MEMBRANES SHALL BE SPECIFIED BY THE ARCHITECT AND MUST MEET THE REQUIREMENTS OF ASTM C957/C957M OR CAN/CGSB-37.50-M.

.4 WHERE A CORROSION INHIBITOR IS REQUIRED BY THE DESIGN, IT SHALL BE IN THE FORM OF A CALCIUM NITRATE ADMIXTURE. A CORROSION INHIBITOR OTHER THAN CALCIUM NITRATE MAY BE USED ONLY IF IT IS TESTED IN ACCORDANCE WITH ASTM G180 OR ASTM G109 IN CONCRETE OF SIMILAR QUALITY TO THAT USED IN THE STRUCTURE.

.5 REFER TO THE ARCHITECTURAL DRAWINGS FOR THE LOCATION OF DRAINS, LAYOUT OF SLOPES, AND ELEVATIONS OF HIGH AND LOW POINTS ON THE FLOOR AND/OR ROOF SURFACE.

.6 THE COORDINATING REGISTERED PROFESSIONAL SHALL DIRECT THE OWNER TO UNDERTAKE A REGULAR MAINTENANCE PROGRAM DESIGNED TO SUSTAIN THE SAFETY AND DURABILITY OF THE STRUCTURE. THE OWNER SHALL BE RESPONSIBLE FOR ENSURING THAT THE MAINTENANCE PROGRAM IS CARRIED OUT. IF A CHANGE OF OWNERSHIP SHOULD EVER OCCUR, THE CURRENT OWNER SHALL BE RESPONSIBLE FOR PROVIDING THE NEW OWNER WITH MAINTENANCE AND REPAIR RECORDS, CONDITION SURVEY REPORTS, AND THE REQUIRED MAINTENANCE PROGRAM.

.7 MEMBRANES AND SEALANTS ARE NOT PERMITTED ON SLABS ON GRADE UNLESS APPROVED BY THE STRUCTURAL ENGINEER.

.8 ALL VERTICAL ELEMENTS (INCLUDING WALLS AND COLUMNS) REQUIRE A MEMBRANE EXTENDING 100mm (4") ABOVE THE FLOOR.

.9 STEEL STAIRS SHALL BE HOT DIP GALVANIZED.

.10 ALTERNATE CORROSION PROTECTION SYSTEMS MAY BE USED ONLY IF THEY PROVIDE THE SAME PROTECTION AS THE SYSTEMS SPECIFIED HERE. ALL CONSULTANTS MUST APPROVE THE ALTERNATE.

3.10 PROTECTION

.1 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period shall be especially protected.

.2 Protect work of other sections from damage resulting from work of this Section.

.3 Provide suitable enclosures for collecting grit and dust from sandblasting operation.

.4 Erect barricades to prevent traffic on newly finished surfaces.

.5 Suggested protection in high traffic areas after the sealer has been applied is as follows:
- .1 Place cheap colourfast carpet that is breathable (not rubber backed), fuzzy side down or Protect CP board.
- .2 Masonite or plywood may then be applied over the carpet/cardboard for further protection.

3.11 ADJUSTING & CLEANING

.1 Progress Cleaning: Clean during progress of the Work 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 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

.4 Engage a concrete finish manufacturer's authorized representative to train Owner's maintenance personnel on proper maintenance procedures

END OF SECTION 03 35 00

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 91 23 – Interior Painting

.2 Section 09 91 13 – Exterior Painting

1.2 REFERENCES

.1 ASTM International

.1 ASTM A 53/A 53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 CSA International

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16, Design of Steel Structures.

.4 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

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

.1 Material Safety Data Sheets (MSDS).

.5 The Master Painters Institute (MPI).

.1 Architectural Painting Specification Manual - current edition.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.1 For finishes, coatings, primers, and paints applied on site: indicate vac concentration in g/L.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.2 Indicate materials, core thicknesses, finishes, connections, and joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.3 Regional Materials; submit evidence that project Incorporates required percentage 10% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.4 Low-Emitting Materials:

.1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: 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.

.4 Ensure companies undertaking welding work are qualified and certified as stated in the requirements in CSA W55.3 or W47.1. Submit name and qualifications of welding supervisor and welders to the departmental representative.

1.5 DELIVERY, STORAGE & 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 of 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.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 7421 Construction/Demolition Waste Management and Disposal.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Structural steel to CSA G40.20/G40.21:.

.1 Steel sections for abutment and mooring piles: to ASTM A252 and CSA G40.20/G40.21, Grade 300W.

.2 Plates and HSS, Grade 350W

.3 Standard Channels and Angles, Grade 300W

.4 Welded and Rolled Sections, Grade 350W

.2 Steel pipe: to ASTM A 53/A 53M standard weight galvanized finish.

.3 Welding materials: to CSA W59.

.1 Welding electrodes: to CSA W48 Series, Class E49XX or Class E55XX.

.2 Bolts: to ASTM A 307.

.3 Anchor rods: to ASTM F 1554 grade 36.

.4 Bolts and anchor bolts for abutment, float and mooring piles: to ASTM F3125, type 1 high strength bolts unless noted otherwise.

.5 Grout: non-shrink, non-metallic, flowable, 15 pile at 24 hours.

.6 Miscellaneous pipe for metal fabrications and handrails shall conform to ASTM A53 type XS, Grade A.

.7 Bolted connections shall be comprised of ASTM F3125, type 1 high strength bolts, nuts to ASTM A194 grade 2H, washers to ASTM F436, all galvanized and snug tightened unless noted otherwise.

.8 Aluminum alloy weldbeads shall be filler Alloy 5356 with an ultimate tensile strength of 190 MPa.

.9 Gusset plates and stiffener plates shall have a minimum thickness of 8mm unless noted otherwise.

.10 End cover plates shall have a minimum thickness of 6mm and be seal welded unless noted otherwise.

.11 All bolts shall be 19mm diameter unless noted otherwise, with threads excluded from shear planes unless noted otherwise.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 Submit fabrication drawings for all steel work prior to commencing fabrication. The Department Representative's review of fabrication drawings will be to ascertain compliance with the design concept only and shall not relieve the fabricator of responsibilities under their contract.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G 164.

.2 Exterior Coating: to MPI EXT 5.1L. Prepare surface to an abrasive blast SSPC-SP6.

.3 Shop coat primer: to CAN/CGSB-1.40.

.4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

.5 All steel (except piles and sheet piles), anchor bolts and fasteners for abutment, float and mooring piles shall be hot dip galvanized, unless otherwise noted.

.6 Guardrail shall be shop painted as specified in Section 2.5.

2.4 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.

2.5 SHOP PAINTING

.1 Primer: VOC limit 150 giL maximum to GS-11.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 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.

.4 Clean surfaces to be field welded; do not paint.

.5 Coatings shall be applied in accordance with the manufacturer's specifications. All blast cleaning and shop painting shall be carried out under cover in an area protected from weather and other detrimental effects.

.6 The detailed requirements of the paint schedule for the approach guardrail and ramp components are given below.

.1 Stripe coats shall be applied to all welds, lap joints, plate edges, corners, sharp edges and any other areas where spray application of the overall coating system may result in low dry film thickness.

.2 The following paint system shall be used:

Coat No.	Type	Binder	Product Name	Dry Film Thickness
1	Primer	Zinc-Rich Epoxy	Interzinc 52	2.5 mils
2	Mid Coat	Polyamide Epoxy	Interseal 670HS	7 mils
2	Stripe Coat	Polyamide Epoxy	Interseal 670HS	5 mils
3	Topcoat	Polyamide Epoxy	Interseal 670HS	7 mils
-	-	-	-	16.5 mils minimum

Note: Finished coating system Dry Film Thickness shall be a minimum of 16.5 Mils (412 microns) at each spot measurement. Stripe coat not included.

.3 Topcoat to be a red top coat (RAL 3000) and curb which shall have a safety yellow top coat (RAL 1003).

.4 The Contractor is responsible for repairing damage to shop applied coatings occurring in storage, erection or installation.

.5 All dry film thickness (DFT) shall be stated in Mils (thousands of an inch). The equivalent measurement and conversions are as follows:

One thousandth of an inch (1 mil) = 25 microns

.7 Field touch up painting shall be carried out in accordance with the paint manufacturer's specifications.

.8 The Contractor shall provide sufficient paint for field touch-up of any damaged paint surface.

Part 3 Execution

3.1 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.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

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 Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Weld field connection with bolts to CAN/CSA-S16.1, or weld.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 150 g/L to GS-11.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 150 g/L to GS-11.

.10 .

.11 All bolted connections shall use two nuts, a half-thickness lock nut closest to the connection and a full-size nut outside.

.12 The width of bolt holes shall be maximum 2mm larger than the bolt diameter unless noted otherwise.

.13 All welds to be 8mm fillet weld unless noted otherwise.

.14 All welds to be continuous unless noted otherwise.

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 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 metal fabrications installation.

END OF SECTION 05 50 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 06 20 00 - Finish Carpentry

.2 Section 01 74 19 - Waste Management and Disposal

.3 Section 03 30 00 - Cast-in-Place Concrete

.4 Section 05 50 00 - Metal Fabrications

.5 Section 06 13 13 - Log Construction

.6 Section 06 13 23 - Heavy Timber Framing

.7 Section 06 17 53 - Shop-Fabricated Wood Trusses

.8 Section 06 20 00 - Finish Carpentry Including Stairs and Trim

1.2 REFERENCES

.1 ASTM International

- .1 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A 653/A 653M-09a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.
- .3 ASTM D 1761-06, Standard Test Methods for Mechanical Fasteners in Wood.
- .4 ASTM D 5055-10, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
- .5 ASTM D 5456-10, Standard Specification for Evaluation of Structural Composite Lumber Products.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-11.3-M87, Hardboard.
- .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.
- .4 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.3 CSA International

- .1 CAN/CSA-A247-M86(R1996, Insulating Fiberboard.
- .2 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .3 CSA O112 Series-M1977 (R2006), CSA Standards for Wood Adhesives.
- .4 CSA O121-08, Douglas Fir Plywood.
- .5 CAN/CSA O122-06, Structural Glued-Laminated Timber.
- .6 CSA O141-05 (R2009), Softwood Lumber.
- .7 CSA O151-09, Canadian Softwood Plywood.
- .8 CSA O153-M1980 (R2008), Poplar Plywood.
- .9 CSA O325-07, Construction Sheathing.

.4 Forest Stewardship Council (FSC)

- .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1

.3 FSC Accredited Certified Bodies.

.5 National Lumber Grades Authority (NLGA)
.1 Standard Grading Rules for Canadian Lumber 2007.

.6 The Truss Plate Institute of Canada
.1 Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses 2007.

.7 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

1.3 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 [wood products and accessories] 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 British Columbia, Canada.

.4 Sustainable Design Submittals:
.1 Construction Waste Management:
.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that of construction wastes were recycled or salvaged.
.2 Regional Materials: submit evidence that project incorporates required percentage 10% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
.3 Wood Certification: submit manufacturer's Chain-of-Custody Certificate number for FSC certified wood.
.4 Low-Emitting Materials:
.1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.
.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 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 in accordance with CSA and ANSI standards.

.3 Sustainable Standards Certification:
.1 Certified Wood: submit listing of wood products and materials used in accordance with FSC-STD-01-001.

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 wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

2.0 PRODUCTS

2.1 FRAMING AND STRUCTURAL MATERIALS

.1 Lumber refer to Structural Drawings for specific grades and species for all structural lumber products. Unless specified otherwise, 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 Wood I-joists in accordance with Prefabricated Wood I-Joists ASTM D5055.

.3 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

.1 Structural Composite Lumber Beams shall have minimum properties as follows:

.1 f_b = 33 MPa at 305mm member depth.

.2 f_v = 3.6 MPa.

.3 E = 13,800 MPa.

.4 f_{cp} = 9.0 MPa.

.5 $K_{zb} = (305/d)^{1/9}$.

.6 f_c = 29.0 MPa.

.7 f_t = 21.0 MPa.

.8 Submit manufacturer’s structural properties data to Departmental Representative for approval.

.4 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:

.1 Board sizes: "Construction and/or #1/#2" or better grade.

.2 Dimension sizes: "Construction and/or #1/#2" light framing or better grade.

.3 Post and timbers sizes: "#1" or better grade.

2.2 PANEL MATERIALS

.1 Douglas fir plywood (DFP): to CSA 0121, standard construction.

2.3 ACCESSORIES

.1 Subflooring adhesive: to CGSB-71.26, cartridge loaded.

.1 Maximum allowable VOC limit: see Architectural Specifications.

.2 General purpose adhesive: to CSA O112 Series.
.1 Maximum allowable VOC limit: see Architectural Specifications.

.3 Nails: to meet CSA B111 requirements for engineered construction nails.

.4 Bolts: to ASTM A307, complete with nuts and washers.

.5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.6 Joist hangers: by joist supplier.

.7 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy.

2.4 FASTENER FINISHES

.1 Hot-dip Galvanizing: to CAN/CSA-G164, use hot-dip galvanized fasteners for exterior work and where shown on the Structural Drawings.

2.5 WOOD PRESERVATIVE

.1 All pressure treated wood where called for on the structural drawings to use ACQ (Amine Copper Quat). Wood materials (other than rot-resistant species) that come in contact with concrete, concrete block and where it is exposed to the weather shall be pressure treated with Amine Copper Quat. Cut surfaces of treated timber are to receive a brush applied coat of preservative. Treated wood products shall bear the stamp of the Canadian Wood Preservers Bureau.

3.0 EXECUTION

3.1 PREPARATION

.1 Store wood products in dry location in accordance with best trade practise.

3.2 INSTALLATION

.1 Comply with requirements of National Building Coder of Canada 2015 and Structural Drawings supplemented by following paragraphs.

.2 Install members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with "crown-edge" up.

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Install subflooring and combined subfloor and underlay with panel end-joints located on solid bearing, staggered at least 800 mm.
.1 In addition to mechanical fasteners, floor panels secure floor subflooring to floor joists using glue. Place continuous adhesive bead in accordance with manufacturer's instructions, single-bead on each joist or wood truss chord and double-bead on joists and chords where panel ends butt.

.7 Install wall sheathing in accordance with manufacturer's printed instructions and in accordance with Structural Drawings.

.8 Install roof sheathing in accordance with requirements of National Building Code and Structural Drawings.

.9 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.

.10 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 indicated on Architectural Drawings.

.11 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.12 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using specified fasteners.

.13 Install sleepers as indicated.

.14 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 SCHEDULES

.1 Roof Sheathing:
.1 Douglas Fir Plywood, sheathing grade T&G edge, as shown on Structural Drawings. Sheathing is applied to trusses and over T & G decking. See Structural Drawings.

.2 Exterior wall sheathing:
.1 Douglas Fir Plywood, sheathing grade square edge, as shown on Structural Drawings.

.3 Subflooring:
.1 Douglas Fir Plywood, sheathing grade T&G edge, as shown on Structural Drawings.

.4 Electrical equipment mounting boards:
.1 Douglas Fir Plywood, sheathing grade square edge 12 mm thick unless shown otherwise.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in

accordance with Section 01 74 00 – Cleaning and Waste Management.

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 19 – 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 rough carpentry installation.

END OF SECTION 06 10 00

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUMMARY OF WORK

.1 Work includes:

.1 Prefabrication of heavy timber structural framing consisting of columns and beams as noted in structural drawings, purlins, and rafters of minimum diameter pole profiles and tapered profiles.

.2 Supply of steel connections, bolts, lags, washers, pins for timber to timber connections.

.2 Any damage to the heavy timber and log components resulting from improper storage or handling by the General Contractor shall be made good at no cost to the Contract.

.3 Related Sections:

.1 Section 03 30 00 Cast–In–Place Concrete
.2 Section 05 50 00 Metal Fabrications
.3 Section 06 10 00 Rough Carpentry
.4 Section 06 13 23 Heavy Timber Framing
.5 Section 08 44 13 Glazed Aluminum Curtain Walls

1.3 QUALITY ASSURANCE

.1 Grading:

.1 NBC Part 4—Design, as applicable to Timber Construction.

.2 Timber components and construction to CSA Standard 086 and according to N.L.G.A. No. 1980 Rules as applicable.

1.4 SUBMITTALS

.1 Submit shop drawings of all timber connections in accordance with Section 01300—Submittals and the General Conditions of Contract prior to fabrication.

2.0 PRODUCTS

2.1 MATERIALS

.1 Members shall be ‘living-edge’, free of bark, and within size range.

.2 All stock shall be sufficiently air-dried to allow construction and resist checking.

2.2 ACCESSORIES

.1 Steel Connection hardware, drift pins, bolts, strap anchors, clip angles, shear plates and other connection items as detailed:

.2 The following specifications and standards apply:

.1 Thru Bolts: ASTM A307, complete with washers
.2 Lag Bolts: ASTM A307, complete with washers
.3 Shear Plates: CSA Standard 086–1984

.3 Shop drawings for the steel connections to be prepared by the fabricator and submitted to the Engineer for approval prior to fabrication.

3.0 EXECUTION

3.1 HANDLING AND STORAGE

.1 All timber shall be handled using rope or canvas belt slings. No cables, chains or pee vees are to be used on finished elements, or on raw logs where their use could predictably damage the intended finished appearance of the log.

.2 All material shall be stored on clean wood spacers and protected from the elements with adequate means during all phases of fabrication and storage until delivery to final construction site.

.3 All timber shall be given one coat of water repellant sealer.

END OF SECTION 06 17 53

1,0 GENERAL

.1 PROTECT TIMBER COMPONENTS FROM DAMAGE DURING SHIPPING, STORAGE ON SITE AND ERECTION. STORE IN A DRY AND WELL VENTILATED AREA. DAMAGED MEMBERS SHALL BE REPAIRED OR REPLACED AT NO COST TO THE OWNER.

.2 UNLESS NOTED OTHERWISE, ALL TIMBER SHALL BE DOUGLAS FIR #1 OR BETTER. TIMBER SHALL BE GRADED ACCORDING TO THE NATIONAL LUMBER GRADING ASSOCIATION (NLGA). GRADE STAMPS SHALL BE LOCATED SO AS NOT TO BE VISIBLE IN THE FINAL ASSEMBLY. THE CONTRACTOR SHALL MAINTAIN RECORDS OF GRADE MARKS AND CERTIFICATES INDICATING CONFORMANCE WITH THE DRAWINGS.

.3 IT IS ASSUMED THAT TIMBERS ARE TO BE CUT AND ASSEMBLED IN THEIR "GREEN" STATE. THE OWNER MUST EXPECT MOVEMENT OF THE MEMBERS, WHICH COULD INCLUDE SHRINKAGE, CHECKING, TWISTING AND/OR BOWING.

.4 ALL JOINERY SHALL BE ACCURATELY CUT SO AS TO MAKE A NEAT, SNUG FIT. EXPOSED EDGES OF MEMBERS SHALL HAVE A MICRO-BEVEL.

.5 SUPPLY AND INSTALL ALL MISCELLANEOUS METALS AND FASTENERS REQUIRED FOR ASSEMBLY AND ERECTION. STEEL PLATE SHALL BE 300W (44W) GRADE. ERECTION BOLTS SHALL BE ASTM A307. THREADED ROD SHALL BE ATSM F1554, GRADE 36 OR ASTM A193 GRADE B7. BOLTS, NUTS AND WASHERS IN CONTACT WITH HOT DIPPED GALVANIZED STEEL SHALL BE HOT DIPPED GALVANIZED.

.6 EXCEPT PARTS OF MEMBERS TO BE GALVANIZED OR UNLESS NOTED OTHERWISE ON THE DRAWINGS, ALL STEEL WORK SHALL BE SHOP PRIMED. PRIMING SHALL BE IN ACCORDANCE WITH CISC/CPMA-1-73a "QUICK DRYING PRIMER" WHEN NO TOP COAT IS REQUIRED AND IN ACCORDANCE WITH CISC/CPMA-2-75 WHEN A TOP COAT IS SPECIFIED. IF A TOP COAT IS SPECIFIED THE PRIMER SHALL BE SELECTED ENSURING COMPATIBILITY WITH THE SPECIFIED SYSTEM. ITEMS SPECIFIED TO BE GALVANIZED SHALL BE HOT DIPPED GALVANIZED TO ASTM A123-12, G185 OR A653 MINIMUM ZINC COATING OF 600g/sq.m. FIELD TOUCH-UP ALL ABRASIONS, SCRATCHES, WELDS OR BOLTS.

.7 TIMBERS AND HEAVY TIMBER TRUSSES SHALL BE ERECTED IN CONFORMANCE WITH THE REVIEWED SHOP DRAWINGS, CODE REQUIREMENTS AND BEST TRADE PRACTICE. USE TEMPORARY BRACING AND GUY LINES TO ENSURE SAFETY AND PROPER ALIGNMENT. USE PADDING, BLOCKING AND NON-MARKING SLINGS TO PROTECT THE WORK DURING ERECTION.

.8 ASSEMBLED MEMBERS SHALL BE STRAIGHT, PLUMB, LEVEL AND SQUARE. PORTIONS OF THE STRUCTURE NOT ADEQUATELY BRACED BY DESIGN SHALL HAVE TEMPORARY BRACES UNTIL DECKING IS APPLIED. ALL JOINTS SHALL BE TIGHT.

.9 TOOLS USED TO DRIVE OR PULL JOINTS TOGETHER SHALL NOT PERMANENTLY MAR THE SURFACE OF THE MEMBERS.

1.1 DOCUMENTS

.1 This Section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUMMARY OF WORK

.1 Work includes:

.1 Prefabrication of heavy timber structural framing consisting of columns and beams as noted in structural drawings, purlins, and rafters of minimum diameter pole profiles and tapered profiles.

.2 Supply of steel connections, bolts, lags, washers, pins for timber to timber connections.

.2 Any damage to the heavy timber and log components resulting from improper storage or handling by the General Contractor shall be made good at no cost to the Contract.

.3 Related Sections:

.1 Section 03 30 00 Cast–In–Place Concrete
.2 Section 05 50 00 Metal Fabrications
.3 Section 06 10 00 Rough Carpentry
.4 Section 06 13 13 Log Construction
.5 Section 08 44 13 Glazed Aluminum Curtain Walls

1.3 QUALITY ASSURANCE

.1 Grading:

.1 NBC Part 4—Design, as applicable to Timber Construction.

.2 Timber components and construction to CSA Standard 086 and according to N.L.G.A. No. 1980 Rules as applicable.

1.4 SUBMITTALS

.1 Submit shop drawings of all timber connections in accordance with Section 01300—Submittals and the General Conditions of Contract prior to fabrication.

2.0 PRODUCTS

2.1 MATERIALS

.1 General: all materials shall be new and of the quality and grade specified. No seconds, off grades or materials not meeting tolerance specifications will be accepted in the finished pre-fabricated work.

.2 Round members shall be ‘living-edge’, free of bark, and within size range. Rectangular members shall be rough-sawn with eased corners.

.3 All sizes are actual.

.4 All stock shall be sufficiently air-dried to allow construction and resist checking.

2.2 ACCESSORIES

.1 Steel Connection hardware, drift pins, bolts, strap anchors, clip angles, shear plates and other connection items as detailed:

.2 The following specifications and standards apply:

.1 Thru Bolts: ASTM A307, complete with washers
.2 Lag Bolts: ASTM A307, complete with washers
.3 Shear Plates: CSA Standard 086–1984

.3 Shop drawings for the steel connections to be prepared by the fabricator and submitted to the Engineer for approval prior to fabrication.

3.0 EXECUTION

3.1 HANDLING AND STORAGE

.1 All timber shall be handled using rope or canvas belt slings. No cables, chains or pee vees are to be used on finished elements, or on raw logs where their use could predictably damage the intended finished appearance of the log.

.2 All material shall be stored on clean wood spacers and protected from the elements with adequate means during all phases of fabrication and storage until delivery by Others to final construction site.

.3 All timber shall be given one coat of water repellant sealer. Specific wood decks shall be pressure treated as specified.

END OF SECTION 06 17 53

1.0 GENERAL

.1 PREFABRICATED JOISTS AND TRUSSES SHALL BE TRANSPORTED, STORED AND ERECTED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS IN SUCH A MANNER THAT BENDING, WARPING, AND OVERTURNING ARE PREVENTED.

.2 TEMPORARY HORIZONTAL AND VERTICAL BRACING OF JOISTS AND TRUSSES SHALL BE IMPLEMENTED UNTIL PERMANENT BRACING AND DECKING ARE INSTALLED.

.3 THE PREFABRICATED JOIST AND TRUSS MANUFACTURER SHALL ACCOMMODATE ALL OPENINGS IN ACCORDANCE WITH THE ARCHITECTURAL PLANS WITH APPROPRIATE GIRDERS. PROVIDE FOR ALL ARCHITECTURAL, MECHANICAL, AND ELECTRICAL EQUIPMENT SUPPORTED BY THE ROOF OR FLOORS. REFER TO THE DRAWINGS OF THESE DISCIPLINES.

.4 THE JOIST AND TRUSS MANUFACTURERS SHALL SUBMIT SHOP DRAWINGS AS SPECIFIED UNDER "SUBMITTALS" TO THE PROJECT ENGINEER FOR REVIEW PRIOR TO FABRICATION. THE MANUFACTURER SHALL INSPECT THE ERECTED JOISTS AND/OR TRUSSES TO VERIFY CORRECT INSTALLATION AND PROVIDE THE STRUCTURAL ENGINEER WITH WRITTEN CONFIRMATION OF SUCH PRIOR TO THE STRUCTURAL ENGINEER CERTIFYING THE FRAMING AS BEING COMPLETE.

.5 LATERAL SPLAY OF TRUSSES TO BE LIMITED TO 19 mm (3/4") TOTAL FROM TRUE ALIGNMENT UNLESS NOTED OTHERWISE. LATERAL SPLAY OF JOISTS TO BE LIMITED TO 13 mm (1/2") FROM TRUE ALIGNMENT.

.6 DO NOT STACK PLYWOOD OR OTHER MATERIALS ON JOISTS OR TRUSSES BEFORE TEMPORARY BRACING OR SHEATHING HAS BEEN INSTALLED. UNDER NO CIRCUMSTANCES ARE APPLIED CONSTRUCTION LOADS TO EXCEED DESIGN LOADS.

.7 LUMBER USED IN THE FABRICATION OF THE JOISTS AND TRUSSES IS TO BE SPF #2 OR BETTER, COMPLYING WITH CAN/CSA-0141 AND NLGA STANDARD RULES FOR CANADIAN LUMBER.

.8 DO NOT CUT OR REMOVE JOIST OR TRUSS MATERIAL WITHOUT THE PRIOR WRITTEN APPROVAL OF THE SPECIALTY STRUCTURAL ENGINEER.

.9 THE JOIST/TRUSS MANUFACTURER SHALL PROVIDE FULL-HEIGHT BLOCKING BETWEEN JOISTS/TRUSSES AT ALL EXTERIOR WALLS AND OVER SHEAR WALLS PERPENDICULAR TO JOIST/TRUSS SPANSS. JOISTS/TRUSSES SHALL BE ALIGNED OVER SHEAR WALLS WHEN SHEAR WALLS RUN PARALLEL TO JOISTS/TRUSSES TO FACILITATE CONNECTION BETWEEN DIAPHRAGM AND SHEAR WALL. CHECK DRAWINGS FOR OTHER SIMILAR LOCATIONS.

1.1 SUMMARY

.1 Section Includes:

.1 Material and installation for prefabricated wood trusses.

.2 Sustainable requirements for construction and verification

.2 Related Sections

.1 Section 01 32 16 – Construction Progress Schedule.

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 61 00 – Common Product Requirements.

.4 Section 06 10 11 – Rough Carpentry.

1.2 REFERENCES

.1 Standards Association (CSA International)

.1 CSA O80 Series-08 (R2012), Wood Preservation.

.2 CAN/CSA-O86-01 (R2006), Engineering Design in Wood.

.3 CAN/CSA-O141-05 (R2014), Softwood Lumber.

.4 CSA S307-M1980 (R2006), Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.

.5 CSA S347-14, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.

.6 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.

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

.1 Material Safety Data Sheets (MSDS).

.3 National Lumber Grades Authority (NLGA)

.1 NLGA-2014, Standard Grading Rules for Canadian Lumber.

.4 National Research Council (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)

.1 CCMC-2014, Registry of Product Evaluations.

.5 Truss Plate Institute of Canada (TPIC)

.1 TPIC – 2014, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

1.3 DESIGN REQUIREMENTS

.1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CAN/CSA-O86.

.2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.

.3 Design trusses, bracing, bridging in accordance with CAN/CSA-O86.1 including supplement CSA-86S1.05 for loads indicated for building locality as ascertained by NBC, Climatic Information for Building Design in Canada and minimum uniform and minimum concentrated loadings stipulated in NBC commentary.

.4 Limit live load deflection to 1/360th of span where plaster and gypsum board ceilings are hung directly from trusses.

.5 Limit live load deflections to 1/240th of span unless otherwise specified or indicated.

.6 Provide camber for trusses as indicated: precamber for dead load plus 25% live load.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.

.2 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

.2 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16 – Construction Progress Schedule.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

.1 Each shop and erection drawing submission showing connection details to be signed and stamped by professional engineer registered or licensed in province of British Columbia, Canada.

.2 The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work, provide to the Departmental Representative a completed Schedules S-B: Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional, and Schedule S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.

.3 Indicate special structural application and specification as according to local Authorities having jurisdiction.

.4 Indicate TPIC Truss Design Procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates

.5 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.

.6 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.

.7 Do load testing on representative trusses selected by Departmental Representative. Provide certification that trusses meet requirements of CSA S307 and CSA S347.

.8 Indicate arrangement of webs or other members to accommodate ducts and other specialties.

.9 Show location of lateral bracing for compression members.

.4 Test reports: submit certified test reports for prefabricated wood trusses from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with 01 61 00 – Common Product Requirements.

.2 Storage and Protection:

.1 Store trusses on job site in accordance with manufacturer's instructions. Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – 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 and 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, and Plastic waste in accordance with Waste Management Plan (WMP).

.5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 MATERIALS

.1 Lumber: Hem-Fir or S-P-F species, No 2 or better grade, softwood, S4S, with maximum moisture content of 19% at time of fabrication and to following standards:

.1 CAN/CSA-O141.

.2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.

.2 Fastenings: to CAN/CSA-O86.

2.2 FABRICATION

.1 Fabricate wood trusses in accordance with reviewed shop drawings.

.2 Provide for design camber and roof slopes when positioning truss members.

.3 Connect members using plywood gussets or metal connector plates.

.4 Cut truss members to accurate length, angle, and size to assure tight joints for finished trusses.

.5 Assemble truss to design configuration.

2.3 SOURCE QUALITY CONTROL

.1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

2.4 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

2.5 ERECTION

.1 Erect wood trusses as indicated in accordance with reviewed approved shop drawings.

.2 Handling, installation, erection, bracing and lifting in accordance with manufacturer’s instructions.

.3 Make adequate provisions for handling and erection stresses.

.4 Exercise care to prevent out-of-plane bending of trusses.

.5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.

.6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.

.7 Do not cut or remove any truss material without approval of Departmental Representative.

.8 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.

2.6 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Manufacturer's field services: provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 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.

.2 Upon completion of work, after cleaning is carried out.

.3 Obtain reports within three days of review and submit immediately to Departmental Representative.

1.7 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment on completion of installation.

END OF SECTION 06 17 53

1.0 GENERAL

.1 THE MANUFACTURER SHALL SUBMIT SHOP DRAWINGS AS SPECIFIED UNDER "SUBMITTALS" TO THE PROJECT ENGINEER FOR REVIEW PRIOR TO FABRICATION. THE MANUFACTURER SHALL INSPECT THE INSTALLED PRODUCT TO VERIFY CORRECT INSTALLATION NAND PROVIDE THE STRUCTURAL ENGINEER WITH WRITTEN CONFIRMATION OF SUCH PRIOR TO THE STRUCTURAL ENGINEER CERTIFYING THE FRAMING AS BEING COMPLETE.

.2 STRUCTURAL COMPOSITE LUMBER (SCL) MEMBERS SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS. MEMBERS SHALL BE PROTECTED FROM MOISTURE AS PER THE MANUFACTURER'S WRITTEN REQUIREMENTS WHEN STORED ON SITE AND AFTER INSTALLATION.

.3 BEAMS UP TO 3 PLY WIDE SHALL BE NAILED TOGETHER AND 4 PLY BEAMS BOLTED TOGETHER IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.

.4 DRILLING, NOTCHING AND CUTTING OF MEMBERS IS NOT PERMITTED UNLESS APPROVED BY THE PROJECT ENGINEER. SUCH APPROVAL SHOULD BE REQUESTED WITH THE SHOP DRAWING SUBMISSION.

.5 SUPPLIERS OF FRAMING MATERIALS USING SYSTEMS NOT CALLED FOR ON THE STRUCTURAL DRAWINGS SHALL RECEIVE APPROVAL FROM THE STRUCTURAL ENGINEER PRIOR TO SHOP DRAWING PRODUCTION. THE APPLICATION SHALL INCLUDE THE PRODUCTS TECHNICAL LITERATURE WHICH SHALL BE SUFFICIENT FOR THE ENGINEER TO DETERMINE THE SYSTEM AND PRODUCT SUITABILITY ON THE PROJECT.

1.1 RELATED SECTIONS

.1 06 10 11 Rough Carpentry

.2 06 13 23 Heavy Timber Framing

1.2 REFERENCES

.1 ASTM International

- .1 ASTM A 36/A 36M-[08], Standard Specification for Carbon Structural Steel.
- .2 ASTM A 47/A 47M-[99(2009)], Standard Specification for Ferritic Malleable Iron Castings.
- .3 ASTM A 307-[07b], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .4 ASTM A 653/A 653M-[09a], 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-1.40-[97], Anti-corrosive Structural Steel Alkyd Primer.

.3 CSA International

- .1 CSA B111-[1974(R2003)], Wire Nails, Spikes and Staples.
- .2 CSA G40.20/G40.21-[04(R2009)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 CAN/CSA G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 CAN/CSA-O80 Series-[08], Wood Preservation.
- .5 CSA O86.[09], Engineering Design in Wood.
- .6 CSA O112 Series-[M1977(R2006)], CSA Standards for Wood Adhesives.
- .7 CAN/CSA-O122-[06], Structural Glued-Laminated Timber, with Update No. 1 [07] and Update No. 2 [09.
- .8 CSA O177-[06], Qualification Code for Manufacturer's of Structural Glued-Laminated Timber.

.9 CSA S16-[09], Design of Steel Structures.
.10 CSA W47.1-[09], Certification of Companies for Fusion Welding of Steel Structures.

.4 Forest Stewardship Council (FSC)
.1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
.2 FSC-STD-20-002-[2004], Structure and Content of Forest Stewardship Standards V2-1.

.5 Green Seal Environmental Standards (GS)
.1 GS-11-[2008, 2nd Edition], Paints and Coatings.

.6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.7 Society of Automotive Engineers International (SAE)
.1 SAE Handbook [2009].

.8 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.1 SCAQMD Rule 1113-[A2007], Architectural Coatings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section (01 33 00 - Submittal Procedures).

.2 Samples:
.1 Submit 2 samples of connector plates.

.3 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

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 Storage and Handling Requirements:
.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Slit underside of membrane covering during storage at site without defacing member.
.3 Store glued-laminated units and protect from weather, block off ground and separate with stripping, so air may circulate around faces of members.
.4 Cover glued-laminated units with opaque moisture resistant membrane if stored outside.
.5 Store and protect glue-laminated products from nicks, scratches, and blemishes.
.6 Replace defective or damaged materials with new.

2.0 PRODUCTS

2.1 MATERIALS

.1 Laminating stock: Fir, Pine and/or Spruce, FSC Certified to CAN/CSA-O122.

.2 Adhesive: to CSA O112 Series, to grade of service required in accordance with CAN/CSA-O122.

.3 Sealer for glued-laminated members: penetrating type, clear, non-yellowing liquid.

.4 Fastenings:

.1 Split ring connections: hot rolled carbon steel, SAE 1010, in accordance with SAE handbook.
.2 Shear plate connections:
.1 Pressed steel type: hot rolled carbon steel, SAE 1010, in accordance with SAE handbook.
.2 Malleable iron type: to ASTM A 47/A 47M, grade [350].
.3 Lag screws: See structured details.
.4 Bolts: to ASTM A 307.
.5 Side plates: to CSA G40.20/G40.21.
.6 Drift pins: to ASTM A 307.
.7 Nails and spikes: to CSA B111.

.5 Shop coat primer for steel connections: to CAN/CGSB-1.40.

2.2 FABRICATION

.1 Fabricate members to following classifications:
.1 Stress grade: to CSA O86 24f-E bending grade.
.2 Service grade: Interior.
.3 Appearance grade: Quality.

.2 Mark laminated members for identification during erection. Marks not to be visible in final assembly.

.3 Do not apply sealer to areas which are to receive stained finish or preservative treatment.

.4 Design connections to CSA O86, and CSA S16 unless specifically detailed, to resist shears, moments and forces indicated.
.1 Fabricate in accordance with CSA S16.

3.0 EXECUTION

3.1 ERECTION

.1 Brace and anchor members until permanently secured by structure.

.2 Make adequate provisions for erection stresses.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by glue laminated construction installation.

END OF SECTION 06 18 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Rough Carpentry Section 06 10 00

.2 Door Hardware Section 08 71 00

.3 Toilet & Bath Accessories Section 10 28 10

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
- .1 Architectural Woodwork Quality Standards, 1st edition, 2009.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-11.3-M87, Hardboard.

.3 CSA International
- .1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O141-05, Softwood Lumber.
- .5 CSA O151-09, Canadian Softwood Plywood.
- .6 CSA O153-M1980 (R2008), Poplar Plywood.

.4 Forest Stewardship Council (FSC)
- .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1.
- .3 FSC Accredited Certified Bodies.

.5 National Lumber Grades Authority (NLGA)
- .1 NLGA Standard Grading Rules for Canadian Lumber 2008.

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
- .1 SCAQMD Rule 1168 2005, Adhesives and Sealants Applications.

.7 Underwriters Laboratories of Canada (ULC)
- .1 CAN4-S104-80 (R1985), Standard Method for Fire Tests of Door Assemblies.
- .2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

1.3 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 samples of all visible wood or plastic finishes to Departmental Representative for approval prior to fabrication or installation.

1.4 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 CAN4-S104 and CAN/ULC-S105.

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 and 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.

.4 Develop Construction Waste Management Plan related to Work of this Section

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal

2.0 PRODUCTS

2.1 MATERIALS

.1 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:
- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber
- .3 AWMAC custom or premium grade, where noted, moisture content as specified.
- .4 Machine stress-rated lumber is acceptable.
- .5 Hardwood lumber: moisture content in accordance:
  - .1 AWMAC custom grade, moisture content as specified.

.2 Panel Material: Urea-formaldehyde free
- .1 Recycled content: provide information indicating recycled content on a % (Post-Consumer + ½ Post-Industrial)
- .2 FSC certified.
- .3 Douglas fir plywood (DFP): to CSA O121, standard construction. 6.1.5 and 6.2.5 where both sides exposed to view.
- .4 Hardwood plywood: to ANSI/HPVA HP-1.

.3 Wood Siding and Soffits:
- .1 Kiln-dried, select grade, tight knot, western Red Cedar, tongue and grove center match, untreated, not stained, FSC certified, 1 x stock as approved by Departmental Representative.

.4 Wood Baseboards
- .1 1 x 6 Fir or Cedar, rough finish, clear matte varnish, submit for approval by Departmental

Representative.

.5 Coat Rods
.1 Heavy Duty Steel, 1 5/16” (59mm) diameter, chrome finish, support every 1220mm max.

2.2 ACCESSORIES

.1 Nails and staples: to CSA B111; galvanized to CAN/CSA-G164 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.

.5 Soffit vents: continuous aluminum soffit vents, colour to match metal siding.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install finish carpentry to Quality Standards of (AWMAC).

.2 Scribe and cut as required to fit to abutting walls and surfaces to fit properly into recesses, and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

3.2 CONSTRUCTION

.1 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 invisible finish surfaces, 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.

.2 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.

.3 Interior and exterior frames:
.1 Set frames with plumb sides and level heads and sills and secure.

.4 Shelving:
.1 Install shelving on ledgers or shelf brackets as indicated.

.5 Other:
.1 Install other specialties including
.1 Coat rods
.2 Coat hooks

3.3 INSTALLATION OF SHELVING

.1 A/B grade plywood painted to match trim colour of room.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

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 06 20 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Rough Carpentry	Section 06 10 11
.2	Joint Sealants	Section 07 92 00
.3	Interior Painting	Section 09 91 23

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
- .1 Architectural Woodwork Quality Standards Illustrated, 8th edition, Version 1.0 2009.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.3 CSA International
- .1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.
- .2 CSA O112.4 SERIES-M1977 (R2006), Standards for Wood Adhesives.
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O141-05, Softwood Lumber.
- .5 CSA O151-09, Canadian Softwood Plywood.
- .6 CSA O153-M1980 (R2008), Poplar Plywood.

.4 American National Standards Institute (ANSI)
- .1 ANSI/NPA A208.1-09, Particleboard.
- .2 ANSI/NPA A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
- .3 ANSI/HPVA HP-1 04, Standard for Hardwood and Decorative Plywood.

.5 ASTM International
- .1 ASTM E 1333-96 (2002), Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using A Large Chamber.
- .2 ASTM D 2832-92 (R2005), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.6 ASTM D 5116-06, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.7 Forest Stewardship Council (FSC)
- .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1.

.8 Green Seal Environmental Standards (GS)
- .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .2 GS-36-00, Commercial Adhesives.

.9 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS)

.10 National Electrical Manufacturers Association (NEMA)
- .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).

.11 National Hardwood Lumber Association (NHLA)
.1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.

.12 National Lumber Grades Authority (NLGA)
.1 Standard Grading Rules for Canadian Lumber 2003(R2007).

.13 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.1 SCAQMD Rule 1113-A2007, Architectural Coatings.
.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 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 Indicate details of construction, profiles, jointing, fastening and other related details.
.1 Indicate materials, thicknesses, finishes and hardware.
.2 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 samples of all visible wood or plastic finishes to Departmental Representative for approval prior to fabrication or installation.

1.4 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, complete with hardware and shop applied finishes for inspection by Departmental Representative.
.2 When accepted, mock-up will demonstrate minimum standard for Work.
.3 Do not proceed with work prior to receipt of written acceptance of mock-up by Departmental Representative.
.4 Mock-up may remain as part of finished work.

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.
.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 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.

.4 Develop Construction Waste Management Plan related to Work

.5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 COORDINATION & VERIFICATION

.1 Verify all dimensions & existing conditions on job site prior to all shop fabrication and work on site. Where major discrepancies occur, alert Departmental Representative.

.2 Coordinate work with electrical and mechanical items.

1.7 INSPECTION

.1 Any work which does not meet AWMAC Quality Standards as specified, shall be replaced by this Section at no additional cost to the Department Representative and to the satisfaction of the Departmental Representative and the inspector.

1.8 GUARANTEE

.1 This section shall furnish the Departmental Representative with a two (2) year M.M.A.B.C. (The BC Chapter of AWMAC) Guarantee Certificate or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork supplied will be in accordance with the Standards incorporated in the AWMAC Quality Standards manual, latest edition.

.2 The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Section, which appear during a two (2) year period following the substantial completion of the Project.

2.0 PRODUCTS

2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

1 This schedule is attached in the appendix and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

.2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the

proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

2.2 MATERIALS

.1 Softwood lumber: in accordance with following standards:
- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.
- .3 AWMAC custom grade, moisture content as specified.
- .4 Forestry Stewardship Council (FSC) certified.

.2 Hardwood lumber: in accordance with following standards:
- .1 National Hardwood Lumber Association (NHLA).
- .2 AWMAC custom grade, moisture content as specified.

2.3 FABRICATION

.1 Fabricate material in accordance with manufacturer's Fabrication Guide.

.2 Fabricate countertops, sinks, and splash of 13 mm thick material unless otherwise indicated.

.3 Cut and finish component edges with clean, sharp returns. Finished edges shall have a 1.6 mm radius.

.4 Integral Cove: Provide shop fabricated integrally molded coves at backsplash and ends where against walls or other vertical surfaces, with 9.5 mm radius between top and splash.

.5 Integral Sinks shall be formed integrally with countertops.

.6 Cutouts for sinks shall be smooth and uniform without saw marks. The top and bottom of openings shall be finished smooth. Maintain minimum 6 mm radius for sink cutouts.

.7 Cutouts for accessories shall be smooth and uniform without saw marks. The top and bottom of openings shall be finished smooth.

.8 Set nails and countersink screws apply stained wood filler to indentations, sand smooth and leave ready to receive finish.

.9 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.10 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

3.0 EXECUTION

3.1 EXAMINATION

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do architectural woodwork to Quality Standards of AWMAC.

.2 Install vanity in accordance with manufacturer's instructions installation guidelines and recommendations.

.3 Install prefinished millwork at locations shown on drawings.
.1 Position accurately, level, plumb straight.

.4 Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.

.5 Cure countertops for 24 hours, minimum, before exposure to moisture or pressure.

.6 Corner joints: Form 3 mm-wide joints, sealed with manufacturer’s color-matching silicone sealant.

.7 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.

.8 Provide integral backsplashes and end splashes as shown on the Drawings.

.9 Field joints shall be hard seamed unless otherwise specified.

.10 Attach solid surfaces material to leveled supports on frame with dabs of silicone every 457 to 610 mm.

.11 Fasten solid surface material to frame by anchoring screws to supports at all corner blocks.

.12 Screws should not come in contact with solid surface material, as this may cause cracking of countertop.

.13 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.14 Fasten and anchor millwork securely.

.15 Use draw bolts in countertop joints.

.16 At junction of counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.
.1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces.
.2 Remove excess glue from surfaces.
.3 Solid surface to be cleaned as per manufacturer’s instructions.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect millwork 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.

3.5 SCHEDULE

.1 Plastic Laminate: Refer to Interior Finish Material and Colour Schedule.

END OF SECTION 06 40 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 27 00 Air Barriers

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .2 CAN/CGSB 37.3-M89, Application of Emulsified Asphalts for Dampproofing or Waterproofing.
- .3 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.
- .4 CGSB 37-GP-6Ma-83 Asphalt, Cutback, Unfilled, for Dampproofing.
- .5 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- .6 CGSB 37-GP-11M-76 (R1984), Application of Cutback Asphalt Plastic Cement.
- .7 CGSB 37-GP-12Ma-84, Application of Unfilled Cutback Asphalt for Dampproofing.
- .8 CGSB 37-GP-15M-76 (R1984), Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
- .9 CAN/CGSB 37.16-M89, Filled, Cutback, Asphalt for Dampproofing and Waterproofing.
- .10 CAN/CGSB 37.28-M89, Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing.
- .11 CGSB 37-GP-36M-76, Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.
- .12 CGSB 37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing.

.2 Canadian Standards Association (CSA International)

- .1 CSA A123.4-98, Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

.3 Health Canada

- .1 Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC)

- .1 Canadian Construction Materials Centre (CCMC)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data sheets for bituminous dampproofing products. Including:

- .1 Product characteristics.
- .2 Performance criteria.
- .3 Application methods.
- .4 Limitations.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store materials on supports to prevent deformation.

.4 Remove only in quantities required for same day use.

.5 Store materials in accordance with manufacturer's written instructions.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - 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.

.4 Ensure emptied containers are sealed and stored safely.

.5 Fold up metal banding, flatten and place in designated area for recycling.

1.6 ENVIRONMENT

.1 Temperature, relative humidity, moisture content.

.1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.

.3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.

.4 Do not apply dampproofing in wet weather.

.2 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

2.0 PRODUCTS

2.1 MATERIALS

.1 Asphalt:

.1 For application and curing at temperatures above 5 degrees C: to CAN/CGSB-37.2 Type 2M.

.1 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.

3.0 EXECUTION

3.1 WORKMANSHIP

.1 Keep hot asphalt:

.1 Below its flash point.

.2 At or below its final blowing temperature.

.3 Within its equiviscous temperature range at place of application.

3.2 PREPARATION

.1 Before applying dampproofing:

.1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.

3.3 APPLICATION

.1 Apply dampproofing in accordance with CAN/CGSB-37-GP-3M except where specified otherwise.

.2 Perform sealing work in accordance with CGSB 37-GP-11M except where specified otherwise.

.3 Prime surfaces in accordance with CGSB 37-GP-15M except where specified otherwise.

.4 Apply continuous, uniform coating to entire exterior faces of foundation walls from 25 mm below finished grade level to and including tops of foundation wall footings.

.5 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.

.6 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

END OF SECTION 07 11 13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Modified Bituminous Membrane Roofing — Section 07 52 00

.2 Thermal Insulation — Section 07 21 00

.3 Sheet Metal Flashing & Trim — Section 07 62 00

.4 Metal Doors and Frames — Section 08 11 00

1.2 REFERENCES

.1 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.

.2 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.3 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.

.3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
- .1 Existing Substrate Condition: report deviations, as described in PART 3 -EXAMINATION in writing to Departmental Representative.
- .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 Applicator: company specializing in performing work of this section with minimum 5 years documented experience with installation of air/vapour barrier systems.

.2 Mock-Up:
- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct typical exterior wall panel, incorporating louvre and door frame, insulation, illustrating materials interface and seals.
- .3 Locate in location as agreed to with Departmental Representative.
- .4 Mock-up may remain as part of finished work.
- .5 Obtain approval of mock-up by Departmental Representative before proceeding with air/vapour barrier Work.

.3 Schedule site visits with Departmental Representative, to review Work, at stages listed:
- .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.2 Upon completion of Work, after cleaning is carried out, prior to cover up by other building component.

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 handle materials in accordance with manufacturer's written instructions.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - 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.

1.7 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.

.2 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.9 WARRANTY

.1 Provide manufacturer’s warranty for sealant and sheet materials for 24 months.

2.0 PRODUCTS

2.1 SELF ADHESIVE MEMBRANE

.1 Membrane composed of high temperature grade SBS modified bitumen and a Tri-laminate woven polyethylene face on the top surface. The self-adhesive bottom surface is protected by a silicone release sheet.

.1 Water Vapour transmission 202 g/m² /24 hours/ASTM E96/B (Dessicant).
.2 Dry Tensile Strength 41 lbf/182N MD, 29 lbf/129N CD, ASTM D 828.
.3 Average Dry Breaking Force 127 lbf/565N MD, 91 lbf/405N CD, ASTM D 5034.
.4 Accelerated Aging, Pass, ICC-ES AC 48, 25 cycles.
.5 Cycling and Elongation, Pass, ICC-ES AC48, 100 cycles at -29°C (20°F).
.6 Application Temperature Minimum 5°C (41°F).
.7 Flame Spread Index 0, Class A, ASTM E-84.
.8 Smoke Developed 105, Class A, ASTM E-84.
.9 Membrane thickness, Minimum 40 mil.
.10 Air Permeance, Pass, ASTM E 2178 (Maximum 0.02 L/m²s @ 75Pa or 0.004 cfm/ft² @ 1.57pcf) ASTM E 2357 – assembly, Pass.
.11 Criteria for Water Resistive Barriers, Pass, ICC-ES AV 38.
.12 Low Temp Flexibility, Pass, ICC-AC38/3.3.4.
.13 Peel-adhesion to Unprimed Plywood, PASS, ICC-ES AC48, Control 62 lbf/ft-905N/m,

After 7 day water immersion 54 lbf/ft-788N/m, After accelerated aging 72 lbf/ft-1051N/m, After UV exposure 77 lbf/ft-1124N/m

.14 Water Penetration Resistance around Nails, PASS, AAMA 711-05 and ASTM D 1970 modified.

2.2 SEALANTS

.1 Sealants in accordance with Section 07 92 00 - Joint Sealants.

.2 Sealant compatible with membrane as recommended by the manufacturer:

.1 Silicone Sealant specifically for use with self-adhered membrane.

.3 Primer: recommended by sealant manufacturer as appropriate to application.

.4 Substrate Cleaner: non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

2.3 PRIMER

.1 Apply primer to gypsum wall board and concrete masonry unit according to manufacturer’s specification. Ensure proper adhesion and compatibility to the membrane.

2.4 ACCESSORIES

.1 Provide mechanically fastened stainless steel termination bar with gumlip edge.

3.0 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials.

3.3 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions to Departmental Representative in writing.

.4 Do not start work until deficiencies have been corrected.

.1 Beginning of Work implies acceptance of conditions.

3.4 PREPARATION

.1 All surfaces to receive the membrane must be thoroughly cleaned so as to have removed all concrete spatter, job dirt, laitance from release agents, curing compounds, or any other substance which could inhibit the adhesion, and long term performance, of the membrane.

.2 All honeycombing in concrete shall be grouted flush prior to application of primer.

.3 Prepare in accordance with manufacturer’s instructions.

3.5 APPLICATIONS

.1 Apply in accordance with manufacturer's instructions.

.2 All joints within and between back up walls and window frames shall be sealed according to detail drawings.

.3 Ensure continuity of air barrier. Co-ordinate construction of roof/wall junction to maintain continuity of air barrier from wall to roof. Co-ordinate with construction of exterior walls to maintain continuity of air barrier between various exterior wall construction types.

.4 Shingle laps to drain. Minimum side and end laps as per manufacturer's recommendation with a minimum of 75mm.

.5 Membrane should be adhered onto window frame section as per detail drawings.

.6 Lap and seal air barrier membrane over through-wall flashing at base of wall and at all horizontal wall flashings.

.7 Lap roof membrane flashing over air/vapour barrier membrane at parapets and seal.

.8 Seal all through-wall equipment flanges with air barrier membrane flashing strips; apply mastic to edges.

.9 Seal all metal fabrication flanges with air/vapour barrier membrane flashing strips; apply mastic to edges.

.10 Seal all horizontal drip flashings to air/vapour barrier membrane with minimum 150 mm strips of membrane flashing applied horizontally; apply mastic to edges of flashing membrane.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.

.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 Ensure finished work is protected from climatic conditions.

END OF SECTION 07 27 00.01

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SECTION INCLUDES

.1 Insulation and moisture protection as indicated on the drawings and specified herein.

1.3 RELATED SECTIONS

.1	Modified Bituminous Membrane Roofing	Section 07 52 00
.2	Gypsum Board Assemblies	Section 09 21 16

2.0 PRODUCTS

2.1 MATERIALS

.1 Acousitc Batt mineral wool: to CSA A101-M83. Acoustic Batt Insulation: Rockwool friction fit insulation to fill up stud space and 1 layer for floor assembly.

.2 Semi-rigid insulation at metal cladding and roofing: Mineral Wool Insulation, non-combusible to ULC with CAN 4-S114 and ASTM E-136, minimum RSI Value 0.7 per 25 mm thickness.

.3 Rigid insulation at exterior walls and ground floor slab and footings: Polystyrene (butt-edge) to CAN/CGSB 51.20-M87, Type 4, thickness as indicated on drawings, minimum RSI value 1.14 per 25 mm thickness.

3.0 EXECUTION

3.1 WORKMANSHIP

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Install batt and rigid insulation to all other areas indicated on drawings to thickness shown.

.3 Fit closely around electrical boxes, pipes, ducts, frames, joists, and other objects in or passing through insulation.

3.2 INSTALLATION

.1 Batt insulation installation

- .1 Apply batt insulation to areas indicated on drawings.
- .2 Cut and trim insulation neatly, to fit spaces. Use batts free of ripped backs and/or edges. Butt edges and ends tightly.
- .3 Install batt insulation for acoustic separations as indicated on the drawings so as to press on drywall over entire surface area.
- .4 Install as per manufacturer’s written instructions.

.2 Schedule of thermal resistance

- .1 Install insulation to achieve or surpass minimum thermal and acoustic requirements noted in National Building Code 2015.

END OF SECTION 07 21 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Air Barriers Section 07 27 00.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI B18.6.4-99, Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM D 2369-03, Test Method for Volatile Content of Coatings.

.2 ASTM D 2832-92(R1999), Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.3 ASTM D 5116-97, Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-93.2-M91, Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use.

.3 CAN/CGSB-93.3-M91, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.

.4 CAN/CGSB-93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.

.5 CGSB 93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.

.4 Canadian Standards Association (CSA International).

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.5 Environmental Choice Program (ECP).

.1 CCD-045-95, Sealants and Caulking Compounds.

.6 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S706-02, Wood Fibre Thermal Insulation for Buildings.

1.3 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:

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

.2 Submit 2 each minimum 300 x 300 mm samples of all siding materials. Obtain approval from Departmental Representative for colour and material prior to installation.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Divert used metal cut-offs from landfill by disposal into the on-site metals recycling bin.

.3 Divert reusable materials for reuse at nearest used building materials facility.

.4 Divert unused caulking, sealants, and adhesive materials from landfill through disposal at hazardous material depot.

2.0 PRODUCTS

2.1 COMPONENT

.1 24 gauge galvanized painted corrugated steel sliding.

2.2 ACCESSORIES

.1 Flashing: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material as cladding, with fastener holes pre-punched.

2.3 FASTENERS

.1 Nails: CSA B111. Screws: ANSI B18.6.4.

2.4 CAULKING

.1 Sealants: as recommended by manufactuer.

.1 Test for acceptable VOC emissions in accordance with ASTM D 2369 and ASTM D 2832.

2.5 SHEATHING PAPER

.1 Refer to section 07 27 00.

3.0 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 INSTALLTION

.1 Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions

.2 Install one layer exterior wall sheathing paper horizontally by stapling lapping edges 150 mm.

.3 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.

.4 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.5 Install soffit and fascia cladding as indicated.

.6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.7 Attach components in manner not restricting thermal movement.

.8 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

.9 Isolate all dissimilar metals.

.10 All cut edges, and panel edges to be treated with gualume paint on side.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 07 46 13

1.0 GENERAL

1.1 SUMMARY OF WORK

.1 Work of this section includes provision of a 2 ply torch applied SBS membrane over insulation sheathing over plywood substrate.

1.2 RELATED REQUIREMENTS

.1	Thermal Insulation	Section 07 21 00
.2	Air Barriers	Section 07 27 00
.3	Sheet Metal Flashing and Trim	Section 07 62 00
.4	Joint Sealants	Section 07 92 00

1.3 REFERENCES

.1 ASTM International Inc.
- .1 ASTM C1177/C1177M-08, Standard Specification for Glass Mat Gypsum Substrate for use as Sheathing.
- .2 ASTM D 6164-05 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

.2 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 Roofing Contractors' Association of British Columbia R.C.A.B.C. RGC Roofing Practices Manual, guarantee standards.

.4 Canadian Standards Association (CSA International)
- .1 CSA-A123.3-05, Asphalt Saturated Organic Roofing Felt.
- .2 CSA-A123.4-04, Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O151-04, Canadian Softwood Plywood.

.5 Factory Mutual (FM Global)
- .1 FM Approvals - Roofing Products.

.6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.7 Underwriters Laboratories' of Canada (ULC)
- .1 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting two week prior to beginning waterproofing Work, with roofing contractor's representative, membrane manufacturer's representative, and Departmental Representative in accordance with Section 01 32 16 - Construction Progress Schedule to:
- .1 Verify project requirements.
- .2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.
.4 Review installation instructions and warranty requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
.1 Provide two 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 two copies of WHMIS MSDS in accordance with Section 01 35 29 – Health, Safety and Emergency Response Procedures, and indicate VOC content for primers.

.3 Provide shop drawings:
.1 Indicate flashing, control joints and tapered insulation details.
.2 Provide layout for tapered insulation.

1.6 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems with minimum 5 years' experience.

.2 Inspection Authority:
.1 Selected from RCABC Approved list of Roofing Inspectors.
.2 The presence of an Inspector shall in no way excuse the Contractor from performing the Work in accordance with the contract Documents and keeping with the best practices of the trades.
.3 The Inspector will not be responsible for or have control or charge over safety precautions and programs required for the Work in accordance with the applicable construction safety legislation, other regulations or general construction practice, the acts or omissions of the contractor, his subcontractors or their agents, employees or other persons performing any of the Work.
.4 The Contractor shall inform the Inspection Agency seven (7) days prior to commencement of work.

1.7 FIRE PROTECTION

.1 Fire Extinguishers:
.1 Maintain one cartridge operated type with shut-off nozzle, on roof per torch applicator, within 6 m of torch applicator.
.2 ULC labelled for A, B and C class protection.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.8 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 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 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 degrees C minimum.

.7 Store insulation protected from daylight and weather and deleterious materials.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.9 SITE CONDITIONS

.1 Ambient Conditions

.1 Do not install roofing when temperature remains below -18 degrees C for torch application, or -5 degrees C for mop application.

.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.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.

1.10 WARRANTY

.1 Upon completion of work, this Contractor shall furnish Owners with a 10-YEAR R.C.A.B.C. Roof Star Guarantee on all work of this section.

.2 Provide for inspection in accordance with specifications and with R.C.A.B.C. Standards. Inspection fees shall be included in this contract.

.3 Upon Total Performance of the Contract submit a Ten (10) year Labour and Materials Warranty issued by the manufacturer of the roofing membrane.

2.0 PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.

2.2 DECK COVERING

.1 Plywood Sheathing.

2.3 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma.

2.4 VAPOUR RETARDER

.1 Base sheet vapour retarder: to CGSB 37-GP-56M, Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, polyester reinforcement, weighing 180 g/m².

.1 Top and bottom surfaces: sanded/thermofusible.

2.5 MEMBRANE

.1 Base sheet: to CGSB 37-GP-56M polyester fibres to ASTM D 6164.

.1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet, polyester reinforcement, having nominal weight of 180 g/m².

.2 Type 1, torch on.

.3 Grade 1 - standard service.

.4 Top and bottom surfaces:

.1 Thermofusible.

.5 Base sheet membrane properties: to CGSB 37-GP-56M.

.1 Strain energy (longitudinal/transversal): 9.0/7.0 kN/m.

.2 Breaking strength (longitudinal/transversal): 17.0/18.0 N/5 cm.
.3 Ultimate elongation (longitudinal/transversal): 60/70.
.4 Tear resistance: 85 N.
.5 Cold bending at -30 degrees C: no cracking.
.6 Softening point: ò 110 degrees C.
.7 Static puncture resistance: > 400.
.8 Dimensional Stability: -0.3 / 0.3 %.

.6 ULC certification: Class A.

.2 Cap sheet membrane: to CGSB 37-GP-56M polyester fibres to ASTM D 6164.
.1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, polyester reinforcement, having nominal weight of 250 g/m².
.2 Type 1, torched on.
.3 Class A-granule surfaced.
.1 Colour for granular surface: red.
.4 Grade 1-standard service.
.5 Bottom surface: thermofusible.
.6 Cap sheet membrane properties: to CGSB 37-GP-56M.
.1 Strain energy (longitudinal/transversal): 13.0/10.0kN/m.
.2 Breaking strength (longitudinal/transversal): 25.0/16.0 kN/m.
.3 Ultimate elongation (longitudinal/transversal): 63/73 60/65 %.
.4 Tear resistance: 80 N.
.5 Cold bending at -30 degrees C: No cracking.
.6 Softening point: ò 110 degrees C.
.7 Static puncture resistance: > 400 370 .
.8 Dimensional Stability: -0.2 / 0.2 %.
.9 ULC certification: Class A.
.10 White colour high reflective surface.

2.6 OVERLAY BOARD

.1 Overlay Board: 6mm thick asphalt impregnated fiberboard.
.1 Install over insulation with adhesive to provide torch safe surface.

2.7 BITUMEN

.1 Asphalt: to CAN/CSA A123.4 ASTM D 312, Type 2 3 .

2.8 POLYISOCYANURATE INSULATION

.1 Typical flatboard polyisocyanurate foam to ULC S704, Minimum 141mm thick equivalent to thermal resistance of R28, at any point of the roof. Refer to Section 07 21 00 Thermal Consultation.

.2 Create cricket around roof mechanical unit as required to divert water away from mechanical equipment.

.3 Tapered insulation to create slope as required and as shown on drawing to divert water towards the roof drain.

2.9 SEALERS

.1 Sealing compound: rubber asphalt type.

.2 Caulking - see Section 07 92 00 - Joint Sealants.

2.10 WALKWAYS

.1 Walkways to consist of one additional ply of cap sheet membrane. Colour to be different from field membrane as selected by Departmental Representative.

2.11 CARPENTRY

.1 Refer to Section 06 08 99 - Rough Carpentry – For Minor Works.

2.12 FASTENERS

.1 Insulation to deck: coated insulation fasteners and galvanized plates must meet FM Approval for wind uplift and corrosion resistance, as recommended by insulation manufacturer.

3.0 EXECUTION

3.1 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual and RCABC Roofing Specification Manual to meet specified Guarantee standards, particularly for fire safety precautions.

.2 Do priming in accordance with manufacturers written recommendations.

.3 The interface of the walls and roof assemblies will be fitted with durable rigid material providing connection point for continuity of air barrier.

.4 Assembly, component and material connections will be made in consideration of appropriate design loads.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:

.1 Inspect with Departmental Representative deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:

.1 Prior to beginning of work ensure:

.1 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.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

3.3 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. Comply with precautions deemed necessary by Departmental Representative.

.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 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 VAPOUR RETARDER

.1 Install peel and stick continuous over installed gypsum sheathing. Extend up vertical surfaces as shown and tie into air/vapour barrier as indicated or required.

3.5 CONVENTIONAL MEMBRANE ROOFING

.1 Insulation: Refer to Section 07 21 00

.2 Tapered insulation application:

.1 Install tapered insulation as second insulation layer, in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

.3 Overlay Board:

.1 Place boards in parallel rows with end joints staggered, mechanically fastened as per manufacturer’s recommendation.

.4 Base sheet application:

.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.
.2 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.
.3 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.
.4 Application to be free of blisters, wrinkles and fishmouths.

.5 Cap sheet application:

.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.
.2 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.
.3 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.
.4 Application to be free of blisters, fishmouths and wrinkles.
.5 Do membrane application in accordance with manufacturer's recommendations.

.6 Flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.
.2 Torch base and cap sheet onto substrate in 1 metre wide strips.
.3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by mopping or torch welding.
.4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.
.5 Provide 75 mm minimum side lap and seal.
.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
.7 Do work in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.

.7 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.

3.6 WALKWAYS

.1 Install additional cap sheet in contrasting colour as walkway membrane in accordance with manufacturer's instructions and as indicated.
  .1 Apply primer to cap sheet membrane and torch apply, ensuring selvage edge is removed.

.2 Install concrete paver at cat ladder landing and foot path as indicated on roof plan. Level on insulation pads, as indicated.

3.7 FIELD QUALITY CONTROL

.1 Inspections:
  .1 Inspection and testing of roofing systems and application will be carried out by testing laboratory designated by Departmental Representative.
  .2 Inspection will be carried out during the entire roof installation procedure.
  .3 Manufacturer’s Representative to complete review of basesheet installation prior to cap sheet installation.
  .4 Manufacturer’s Representative to complete review of cap sheet installation.

3.8 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 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.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
  .1 Place materials defined as hazardous or toxic in designated containers.
  .2 Ensure emptied containers are sealed and stored safely.
  .3 Unused adhesive, sealant and asphalt materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
  .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.
  .5 Dispose of unused sealant material at official hazardous material collections site approved by Departmental Representative.
  .6 Divert unused gypsum materials from landfill to recycling facility as reviewed by Departmental Representative.

END OF SECTION 07 52 00

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SECTION INCLUDES

.1 Provide all material, labor and services necessary to design, supply and install pre-finished metal standing seam roofing, galvanized metal 'Z' girts with concealed fastenings at canopy over Bike Storage Area and ARIEL Entry Vestibule.

1.3 RELATED SECTIONS

.1 Rough Carpentry Section 06 10 00

.2 Sheet Metal Flashing and Trim Section 07 62 00

1.4 DESIGN CRITERIA

.1 Standing Seam Roofing shall be designed and installed conforming to CAN/CSA-S16. 1-M-Limit States Design of Steel Structures and CAN/CSA- S136-M- Cold Formed Steel Structural Members.

.2 Design roof system to withstand dead and live loads in accordance with the BCBC 2006. Limit deflections to amount recommended by the manufacturer of the roof system to obtain a long lasting, leak proof and maintenance free roof installation.

.3 Provide expansion control as required to allow for thermal movement of component materials caused by an ambient temperature range of -40°C to +40°C (-40°F to +104°F) without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects. All shear loads to be able to transfer into the supporting structure by a shear device.

.4 Design shall be "a floating roof," using maximum length panels to minimize joints. Secure panels to the structure with concealed clips. Interlock panels at seams with a mechanical seamer to create a double locking system.

.5 Ridge covers, gable trims and flashings shall be designed to maintain the "floating" capability of the roof system. All sealants and gaskets to be as recommended by the system manufacturer.

1.5 QUALITY ASSURANCE

.1 The Subcontractor for this Section shall be approved by the system manufacturer, employing skilled workers competent in the installation of the selected roof system.

1.6 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Shop drawings to be designed and prepared under the supervision of a registered Professional Engineer registered in British Columbia. All submitted shop drawings shall be sealed and signed by the said Professional Engineer. The same Professional Engineer shall provide a letter of Assurance Schedule B and C-B as per B.C.B.C. 2006 confirming the work is designed and installed in conformance with the structural design criteria.

.3 Submit 300mm length sample of metal roof cladding.

1.7 CO-ORDINATION

.1 Co-ordinate the work of this Section with the work of other trades.

1.8 GUARANTEE

.1 Provide the Roofing manufacturer's five (5) year guarantee for new roofing systems and flashings specified in this Section. Guarantee shall cover all materials, installation and workmanship for a period of five (5) years from the date of Substantial Performance of the Project.

2.0 PRODUCTS

2.1 MATERIALS

.1 Cladding: Roofing panels to be factory formed fabricated from ASTM A653/A653M SQ/(structural quality) minimum grade 33 galvanized steel with a zinc coating of Z275 galvanized as designated ASTM A653 or ASTM A792/A792 M 55% Aluminum – Zinc Alloy coated steel with an Alloy coating of AZ150 as designated by ASTM A792.

.2 Finish: As approved by Departmental Representative.

.3 Sub Girts: Shall be metal 'Z' shall be roll formed from 0.53 mm hot dipped galvanized steel having a Z180 zinc coating to ASTM 525

.4 Fastening System: Pan-cake #12-11 x 1" screws or longer for insulated roof systems to be installed along the panel flange at 24" on center into the sub-structure solid wood, plywood or steel decks. ¼" wide x ¾" long holes to be placed in the panel screw flange at 24" centers for expansion control. Place screw in middle of slot unless otherwise instructed.

.5 Acceptable Profiles:
- .1 Vicwest Prestige.
- .2 Westform Prolock16
- .3 Interlock Standing Seam
- .4 Crown Snaplock Standing Seam

.6 Provide polybutylene Mastic tape caulking for sealing of side and end lap joints.

.7 Trim: Trim shall be fabricated from the same material, thickness and finish same as metal roof.

.8 Closure: Closure to close off ends of standing seam.

3.0 EXECUTION

3.1 EXAMINATION

.1 Examine and obtain all necessary measurements of previously executed work which may affect the work of this Section.

.2 Report any discovered discrepancies to the Contractor so that instructions may be give for the necessary remedial work.

3.2 STORAGE & HANDLING

.1 Exercise care in storing, handling and placing the roof panels to prevent damage likely to impair the adequacy or appearance of the material in the finished structure.

.2 Damaged material shall be replaced or corrected to the satisfaction of the Consultant and any costs incurred shall be borne by the parties responsible for the damage.

3.3 'Z' GIRTS

.1 Install thermally broken metal 'Z" girts over self-adhered membrane in accordance with manufacturers written instructions.

.2 Apply mastic at all fastenings and penetrations through roof membrane to ensure a complete watertight seal.

3.4 METAL STANDING SEAM ROOFING

.1 Erect Standing Seam Roofing to manufacturer's instructions and in accordance with the drawings and details over metal deck.

.2 All erection work shall be the responsibility of the manufacturer and such erection work shall be carried out by the manufacturer's trained erection crews or manufacturer's approved erector in strict accordance with manufacturer's directions and reviewed shop drawings.

.3 Metal roofing shall be installed to the slope as indicated on the drawings.

3.5 ROOF PANEL INSTALLATION

.1 Install exterior pre-finished roof panels on panel support clips using manufacturer's proper construction procedure. Ensure batten is positively locked for full length of roof fascia. Field-cut mitres where applicable. Install batten cap and snap-on batten covers.

3.6 FLASHING INSTALLATION

.1 Use concealed fasteners where appropriate. Exposed fasteners to be of same color as sheet.

.2 Lock end joints and caulk to provide weather-tight seal. Use standing seam joints in flashings to RCABC Standards. Seal all joints in flashings.

.3 Provide all flashings to make metal roofing watertight.

.4 Install matching cap flashing at ridges, eaves, skylights, walls and other locations as indicated.

.5 Flashing color to match metal cladding colors where exposed to view.

.6 Flashing details shown on the drawings indicate the general type and appearance required. Carry out all work in a proper workmanlike manner to RCABC Standards and details. Form proper returns to stop ends and work to and around all features as necessary.

.7 Make all roof areas watertight as required. Flash openings and items projecting through roofing. Bend up flashing as required; fold and clip neatly and secure in straight lines free from wrinkles and undulations. Fastening to be concealed and watertight. Carefully place, form and trim breaks. Bond and neutralize soldering.

.8 Turn back edges of all exposed flashing to form ¼" (6mm) stiffeners.

.9 Form all flashings on a bending brake. Execute all hand trimming, shaping and soldering with appropriate tools. Install with hold down clips.

.10 Allow for expansion and contraction to finished work without deformation.

.11 Install scuppers and drainage channels in accordance with RCABC Standards.

3.7 SEALANT

.1 Provide sealant and joint packing to perimeter joints at metal roofing and at all penetrations through roofing.

3.8 CLEAN UP

.1 Before removing scaffolding, clean off any marks on metal roofing. Repair any defects to any other work caused by this work; leave panels free of oil, grease and dirt.

.2 This subcontractor shall leave all metal roofing panels clean and free of all grime and dirt.

.3 At the completion of the work of this Section, remove any excess materials, debris and equipment, pertaining to the work of this Section from the site.

END OF SECTION 07 41 13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Modified Bituminous Membrane Roofing Section 07 52 00.

1.2 REFERENCES

.1 The Aluminum Association Inc. (AAI)
- .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
- .2 AAI DAF45-03, Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 167-99 (2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM A 240/A 240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .3 ASTM A 606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- .4 ASTM A 653/A 653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .5 ASTM A 792/A 792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .6 ASTM B 32-04, Standard Specification for Solder Metal.
- .7 ASTM B 370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
- .8 ASTM D 523-89 (1999), Standard Test Method for Specular Gloss.
- .9 ASTM D 822-01 (2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canada Green Building Council (CaGBC)
- .1 LEED Canada-NC Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.4 Canadian Roofing Contractors Association (CRCA)
- .1 Roofing Specifications Manual 1997.

.5 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.6 Canadian Standards Association (CSA International)
- .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
- .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
- .3 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.7 Green Seal Environmental Standards
- .1 Standard GS-03-93, Anti-Corrosive Paints.
- .2 Standard GS-11-97, Architectural Paints.
- .3 Standard GS-36-00, Commercial Adhesives.

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

.1 Material Safety Data Sheets (MSDS).

.9 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule #1113-04, Architectural Coatings.
- .2 SCAQMD Rule #1168-05, Adhesives and Sealants.

.10 Roofing Contractors Association of British Columbia (R.C.A.B.C) Manual and U.L.C. requirements.

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:
- .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province, Territory, of British Columbia, Canada.

.4 Samples:
- .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, 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 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and, with contractor's representative, Departmental Representative in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:
- .1 Verify project requirements.
- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.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 and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Materials and Resources Credit MRc2.1 Construction Waste Management: Divert 50% From Landfill and MRc2.2 Construction Waste Management: Divert 75% From Landfill: prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.61 mm (24ga) thickness, commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating.

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.
- .1 Class F2S.
- .2 Colour selected by Departmental Representative Consultant from manufacturer's standard range.
- .3 Specular gloss: 5 units +/-5 in accordance with ASTM D 523.
- .4 Coating thickness: not less than 22 micrometres.
- .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5units or less and erosion rate less than 20 % to ASTM D 822 as follows:
  - .1 Outdoor exposure period 2500 hours.
  - .2 Humidity resistance exposure period 5000 hours.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.
- .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.3 Underlay for metal flashing: asphalt laminated 3.6 to 4.5 kg kraft paper.

.4 Sealants.
- .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.6 Fasteners: of same material as sheet metal, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.

.7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.8 Touch-up paint: as recommended by prefinished material manufacturer.
- .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1113.

2.5 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable RCABC Standards.

.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.

.3 Form pieces in 2400 mm maximum lengths.
- .1 Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm.
- .1 Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental

to appearance or performance.

.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.6 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.61mm, 24ga thick galvanized steel.

2.9 EAVES TROUGHS AND DOWNPIPES

.1 Form eaves troughs and downpipes from 0.5 mm thick aluminum.

.2 Sizes and profiles as indicated, Downspouts 75mm DIA Round.

.3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

.4 Form 600 x 600 mm splash pans from 0.5 mm thick.

2.10 SCUPPERS

.1 Form scuppers from 0.5 mm thick aluminum sheet metal.

.2 Sizes and profiles as indicated.

.3 Provide necessary fastenings.

.4 Form 600 x 600 mm splash pans from 0.5 mm thick aluminum.

2.11 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with AA DAF45.
- .1 Clear anodic finish: designation AA- M12C22A47.
- .2 Integral colour anodic finish: colour to match Departmental Representative's sample.

.2 Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative: to AAMA/WDMA/ CSA-101/I.S.2/A440, for coating Classes 1, 2 and 3 respectively.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install sheet metal work in accordance with R.C.A.B.C standards.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal.
- .1 Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
- .1 Flash joints using S-lock forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Install pans, where shown around items projecting through roof membrane.

3.3 EAVES TROUGHS AND DOWNPIPES

.1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.
  .1 Slope eaves troughs to downpipes as indicated.
  .2 Seal joints watertight.

.2 Install downpipes and provide goosenecks back to wall.
  .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

.3 Install splash pans.

3.4 SCUPPERS

.1 Install scuppers as per R.C.A.B.C. guidelines.

3.5 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.

3.6 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 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION 07 62 00

1 .0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Mechanical Divisions 20-25

.2 Electrical Communications/Electronics/Security Divisions 26-28

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)
- .1 ULC-S115-1995, Fire Tests of Fire stop Systems.

1.3 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 noncombustible 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.

1.4 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.

.3 Shop Drawings:
- .1 Submit shop drawings to show location, 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.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company specializing in fire stopping installations with 5 years documented experience.

.2 Pre-Installation Meetings: convene pre-installation meeting two weeks prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 32 16 - Construction Progress Schedule to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.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.

1.6 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 in dry location 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 19 - Waste Management and Disposal.

2.0 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 stop system rating: 1 hour.

.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 NBC.

.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.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 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 materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

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 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in 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.

3.6 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 at:

.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, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: 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.

1 .0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Finish Carpentry	Section 06 20 00
.2	Sheet Metal Flashing and Trim	Section 07 62 00
.3	Metal Doors and Frames	Section 08 11 00
.4	Gypsum Board Assemblies	Section 09 21 16
.5	Ceramic Tiling	Section 09 30 13
.6	Exterior Painting	Section 09 91 13
.7	Interior Painting	Section 09 91 23
.8	Mechanical	Divisions 20-25
.9	Electrical Communications/ Electronics/Security	Divisions 26-28

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C 919- 02, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 19-GP-5M- 1984 , Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
- .2 CAN/CGSB-19.13- M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .3 CGSB 19-GP-14M- 1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
- .4 CAN/CGSB-19.17- M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .5 CAN/CGSB-19.24- M90, Multi-component, Chemical Curing Sealing Compound.

.3 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 General Services Administration (GSA) - Federal Specifications (FS)
- .1 FS-SS-S-200- E (2)1993 , Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.6 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's product to describe.

.1 Caulking compound.
.2 Primers.
.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.4 Submit duplicate samples of each type of material and colour.

.5 Cured samples of exposed sealants for each color where required to match adjacent material.

.6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
.1 Instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE / 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 joints complete with back-up material, primer, caulking and sealant.

.3 Mock-up will be used:
.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Location to be decided with Departmental Representative.

.5 Allow 24 hours for inspection of mock-up by Departmental Representative 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.

1.5 DELIVERY, STORAGE & HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

.3 Upon completion of Work, after cleaning is carried out.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and

Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 SITE CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

2.0 PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Standard: For interior and exterior work unless otherwise specified, ensure compatibility of sealants being used and other materials in contact with them, meet LEED® requirement VOC level of 250 g/L

for architectural sealant, and conform to the latest editions of the specifications summarized below:

2.2 SEALANT TYPE

.1 Type 1: Multi-Component chemical cure sealants: unless otherwise specified conform to CAN/CGSB-219.24-M90(TT-00227E-Type 11, Class A) standard, sealing compounds and as otherwise specified to exceed that standard; deliver to site and bear in addition to the product identification name, the qualification number when tested under CAN/CGSB Standard, Type 1 (self-leveling-horizontal joints) Type 2 (non-sag-vertical joints), Class A for glazing standard, Class B for non-glazing standard.

.2 Type 2: Multi-component chemical sealants: unless otherwise specified conform to CAN/CGSB-1-19.24-M90 (TT-00227E-Type 11, Class A) standard, sealing compounds and as otherwise specified to exceed that standard; deliver to site and bear in addition to the product identification name, the qualification number when tested under CAN/CGSB standard, Type 1 (self-leveling-horizontal joints) Type 2 (non-sag-vertical joints), Class A for glazing standard, Class B for non-glazing standard.

.3 Type 3: One component polyurethane sealants: conform at least to CAN/CGSB-2-19.13-M87 (TT-S-00230C) specifications; non-sag type; not fall cohesively or adhesively in a properly designed joint where total expansion does not exceed 25% of the minimum width.

.4 Type 4: Structural glazing sealant: two part, neutral cure, elastomeric silicone sealant conforming to ASTM C920, Type S, NS, Class 25 standard; designed for joint dynamic movement 25%.

.5 Type 5: One component elastomeric chemical cure silicone: for joints minimum 6 mm x 6 mm and maximum as directed by product manufacturer; conform to CAN/CGSB-2-19.13-M87 (TT 002230C Type 11, Class A) standard; one component silicone base. (Consultant's written approval shall be required prior to use of this sealant).

.6 Type 6: Acrylic sealant: conform to CGSB-19-GP-5M.

.7 Type 7: Silicone caulking: white, mildew resistant.

.8 Type 8: Partition sealant: acrylic sealant conforming to CGSB 19-GP-5M standard, for exposed to view sealing work; provide around electrical boxes, phone plugs, and other penetrations in partitions scheduled for acoustic separation.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant type: 1 or 5.

.2 Metal flashing and metal soffit: Sealant type: 3.

.3 Structural glazing: Sealant type: 4.

.4 Perimeters of interior frames: Sealant type: 6.

.5 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: 6.

.6 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Sealant type: 6.

.7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant

type: 7.

.8 Exposed interior control joints in drywall: Sealant type: 8.

.9 Submersion/sealing of areas of standing water: Sealant type 2.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

3.0 EXECUTION

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

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 Cleanup.
.1 Clean adjacent surfaces immediately and leave Work neat and clean.
.2 Remove excess and droppings, using recommended cleaners as work progresses.
.3 Remove masking tape after initial set of sealant.

3.7 CLEANING

.1 Clean adjacent surfaces immediately and leave work clean and neat. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints.

END OF SECTION 07 92 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Flush Wood Doors Section 08 14 16

.2 Hardware Section 08 71 00

.3 Glazing Section 08 80 50

1.2 REFERENCES

.1 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.

.2 Canadian Standards Association (CSA International)
- .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.3 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.

.4 National Fire Protection Association (NFPA)
- .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.

.5 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule 1113-04, Architectural Coatings.
- .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.6 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
- .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, and listed by nationally recognized agency having factory inspection services and to ULC fire protection rating

1.4 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, arrangement of hardware and fire rating and finishes.
.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and finishes.
.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 DELIVERY, STORAGE AND HANDLING

.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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 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 to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

.3 Exterior Door Frames: 16ga

.4 Interior Door Frames: 16ga

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:
.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.

.2 Stiffened: face sheets honeycomb core.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

.4 All exterior doors to be insulated.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
.1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.

.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.

.4 All exterior doors to be insulated.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L to GC-03.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 23 - Interior Painting, 09 91 13 - Exterior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

.1 Maximum VOC emission level 50 g/L to GS-11 to SCAQMD Rule 1113.

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 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal rivited.

.6 Sealant:

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.8 Glazing: Refer to Section 08 08 50.

.9 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: 1.2 mm thermally broken type construction.

.4 Interior frames: 1.2 mm welded type construction.

.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 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate exterior frame components with polyurethane 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 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

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 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: honeycomb construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with 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.

.9 Manufacturer's nameplates on doors are not permitted.

2.13 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 1.2 mm sheet steel with honeycomb core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.2 mm sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

2.14 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from 1.2 mm sheet steel.

.2 Form face sheets for interior doors from 1.2 mm sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with fibreglass core.

.5 Fill voids between stiffeners of interior doors with honeycomb core.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION 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 1200 mm 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.

.6 Maintain continuity of air barrier and vapour retarder.

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 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 Finished floor: 13 mm.

.3 Adjust operable parts for correct function.

.4 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.

END OF SECTION 08 11 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Metal Doors & Frames — Section 08 11 00

.2 Hardware — Section 08 71 00

.3 Glazing — Section 08 80 50

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
- .1 Quality Standards for Architectural Woodwork latest edition.

.2 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
- .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.3 Canadian Standards Association (CSA International).
- .1 CSA A440.2-98, Energy Performance of Windows and Other Fenestration Systems.
- .2 CSA O115-M1982 (R2001), Hardwood and Decorative Plywood.
- .3 CAN/CSA O132.2 Series-90 (R1998), Wood Flush Doors.
- .4 CAN/CSA-O132.5-M1992 (R1998), Stile and Rail Wood Doors.
- .5 CAN/CSA-Z808-96, A Sustainable Forest Management System: Guidance Document.
- .6 CSA Certification Program for Windows and Doors 00.

.4 Environmental Choice Program (ECP).
- .1 CCD-045-92, Sealants and Caulking Compounds.
- .2 CCD-046-92, Adhesives.

.5 National Fire Protection Association (NFPA).
- .1 NFPA 80-1999, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-1999, Standard Method of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC).
- .1 CAN-4S104M-80 (R1985), Fire Tests of Door Assemblies.
- .2 CAN4-S105M-85 (R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.

.7 LEED 2009 New Construction

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For caulking materials during application and curing.
  - .2 For door materials and adhesives.

.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.

1.4 SAMPLES

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

.2 Submit one 300 x 300 mm corner sample of each type wood door.

.3 Show door construction, core, glazing detail and faces.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 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.

1.6 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 in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.3 Protect doors from scratches, handling marks and other damage. Wrap doors.

.4 Store doors away from direct sunlight.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard polystyrene 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 approved by Departmental Representative.

.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.

2.0 PRODUCTS

2.1 FIRE RATED WOOD DOORS

.1 Wood doors: tested in accordance with CAN4-S104 or /NFPA 252 to achieve rating as scheduled.

.1 Face panels: paint grade MDO.

2.2 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.
  .1 Construction:
    .1 Core: Agfiber particleboard to ANS1 A280.1 LD7
  .2 Face Panels as scheduled:
    .1 Paint grade MDO

.2 Adhesive: Type I (waterproof) no urea formeldhyde for all doors.

.3 Stiles:
  .1 CE Compatible with face veneer mill option AWS Type B veneered
  .2 Standard: AWMAC Custom Grade

2.3 GLAZING

.1 Glass: As per Glazing Section 08 80 50

2.4 FABRICATION

.1 Vertical edge strips to match face veneer.

.2 Prepare doors for louvres and glazing. Provide to match face veneer glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.4 Radius vertical edges of double acting doors to 60 mm radius.

3.0 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 stops 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 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 08 14 16

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SECTIONS INCLUDED

.1 Provide manually and automatically operated, sectional steel, insulated overhead door, complete with lift hardware, tracks, door guides and glazing. Refer to Door Schedule for glazing arrangement.

1.3 RELATED SECTION

.1 Metal Fabrications Section 05 50 00

1.4 DESIGN

.1 Wind load: Design exterior door assembly to withstand a wind load calculated in accordance with the National Building Code.

.2 Single-Source Responsibility: Provide doors, tracks, and accessories from manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate materials, operating mechanisms, and required clearances.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store door to prevent damage.

.2 Made good or replace damaged units to the consultant’s acceptance.

1.7 MAINTENANCE DATA

.1 Provide operation and maintenance data for overhead door hardware for incorporation into operation and maintenance manual.

1.8 GUARANTEE

.1 A written warranty will be required, guaranteeing the work from all defects from the use of materials, deficiencies of design strength, or by reason of poor workmanship which may appear within one (1) year from the date of Substantial Performance.

2.0 PRODUCTS

2.1 MATERIALS

.1 Insulated Steel Sectional Overhead Doors

Insulated sectional overhead steel doors. Units shall have the following characteristics:

.1 Door Sections: Shall be of steel/polyurethane/steel sandwich type construction with thermal break.

.1 Panel Thickness: 1-1/2 inches (38 mm).

.2 Exterior Surface: Ribbed or Flush

.3 Exterior Steel: .016 inch (0.40 mm), hot-dipped galvanized, prepainted.

.4 Thermal Values: R-value of 13.21 ft2 hF/Btu minimum.

.5 A continuous, cavity-free, CFC/HCFC-free polyurethane insulation.

.6 Door to have high strength-to-weight ratio and to resist deflection.

.7 Section to feature thermal breaks and continuous replaceable seals to minimize air flow.
.8 Internal steel reinforcement for hardware mounting.
.9 End caps-galvanized 1.6mm.

.2 Finish and Color:
.1 Two coat baked-on polyester:
.1 Interior: Finish and color as chosen by Departmental Representative from manufacturer's full range.
.2 Exterior: Finish and color as chosen by Departmental Representative from manufacturer's full range.

.3 Windload Design: Provide to meet the Design/Performance requirements specified.
.4 Hardware: All hardware to be fabricated from commercial galvanized steel.
.5 Automatic and Manual Operation: Doors to be Automatic operation, for electric operator and controls with manual option

2.2 HARDWARE

.1 Weatherstripping: Full length retainer and bulb weather strip minimize air flow and ensure weather-tightness at the base of your door. Flexible Top Weather Seal.

.2 Trussing: Doors to be constructed to withstand wind load specified in ANSI/DASMA 108. Linear style trusses to be provided according to door size.

.3 Track: Roll formed from commercial galvanized steel. Vertical tracks sloped to ensure weather tight seal. Horizontal track curve 16″ (406mm) radius.

.4 Track Brackets: Bolted type, field adjustable, rib reinforced, stamped from 0.123″ (3.1 mm) thick commercial galvanized steel.

.5 Rollers: Ten ball bearings for smooth and quiet operation. 7/16″ (11mm) diameter standard stem, long stem on doors over 16'-2″ (4928mm) wide.

.6 Counter Balance: Helically wound torsion springs manufactured from oil tempered spring wire, stress relieved, minimum 10,000 cycles. Aluminum die-cast grooved drums. Flexible 7 x 19 construction aircraft type galvanized cables with 5:1 safety factor. Higher cycle available upon request.

.7 Horizontal Angle: 72″ (1829 mm) long or 90″ (2286mm) for 3″ hardware.

.8 Hinges: Linear type, fabricated from 0.078″ or 0.106″ (2 or 2.7mm) thick zinc plated steel with embossments designed to resist higher load and provide greater stability resulting in improved performance.

.9 Top Roller Carrier: Fabricated from zinc plated steel designed to provide greater stability, field adjustable to ensure weather tight seal.

.10 Roller Brackets: Linear type fabricated from 0.078″ or 0.106″ (2 or 2.7mm) zinc plated steel. Graduated type design to ensure weather tight seal.

.11 Shafts: 1″ (25mm) diameter 0.078″ (2mm) tube or 1/8″ (3mm) wall keyed full length or 1″ (25mm) diameter cold rolled galvanized steel keyed full length.

.12 Head Plates: Full height fabricated from galvanized steel, complete with bolt-on type bearings.

.13 Lock: Interior slide bolt type.

.14 Mounting Fasteners: Zinc plated.

3.0 EXECUTION

3.1 FABRICATION

.1 Fabricate the work true to dimensions and square. Fabricate finished work free from distortion and defects detrimental to appearance and performance.

.2 Use shop and field connections complying with CAN/CSA S16. 1-M89.

.3 Accurately fit joints and intersecting members with adequate fastenings.

3.2 INSTALLATION

.1 Examine supports provided by others, at time of bidding and before installation. Report deficiencies to Consultant. Commencement of installation will signify acceptance of work by others.

.2 Install guides and door hardware plumb, true and square, in accordance with drawings and manufacturer’s instructions.

.3 Install counter balance assembly as shown, electrical operator complete with controls.

.4 Provide all necessary accessories for the complete installation of doors, guides, and operator to achieve a weather tight installation.

.5 Install doors and align to ensure smooth operation and to provide correct closure.

.6 Install manual chain hoist.

.7 Check and adjust as required and deliver to Owner complete and functional overhead door system.

.8 Touch up door with primer where galvanized finish damaged during fabrications.

.9 Adjust weather stripping to form a weather tight seal.

.10 On completion, adjust and lubricate sectional overhead doors. Check and adjust controls. Ensure that equipment and mechanisms are operating smoothly. Demonstrate the operation, control and safety features.

END OF SECTION 08 36 00

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and co-ordinated with all other parts.

1.2 SECTION INCLUDES

.1 Supply and install interior storefront aluminum entrances, windows, single glazed, and all necessary flashings, sealants, gaskets, caulking and accessories to full extent shown on drawings and as specified here-in-included but not limited to specifically:

- .1 Interior aluminum windows.
- .2 Interior Aluminum entrance doors.
- .3 Thresholds to doors.
- .4 Related operating hardware - coordinate with 08 71 00.
- .5 Glass and glazing.
- .6 Aluminum flashing and cladding.
- .7 Matching metal panels as detailed.
- .8 Related deflection header components.

1.3 RELATED SECTIONS

.1	Structural Steel Framing	Section 05 12 00
.2	Metal Fabrications	Section 05 50 00
.3	Door Hardware	Section 08 71 00
.4	Glazing	Section 08 80 00

1.4 REFERENCES

.1 AAMA-1979, "Aluminum Curtain Walls Design Guide Manual".

.2 ASTM E283-84, "Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors."

.3 ASTM E331-86, "Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Differential".

.4 NRCC/DBR Building Practice Note #234.

.5 Canadian Building Digest #96, "Use of Sealants", by G.K. Garden.

.6 CAN2-12.1-M76 - Glass, Safety, Tempered or Laminated

.7 CAN2-12.1-M76 - Glass, Polished Plate or Float, Flat, Clear.

.8 CAN2-12.4-M76 - Glass, Heat Absorbing.

.9 CAN2-12.8-M76 - Insulating Glass Units.

.10 CAN3-S157 - Strength Design in Aluminum.

.11 CAN/CSA - A440 Windows, 2000.

.12 Insulating Glass Manufacturers of Canada, Guidelines.

1.5 DESIGN AND LABORATORY TESTING REQUIREMENTS

.1 The Contractor shall design, test, fabricate and install the complete integrated assembly to meet the following performance criteria. The drawings shall be held to indicate the general arrangement

of the assemblies, spacing of members, profile and sizes of members, materials and interface with adjacent construction.

.2 As a min. the assembly shall be designed, fabricated and installed in accordance with the National Building Code latest edition, including seismic design.

.3 Design assembly to support dead loads and accommodate structural deflection and long term creep movements and drift without stress on glass, buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects caused by structural movement.

.4 Air infiltration for pair of 1830 x 2134 doors and frames shall not exceed 5.56 m^3/hm per linear foot of crack.

1.6 SUBMITTALS

.1 Provide a sample and site mock-up of each of the following in actual approved material, colour range, finish minimum size noted:
- .1 Section of glazing frame 600 mm long, complete with glazing gaskets.
- .2 Complete curtain wall assemblies, with all hardware as designated on the hardware schedule and installation materials, size as designated by the Departmental Representative.
- .3 Insulating glass 600 x 600 mm for each type of glass specified.
- .4 Spandrel glass 600 x 600 mm.

.2 Submit shop drawings for review in accordance with Section 01 33 00.

.3 Shop drawings shall be prepared and sealed by a professional engineer registered in the Province of British Columbia to indicate that the assembly will withstand all design loads imposed upon it, and that connections to building structure will transfer all loads, reactions and forces to the structure, and that the assembly meets air infiltration and design and laboratory testing requirements. Said Engineer shall provide BCBC Schedule S signed and sealed.

.4 Shop drawings and fabrication shall be prepared by the manufacturer.

.5 Clearly detail profiles, die drawings, construction, assembly, installation for all conditions, including structural connectors at high span locations and also flashing, caulking, sealing, provision for thermal movement, deflection and glazing, anchorage attachment to building structure, method of adjustment.

.6 Provide four (4) copies of maintenance data for cleaning and maintenance of aluminum finishes for incorporation into the Owner's operation and maintenance manuals.

1.7 QUALITY ASSURANCE

.1 Curtain walls, glass, glazing and sealants shall be fabricated and installed by companies and skilled workers having a minimum of five (5) years proven experience in the completion of this type of installation for a comparable project.

.2 The glazing and electrical trades shall work cooperatively with each other to provide a complete installation in conformance with the documents and all applicable codes and standards.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle and store units in accordance with the manufacturer's directions.

.2 Store units at site on raised wood pallets protected from the elements and corrosive materials. Do not remove from crates or other protective covering until ready for installation.

.3 Store prefabricated frame assemblies blocked off the ground in an approved manner to prevent warping, twisting, undue strain on assembly or physical abuse and damage.

.4 Match mark all components for field assembly.

.5 Insulating glass units must be stored with a positive bottom support at right angles to the plane of the glass.

1.9 WARRANTY

.1 Provide written warranty issued in the name of the Owner and signed by the Installer stating that the storefront assembly is warranted to perform in accordance with design and performance requirements specified under clauses 1.5 for a period of not less than one (1) year from date of Substantial Performance.

.2 Finish: Against non-uniform fading during warranty period to extent that adjacent members have a colour range greater than originally accepted colour range samples approved by the Consultant; pitting or other type of corrosion resulting from natural elements in local atmosphere; discolouration, staining or streaking of the surface.

.3 Sealed Units: Against failure for ten (10) years.

2.0 PRODUCTS

2.1 MATERIALS

.1 General: All materials used in this contract shall be of the highest quality as manufactured by nationally recognized manufacturers and of the type indicated on the drawings and in these specifications.

.2 Steel Shapes: To CAN3-G40.21-M81, Grade 300W.

.3 Aluminum Members: Extruded from 6063-T54 alloy free from defects impairing strength, appearance and durability.

.4 Fastenings: Stainless steel, aluminum or other corrosion resistant material.

.5 Reinforcement Steel: Steel as reinforcement to aluminum members and fixing support for aluminum frames to be medium structural steel conforming to CSA Standard G-40.21, Type 44W.

.6 Metal Cladding (Head, Mullion, Sill): Provide matching metal cladding to all locations as indicated on drawings and as required for complete installation. All fastenings concealed.

.7 Aluminum trim, flashing and cladding at perimeter walls as per drawings.

2.2 FRAMING SYSTEM

.1 Storefront Window: non-thermally broken, centre glazed.

2.3 ENTRANCE DOORS

.1 Institutional non thermally broken single glazed. Stiles to be wide-stile. Sizes as per drawings and door schedule.

.2 Finish Hardware: Door assemblies shall be prepared for installation of hinges, mortise locks, closers and panic hardware as specified in Section 08 71 00.

2.4 FASTENERS

.1 In accordance with AAMA Guide Specification Manual to suit base metals in which they occur. Where exposed, colour coded to match surface in which they occur.

2.5 SEALANT

.1 In accordance with CBD #96.

.2 Colour as selected by the Consultant.

2.6 GLAZING MATERIALS

.1 Exterior and Interior Glazing Gaskets: Dense, EPDM Durometer 50 (Shore A) to ASTM C509, keyed into stops and frames.

.2 Glass Setting Blocks: Compatible with glass edge seals, with a durometer hardness of 80 of ASTM D2240.

2.7 GLASS AND GLAZING

.1 Safety (tempered) glass shall be fully tempered, Type 2, Class B, clear float or plate glass, conforming to CAN2-12.1-M76 clear. Thicknesses 6mm and 8mm.

.2 Glass Schedule:

.1 Interior glazed lite:

.1 Typical interior glazed windows: 6mm tempered glass., and 8 mm tempered.

.2 Interior glass single glazed lite(s): Clear glass as required to meet performance requirements for sealed units and tempered to meet Building Code requirements.

2.8 FINISHES

.1 Finish to aluminum components shall be clear anodized to Aluminum Association AA M12C22A31.

2.9 ATTACHMENTS

.1 Door Sweep: Standard components as supplied by manufacturer.

.2 Weather-stripping: Standard components as supplied by manufacturer: Kawneer.

2.10 FABRICATION

.1 Fabricate members to shapes, sizes and configurations as shown on the drawings in accordance with reviewed shop drawings.

.2 All materials to be used internally or externally shall be corrosion resistant, nonstaining, non-bleeding and compatible with adjoining material.

.3 Fabricate all parts and assemblies to AAMA standards for aluminum framing as a minimum and as further specified in this section to provide a weathertight and waterproof system.

.4 Fabricate units in shop in accordance with the manufacturer's assembly details and reviewed shop drawings. Build square, true, accurate to size, free from defects detrimental to appearance and performance.

.5 Machine all joints, corners, mitres, accurately to hairline joints. Provide interior reinforcing at connections of hollow assemblies to structural supports. Mechanical fasteners shall be hidden in completed installation. Join corners with metal corners sleeves and/or mitre and weld continuously along entire length of contact.

.6 Fabricate units in largest practical size for handling, transport and installation. Trial assemble all large units in shop and match-mark for field assembly.

.7 Build in expansion joints and deflection channels.

.8 Reinforce vertical and horizontal sections as required to ensure adequate strength to meet performance requirements and support dead load of system.

.9 Provide, install all alignment bars, brackets, clips, tees, inserts, splice plates, fastenings, anchors, etc., for fabrication and assembly. Ship loose those items required for field installation.

.10 Provide all caps, closures, trim, flashings as required to complete field installations.

.11 Back paint all aluminum surfaces in contact with concrete, masonry, mortar, plaster or other dissimilar materials with approved bituminous protective paint.

.12 Provide shielded drainage and pressure equalization vents where required. All horizontal members shall be sealed to vertical members to provide individual compartments within the system in accordance with the rain screen principle.

.13 Factory pre-drill frames as required for installation of electrical components and wiring.

3.0 EXECUTION

3.1 INSPECTION

.1 Inspect the work of other sections upon which the work of this section depends. Proceed only after deficiencies, if any, in the work of other sections have been corrected.

.2 Ensure that all anchor and setting or installing assemblies or components supplied by the trade for installation by others are properly located and correctly set in place.

3.2 PREPARATION

.1 Obtain all dimensions affecting the work of this section from the job site.

.2 Provide data, dimensions and components, anchors and assemblies to be installed by others in proper time for installation.

.3 Attend a pre-installation meeting with General Contractor, Manufacturer’s field representative, Owner’s representative and Consultant.

.4 Prepare doors and frames to receive and install all finish hardware supplied by Section 08 71 00. Prepare doors and frames to receive all electrified finish hardare supplied and installed by Section 08 79 00. Frame preparation for electried hardware shall include preparing frames holes and plastic knock-out grommets for cable pathway where required, and the installation of cabling within frame assemblies during installation where required. Headers for overhead concealed automactic operators shall be finished and installed by this section as part of the glazing system. Pull strings to be installed in all cable raceways. Mounting tabs shall be provided for all flush mounted mortised hardware. Coordinate with all affected trades.

3.3 ERECTION

.1 Erect and secure assemblies aligned plumb and square, free from warp, twist or superimposed loads, installed to achieve weathertight installation with air/thermal barrier seal to full system.

.2 Erect in strict accordance with the manufacturer's written instructions and reviewed shop drawings.

.3 All anchors and fitments shall be concealed. Exposed heads of fasteners not permitted unless specified otherwise. All joints in exposed work shall be flush hairline butt joints. Attachments to be concealed include but are not limited to, all windows at stair locations and public corridor locations.

.4 Use anchors that will permit sufficient adjustment for accurate alignment.

.5 Build-in and provide any supplementary reinforcing and bracing required for assembly loads and deflections.

.6 Build in anchors and other items provided by other trades for incorporation into window system.

.7 Secure work adequately to structure in a manner not restricting thermal and wind movement. Touch-up any damaged finish.

.8 Correctly locate and install flashings, deflectors and weep holes to ensure proper drainage of moisture to exterior.

.9 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coating of bituminous paint.

.10 Ensure that all stops, gaskets, splines, seals, etc., are perfectly aligned and ready to receive glazing as specified herein.

3.4 GLASS AND GLAZING

.1 All sealed units to be installed and handled in accordance with Insulating Glass Manufacturers association of Canada (IGMAC) guidelines

.2 Glazing Method:

.1 Dry Glazing:

.1 corners must be glued, vulcanized or welded.

.2 glazing pressure below 5 kp/cm.

3.5 SEALANTS

.1 Installed in accordance with CBD #96.

3.6 ADJUSTING AND CLEANING

.1 At completion of work of this section, and continuously as work proceeds, remove all surplus materials, debris and scrap.

.2 At completion of work, remove all protective surface covering film and wrappings. Clean all glass panels, frames using mild soap or other cleaning agent approved by the aluminum storefront manufacturer.

.3 Remove all excess glazing or joint sealing materials from exposed surfaces. Clean and polish glass.

.4 Adjust all hardware for proper function.

END OF SECTION 08 41 13

1.0 GENERAL

1.1 DOCUMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and co-ordinated with all other parts.

1.2 SECTION INCLUDES

.1 Exterior aluminum entrances, curtain walls, aluminum windows, thermally broken, double glazed, and single glazed where noted.

.2 Aluminum entrance doors, double glazed.

.3 Thresholds to exterior doors.

.4 Related operating hardware - coordinate with 2.4.2.

.5 Glass and glazing.

.6 Aluminum flashing and cladding.

.7 Matching metal panels as detailed.

.8 Related deflection header components.

.9 Internal curtain wall stiffeners as required at highspan locations.

1.3 RELATED SECTIONS

.1	Joint Sealants	Section 07 92 00
.2	Finish Hardware	Section 08 71 00
.3	Glazing	Section 08 80 00

1.4 REFERENCES

.1 AAMA-1979, "Aluminum Curtain Walls Design Guide Manual".

.2 ASTM E283-84, "Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors."

.3 ASTM E331-86, "Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Differential".

.4 NRCC/DBR Building Practice Note #234.

.5 Canadian Building Digest #96, "Use of Sealants", by G.K. Garden.

.6 CAN2-12.1-M76 - Glass, Safety, Tempered or Laminated

.7 CAN2-12.1-M76 - Glass, Polished Plate or Float, Flat, Clear.

.8 CAN2-12.4-M76 - Glass, Heat Absorbing.

.9 CAN2-12.8-M76 - Insulating Glass Units.

.10 CAN3-S157 - Strength Design in Aluminum.

.11 CAN/CSA - A440 Windows, 2000.

.12 Insulating Glass Manufacturers of Canada, Guidelines.

.13 National Energy Code of Canada 2015

1.5 DESIGN AND LABORATORY TESTING REQUIREMENTS

.1 Exterior windows and doors shall have a maximum U-value of 1.9 as per National Energy Code of Canada 2015 requirements for this region.

.2 As a min. the assembly shall be designed, fabricated and installed in accordance with the National Building Code, latest edition, including seismic design.

.3 Design assembly to support dead loads and accommodate structural deflection and long term creep movements and drift without stress on glass, buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects caused by structural movement.

.4 Design exterior curtain wall and entrance framing systems to provide for such expansion and contraction of component materials as will be caused by a surface temperature ranging from 20°C to 70°C without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating windows and doors shall function normally over this temperature range.

.5 Design assembly to restrict air infiltration to 0.0003 $m^3/s/m^2$ at 300 Pascals. Test assembly in accordance with ASTM E283.

.6 Design assembly to resist water infiltration (static and dynamic) when tested in accordance with ASTM E331 up to 575Pa. pressure differential. There shall be no leakeage, as defined in AAMA 501.

.7 Storefront members to incorporate rigid PVC or polyurethane thermal break.

.8 Air infiltration for pair of 1830 x 2134 doors and frames shall not exceed 5.56 m^3/hm per linear foot of crack.

.9 Thermally, the grid members shall have a condensation resistance equal to or better than the area along the bottom of a 1" sealed glass on it with standard metal spacer edge construction.

.10 Fixed windows shall conform to the following requirements of CSA standard/CAN/CSA-A 440 windows.

.1 Water infiltration shall meet the B7 rating, and B5 for operable units.
.2 Wind load resistance shall meet the C5 rating.
.3 Intermediate mullions and horizontals shall be designed to withstand loading in accordance with the National Building Code of Canada.
.4 Condensation resistance temperature index of the framing shall be a minimum of 55.2.

1.6 SUBMITTALS

.1 Provide a sample and site mock-up of each of the following in actual approved material, colour range, finish minimum size noted:

.1 Section of glazing frame 600 mm long, complete with glazing gaskets.
.2 Complete curtain wall assemblies, with all hardware as designated on the hardware schedule and installation materials, size as designated by the Consultant.
.3 Insulating glass 600 x 600 mm for each type of glass specified.

.2 Submit shop drawings for review in accordance with Section 01 33 00.

.3 Shop drawings shall be prepared and sealed by a professional engineer registered in the Province of British Columbia to indicate that the assembly will withstand all design loads imposed upon it, and that connections to building structure will transfer all loads, reactions and forces to the structure, and that the assembly meets air infiltration and design and laboratory testing requirements. Said Engineer shall provide BCBC Schedule S signed and sealed.

.4 Shop drawings and curtain wall fabrication shall be prepared by the manufacturer.

.5 Provide four (4) copies of maintenance data for cleaning and maintenance of aluminum finishes for incorporation into the Owner's operation and maintenance manuals.

1.7 QUALITY ASSURANCE

.1 Curtain walls, glass, glazing and sealants shall be fabricated and installed by companies and skilled workers having a minimum of five (5) years proven experience in the completion of this type of installation for a comparable project.

.2 The glazing and electrical trades shall work cooperatively with each other to provide a complete installation in conformance with the documents and all applicable codes and standards.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle and store units in accordance with the manufacturer's directions.

.2 Store units at site on raised wood pallets protected from the elements and corrosive materials. Do not remove from crates or other protective covering until ready for installation.

.3 Store prefabricated frame assemblies blocked off the ground in an approved manner to prevent warping, twisting, undue strain on assembly or physical abuse and damage.

.4 Match mark all components for field assembly.

.5 Insulating glass units must be stored with a positive bottom support at right angles to the plane of the glass.

1.9 WARRANTY

.1 Provide written warranty issued in the name of the Owner and signed by the Installer stating that the storefront assembly is warranted to perform in accordance with design and performance requirements specified under clauses 1.5 for a period of not less than one (1) year from date of Substantial Performance.

.2 Finish: Against non-uniform fading during warranty period to extent that adjacent members have a colour range greater than originally accepted colour range samples approved by the Consultant; pitting or other type of corrosion resulting from natural elements in local atmosphere; discolouration, staining or streaking of the surface.

.3 Sealed Units: Against failure for ten (10) years.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Kawneer, Alumicor, Vision Wall, AGS, Ferguson, Columbia Glazing Systems Inc. or equal.

2.2 MATERIALS

.1 General: All materials used in this contract shall be of the highest quality as manufactured by nationally recognized manufacturers and of the type indicated on the drawings and in these specifications.

.2 Steel Shapes: To CAN3-G40.21-M81, Grade 300W.

.3 Aluminum Members: Extruded from 6063-T54 alloy free from defects impairing strength, appearance and durability.

.4 Fastenings: Stainless steel, aluminum or other corrosion resistant material.

.5 Reinforcement Steel: Steel as reinforcement to aluminum members and fixing support for aluminum frames to be medium structural steel conforming to CSA Standard G-40.21, Type 44W.

.6 Metal Cladding (Head, Mullion, Sill): Provide matching metal cladding to all locations as indicated on drawings and as required for complete installation. All fastenings concealed.

.7 Aluminum trim, flashing and cladding at perimeter walls as per drawings.

.8 Anti-rotation block: solid aluminum or pvc blocking, not rigid polystyrene.

2.3 CURTAIN WALL FRAMING SYSTEM

.1 Curtain wall framing system at curtain walls at main entrance door 101. Fixed B7C5 Ratings.

.2 All framing to be panelized, with split mullions, utilizing clamped EPDM gaskets, drained at the base of each panel.

.3 Glazing system: 4 sided capture.

.4 Glazing pane: Front.

2.4 ENTRANCE DOORS

.1 Institutional non thermally broken double glazed. Acceptable manufacturers: Kawneer Extra duty “500” or Alumicor 600 Series A/B doors, Columbia 500 door or equal. Sizes as per drawings and door schedule.

.2 Finish Hardware: Exterior door assemblies shall be prepared for installation of hinges, mortise locks, closers and panic hardware as specified in Section 08 71 00.

2.5 WINDOW UNITS

.1 Provide operable units, awning style with limit arms, located as indicated on drawings.

.1 Hardware: Provide the following items of hardware:

.1 Hinges
.2 Limit arms
.3 Weep covers
.4 Roto-Operator
.5 Insect screens: to be extruded aluminium finished to match window frame and joined at the corners. Screen to be 18 x 16 glass fiber mesh. Spines to be removable to permit re-screening.

2.6 FASTENERS

.1 In accordance with AAMA Guide Specification Manual to suit base metals in which they occur. Where exposed, they shall be stainless steel.

2.7 SEALANT

.1 In accordance with CBD #96 and to suit manufacturer’s recommendations.

.2 Colour as selected by the Departmental Representative.

2.8 GLAZING MATERIALS

.1 Exterior and Interior Glazing Gaskets: ASTM C864.

.2 Glass Setting Blocks: Compatible with glass edge seals.

2.9 GLASS AND GLAZING

.1 Float Glass: To CAN 2-12.3, "Glazing", min. 6.0 mm thick.

.2 Heat Absorbing Glass: To CAN 2-12.4, min. 6.0 mm thick.

.3 Heat Strengthened Glass: To CANB 2-12.4, Class B-Heat strengthened, min. 6.0 mm thick.

.4 Safety (tempered) glass shall be fully tempered, Type 2, Class B, clear float or plate glass, conforming to CAN2-12.1-M76 tinted to match balance of glazing.

.5 Glass Schedule:

.1 Exterior glazing as required to achieve maximum assembly U-value of 1.9.

.2 Interior lite(s) typical: Clear glass as required to meet performance requirements for sealed units.

.3 Manufacture sealed units to Insulating Glass Manufacturers of Canada (IGMAC) guidelines.

.4 Door glazing shall have both lights tempered to conform to Code requirements, exterior lite clear.

.5 All other lites of interior doors to be tempered.

2.10 FINISHES

.1 Finish to aluminum components shall be clear anodized to Aluminum Association AA-M12C22A31.

2.11 ATTACHMENTS

.1 Door Sweep: Standard components as supplied by manufacturer.

.2 Weather-stripping: Standard components as supplied by manufacturer.

.3 Door Threshold: Standard 6.25” components as supplied by manufacturer.

2.12 FABRICATION

.1 Fabricate members to shapes, sizes and configurations as shown on the drawings in accordance with reviewed shop drawings.

.2 All materials to be used internally or externally shall be corrosion resistant, nonstaining, non-bleeding and compatible with adjoining material.

.3 Fabricate all parts and assemblies to AAMA standards for aluminum framing as a minimum and as further specified in this section to provide a weathertight and waterproof system.

.4 Fabricate units in shop in accordance with the manufacturer's assembly details and reviewed shop drawings. Build square, true, accurate to size, free from defects detrimental to appearance and performance.

.5 Machine all joints, corners, mitres, accurately to hairline joints. Provide interior reinforcing at connections of hollow assemblies to structural supports. Mechanical fasteners shall be hidden in completed installation. Join corners with metal corners sleeves and/or mitre and weld continuously along entire length of contact.

.6 Fabricate units in largest practical size for handling, transport and installation. Trial assemble all large units in shop and match-mark for field assembly.

.7 Build in expansion joints and deflection channels.

.8 Reinforce vertical and horizontal sections as required to ensure adequate strength to meet performance requirements and support dead load of system.

.9 Provide, install all alignment bars, brackets, clips, tees, inserts, splice plates, fastenings, anchors, etc., for fabrication and assembly. Ship loose those items required for field installation.

.10 Provide all caps, closures, trim, flashings as required to complete field installations.

.11 Back paint all aluminum surfaces in contact with concrete, masonry, mortar, plaster or other dissimilar materials with approved bituminous protective paint.

.12 Provide shielded drainage and pressure equalization vents where required. All horizontal members shall be sealed to vertical members to provide individual compartments within the system in accordance with the rain screen principle.

.13 Factory pre-drill frames as required for installation of electrical components and wiring.

3.0 EXECUTION

3.1 INSPECTION

.1 Inspect the work of other sections upon which the work of this section depends. Proceed only after deficiencies, if any, in the work of other sections have been corrected.

.2 Ensure that all anchor and setting or installing assemblies or components supplied by the trade for installation by others are properly located and correctly set in place.

3.2 PREPARATION

.1 Obtain all dimensions affecting the work of this section from the job site.

.2 Provide data, dimensions and components, anchors and assemblies to be installed by others in proper time for installation.

.3 Attend a pre-installation meeting with General Contractor, Manufacturer’s field representative, Owner’s representative and Consultant.

3.3 ERECTION

.1 Erect and secure assemblies aligned plumb and square, free from warp, twist or superimposed loads, installed to achieve weathertight installation with air/thermal barrier seal to full system.

.2 Erect in strict accordance with the manufacturer's written instructions and reviewed shop drawings.

.3 All anchors and fitments shall be concealed. Exposed heads of fasteners not permitted unless specified otherwise. All joints in exposed work shall be flush hairline butt joints.

.4 Use anchors that will permit sufficient adjustment for accurate alignment.

.5 Build-in and provide any supplementary reinforcing and bracing required for assembly loads and deflections.

.6 Build in anchors and other items provided by other trades for incorporation into window system.

.7 Secure work adequately to structure in a manner not restricting thermal and wind movement. Touch-up any damaged finish.

.8 Correctly locate and install flashings, deflectors and weep holes to ensure proper drainage of moisture to exterior.

.9 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coating of bituminous paint.

.10 Coordinate installation of automatic window operators and window security sensors, security hardware and other electrical components with other contractors.

.11 Ensure that all stops, gaskets, splines, seals, etc., are perfectly aligned and ready to receive glazing as specified herein.

3.4 AIR SEAL MEMBRANE

.1 Seal all joints within and between back up walls and frames with a 300 mm strip of membrane air/vapour barrier. Acceptable product jiffy seal 140/60 (protecto wrap)

.2 Preparation of surfaces for membrane application shall consist of ensuring surfaces are smooth sound and clean, then apply the primer. Concrete structure shall also be primed with same after all honeycombing has been grouted flush.

.3 Bridging of membrane from adjacent walls to frames of gaps greater than 13 mm will not be accepted.

3.5 GLASS AND GLAZING

.1 All sealed units to be installed and handled in accordance with Insulating Glass Manufacturers association of Canada (IGMAC) guidelines

.2 Glazing Method:

.1 Dry Glazing:

i) corners must be glued, vulcanized or welded.

ii) glazing pressure below 5 kp/cm.

3.6 SEALANTS

.1 Installed in accordance with CBD #96.

3.7 FIELD TESTING

.1 Contractor to include and provide for independent window testing of Curtain Wall assemblies and installed adjacent wall assemblies. Testing to include in accordance with manufacturer's field quality control requirements and as noted below:

.1 Assembly and installation of testing equipment and pressure room constructions.

.2 3 random window tests at locations directed by the Departmental Representative.

.3 1 test on mock-up curtain wall assembly and trim to adjacent wall/structure. Include all typical horizontal and vertical mullions and conditions to adjacent structure.

.4 Visual review of windows prior to testings.

.5 Perform window tests as per CAN/CSA and AAMA 503 guidelines in presence of Departmental Representative and General Contractor.

.6 Advise Departmental Representative and manufacturer's representative minimum 48 hours in advance of proposed test time.

.7 If water penetration occurs, contact appropriate parties.

.8 Prepare a report in a timely manner and present conclusions. Forward report to General Contractor and Departmental Representative.

.2 Cost of testing to be included in contract price, and identified as a separate prize.

.3 Work not meeting specific performance requirements shall be corrected as part of the contract price.

3.8 ADJUSTING AND CLEANING

.1 At completion of work of this section, and continuously as work proceeds, remove all surplus materials, debris and scrap.

.2 At completion of work, remove all protective surface covering film and wrappings. Clean all glass panels, frames using mild soap or other cleaning agent approved by the aluminum storefront manufacturer.

.3 Remove all excess glazing or joint sealing materials from exposed surfaces. Clean and polish glass.

.4 Adjust all hardware for proper function.

END OF SECTION 08 44 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Finish Carpentry	Section 06 20 00
.2	Metal Doors & Frames	Section 08 11 00
.3	Aluminum Doors & Frames	Section 08 11 16
.4	Flush Wood Doors	Section 08 14 16
.5	Glazed Aluminum Curtain Walls	Section 08 44 13

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 A156.2- 2003, Bored and Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.3- 2001, Exit Devices.
- .4 ANSI/BHMA A156.4- 2000, Door Controls - Closers.
- .5 ANSI/BHMA A156.5- 2001, Auxiliary Locks and Associated Products.
- .6 ANSI/BHMA A156.6- 2005, Architectural Door Trim.
- .7 ANSI/BHMA A156.8- 2005, Door Controls - Overhead Stops and Holders.
- .8 ANSI/BHMA A156.10- 1999, Power Operated Pedestrian Doors.
- .9 ANSI/BHMA A156.12- 2005, Interconnected Locks and Latches.
- .10 ANSI/BHMA A156.13- 2002, Mortise Locks and Latches Series 1000.
- .11 ANSI/BHMA A156.14- 2002, Sliding and Folding Door Hardware.
- .12 ANSI/BHMA A156.15- 2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
- .13 ANSI/BHMA A156.16- 2002, Auxiliary Hardware.
- .14 ANSI/BHMA A156.17- 2004, Self-closing Hinges and Pivots.
- .15 ANSI/BHMA A156.18- 2006, Materials and Finishes.
- .16 ANSI/BHMA A156.19- 2002, Power Assist and Low Energy Power - Operated Doors.
- .17 ANSI/BHMA A156.20- 2006, Strap and Tee Hinges and Hasps.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

- .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION & INFORMAL 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 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 contract hardware list.
.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 Sustainable Design Submittals:
.1 Materials and products in accordance with Section 01 47 15 Sustainable Requirements: Contractor's Verification.

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 door hardware for incorporation into manual.

1.5 MAINTENANCE MATERIALS SUBMITTALS
.1 Extra Stock Materials:
.1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
.2 Tools:
.1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.6 QUALITY ASSURANCE
.1 Regulatory Requirements:
.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY, STORAGE & 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 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 strippable coating.
.4 Replace defective or damaged materials with new.

.5 Develop Construction Waste Management Plan related to Work of this Section and in accordance

with Section 01 74 21-Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:
- .1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
- .2 Lever handles: plain 64mm x 114mm x 51mm design.
- .3 Roses: round.
- .4 Normal strikes: box type, lip projection not beyond jamb.
- .5 Cylinders: key into keying system as noted as directed.
- .6 Finished to 652, 626 & 630

.2 Butts and hinges:
- .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.

.3 Exit devices: to ANSI/BHMA A156.3, type & function as listed, grade (1)
- .1 Auxiliary items: door coordinator.

.4 Door Closers and Accessories:
- .1 Door controls (closers): to ANSI/BHMA A156.4, listed in Hardware Schedule, multi-sized sized 1 to though 6 in accordance with ANSI/BHMA A156.4, table A1, finished to 689.
- .2 Door controls - overhead holders: to ANSI/BHMA A156.8, designated by letter C and numeral identifiers listed in Hardware Schedule, finished to 626.
- .3 Closer/holder release devices: to ANSI/BHMA listed in hardware schedule, finished to 689.

.5 Door Operators:
- .1 Power-operated pedestrian doors: to ANSI/BHMA A156.10.
- .2 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.

.6 Auxiliary locks and associated products: to ANSI/BHMA A156.5, numeral identifiers listed in Hardware Schedule, finished to 626.
- .1 Cylinders: type as listed, finished to 626, for installation in deadlocks provided with special doors as listed in Hardware Schedule. Key into keying system as directed by Departmental Representative.

.7 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule as listed below, finished to 626 or 630.
- .1 Architectural door trim: to ANSI/BHMA A156.6, listed in Hardware Schedule as listed below, finished to 626 or 630
- .2 Door protection plates: kick plate type as listed, 1.27 mm thick stainless steel, 1 edges, size as indicated, finished to 630.
- .3 Push plates: type as listed, 1.27 mm thick stainless steel, 1 edge, as listed, finished to 630.
- .4 Push/Pull units: type as listed, finished to 630.

.8 Sliding and folding door hardware: to ANSI/BHMA A156.14 finished to 626.

.1 Heavy sliding doors (over 91 kg): box track, commercial series hanger and double sidewall overhead style track supports, as listed in above standard for door weight.
.2 Bi-passing sliding door hardware: double leg aluminum track without fascia and commercial series steel hangers, as listed in above standard for door weight
.3 Accessory item: door pulls stops double roller guides with channel in door type commercial grade

.9 Auxiliary hardware: to ANSI/BHMA A156.16, listed in Hardware Schedule finished to 626 or 630.

.10 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene weather seal, recessed in door bottom surface mounted recessed in door face, closed ends, adjustable automatic retract mechanism when door is open, clear anodized finish.

.11 Thresholds: 127mm wide x full width of door opening, extruded aluminum mill finish, serrated surface, with lip and vinyl door seal insert.

.12 Weatherstripping:
.1 Head and jamb seal:
.1 Adhesive backed neoprene vinyl covered foam material.

.2 Door bottom seal:
.1 Extruded aluminum frame and closed cell neoprene vinyl sweep, clear anodized finish.

.13 Astragal: overlapping, Primed steel meeting stiles Pile

.14 Barrier Free Pneumatic Door Operator:
.1 Heavy duty pneumatically assisted door closer, capable of multi-door operation, complete with actuators, control boxes, pneumatic tubing and compressed air source.
.2 Self-contained control box/compressor combination for independent operation of two door leaves.
.3 Control boxes: complete with electric strike relay.
.4 Mount operators on either push or pull sides of doors as required to place them inside rooms.
.5 Actuation of operators by card readers push button.
.6 Electrical box and actuator: Hardwired low voltage actuator with stainless steel 114 mm round plate, engraved blue filled with handicap symbol. Box 51 mm wide X 102 mm high x 50 mm deep single gang electrical box, flush mounted in wall, locations indicated.
.7 Supply switched line voltage to control box. Locate switch adjacent to box.
.8 Supply low voltage wiring to each actuator and 6 mm diameter air tubing to each operator.
.9 Mount control box in location as directed by Departmental Representative.

2.3 MISCELLANEOUS HARDWARE

.1 Indexed key control system: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers, wall mounted, type 50% expandable colour enamel paint finish.

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 and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.5 KEYING

.1 Doors, padlocks and cabinet locks to be keyed as directed. Prepare detailed keying schedule in conjunction with Departmental Representative.

.2 Supply keys in duplicate for every lock in this Contract.

.3 Supply 3 master keys for each master key or grand master key group.

.4 Stamp keying code numbers on keys and cylinders.

.5 Supply construction cores.

.6 Hand over permanent cores and keys to Departmental Representative.

3.0 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 metal door and frame manufacturers with complete instructions and templates for preparation of their work 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 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Install key control cabinet.

.7 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.8 Remove construction cores locks when directed by Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly.

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.

.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 Departmental Representative.

.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 Use, application and storage of wrenches for door closers locksets and fire exit hardware.

.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 door hardware installation.

4.0 SCHEDULE

4.1 FINISH HARDWARE SCHEDULE

.1 Schedule

HARDWARE LIST

.1 Hinges:

A1 – Hinge 3 Knuckle-.180 gauge-114mm x 101mm x Non Removable Pin x 652
A2 – Hinge 3 Knuckle-.134 gauge- 114mm x 101mm x Non Removable Pin x 652

A3 –Hinge 3 Knuckle-.180 gauge-114mm x 101mm x Non Removable Pin x 630
A4 – Hinge 3 Knuckle-.134 gauge- 114mm x 101mm x Non Removable Pin x 630
A5 –Transfer Hinge 3 Knuckle 12 wire-.180 gauge-114mm x 101mm x 630
A6 –Springe Hinge 3 Knuckle .134 gauge-114mm x 101mm x 652

.2 Locks, Dead bolts and Privacys:

B1 - Cylinder Type x length x cam to suit 626

B2 – Card reader	Proximity Access by others	
B3- Lock set	ANSI F09	626
B4 - Privacy set	ANSI F22 with indicator	626
B5 - Lock set	ANSI F14	626
B6 - Lock set	ANSI F07	626
B7 - Lock set	ANSI F04	626
B8 - Lock set	ANSI F05	626
B9 - Dead latch	Heavy duty for aluminum door	
	-BS-Hand with Thumb turn	628
B10 - Lock set	ANSI F13	626
B11 – Electric strike	ANSI A156.31, grade 1 x 24VDC x ¾" keeper	
	-conduits, wiring, power supply, junction box, & all Hookups by electrical	
B12 - Dead lock	ANSI F17	626
B13- Lock set	ANSI F88	626 10G16
B14 – Mag Lock	ANSI 294x 1200 lbs holding force x 24VDC x brackets	
	-conduits, wiring, power supply, junction box, fire alarm reset switch & all Hookups by electrical	

.3 Closers:

Note: Include thru-bolts and grommet nuts fasteners.

C1 - Institutional, non-sized, regular arm x delayed action x 689

C2 - Institutional, non-sized, compression spring buffer arm x delayed action x 689

.4 Operators:

C4– Operator see 2.2.14

.5 Exit Devices:

D1 - Exit Device	Mechanical Bar-Motion for mag lock release x all hookups by electrical
D2 - Exit Device	ANSI A156.3 2008 grade 1 x 630 x ANSI 03 function fire rated
D3 - Exit Device	ANSI A156.3 2008 grade 1 x 630 x ANSI 08 function fire rated

.6 Auxiliary hardware:

F1 - Wall stop Cast concealed mount, concave bumper with back plate x 626

F2 – Flush Bolts Self latching with bottom fire bolt x 626

F3 – Coordinator ANSI A156.3 Type 21

F4 – 2 Ea. Viewer with full 140 degrees of visibility x 626

F5 - OH stop ANSI C05532 x 626

.7 Sliding & Bifold door hardware:

H1 – Bifold door track & hardware nylon wheels max weight 120 kg with roller guides on floor & channel in door to KrisTack KT15KIT-2L with KT146B brackets quantity to suit opening, pulls to Gallery 360A x 630 Fascia, and the balance of hardware by door supplier

.8 Architectural door trim:

J1 –Pull	Sets ANSI J401 25mm dia x 304mm with base plates x 90 degree offset B to B mounting x 630
J2 –Pull	Sets ANSI J401 25mm dia x 304mm with base plates x x 630
J3 -Kick Plate	1.27 mm thickness x 254mm height x width less 38mm x 630
J4 -Kick Plate	1.27 mm thickness x 254mm height x width less 25mm x 630
J5 -Push Plate	101mm x 406mm x 630

.9 Threshold, seals, door bottoms, astragal:

M1 -Threshold	Thermal Barrier free Saddle 181mm x 6.4mm x width with non-skid

	finish set in solid mastic and secured with counter sunk SS screws And metal shields every 300 mm
M2 -Threshold	Thermal Barrier -free latching panic exit Saddle 127mm x 6.4mm x 6.4 stop strip x ThemoSeal with non-skid finish set in solid mastic and secured with counter sunk SS screws and metal shields every 300 mm, size door to make continuous contact with door.
M3 -Threshold	Barrier free Saddle 127mm x 6.4mm x width
M4 –Door Shoe	Similar to Pemko 2221APK-width
M5 - Seals	Adjustable jamb type x silicone insert x 2/height x 1 width
M6 –Door Shoe	Similar to Pemko 211APK-width
M7 - Astragal	Off set security bar x height welded to door by door supplier
M8 - Astragal	Security bar x height welded to door by door supplier

Other items:

N1 – All Hardware by door supplier
N2 – No Hardware required

DOOR INDEX

Dr. #	Set #	Dr. #	Set #	Dr. #	Set #	Dr. #	Set #	Dr. #	Set #
101	01	**114**	06	**121**	10	**ST102b**	11	**210**	16
102	02	**115**	07	**122**	10	**201**	13	**212**	05
103	03	**116a**	08	**123a**	18	**202**	13	**213**	**06**
104	04	**116b**	09	**123b**	**18**	**203**	**13**	**EL201**	**18**
106	04	**116c**	18	**123c**	**08**	**204**	**14**	**ST201**	**12**
108	19	**117a**	04	**123d**	**08**	**205**	**14**	**ST202b**	**12**
109	05	**117b**	08	**124**	**18**	**206**	**14**	**300**	**17**
110	05	**117c**	**04**	**EL107**	**18**	**207a**	**13**		
111	06	**118**	**06**	**ST101a**	11	**207b**	**15**		
112	04a	**119**	**06**	**ST101b**	12a	**208**	**05**		
113	06	**120**	**06**	**ST102a**	12	**209**	05		

HARDWARE SETS

Hardware Set 01
4 @ A3, 2@ A5, B2, 2 @ B14, 2 @ D1, C2, 2 @ J1, M2
Note: Seals from door supplier.
Note: Interlock card reader and accessible push button by others.

Hardware Set 02
6 @ A1, 2 @ J1, C2
Note: Seals from door supplier.
Note: Accessible push button by others.

Hardware Set 03
2 @ A6, B13, B11, F1
Note: Electronic gate latch remotely located.

Hardware Set 04
3 @ A2, B1, B7, F1

Hardware Set 04a
5 @ A2, B1, B09, J1, F5

Hardware Set 05
3 @ A2, B4, F1, J3, C1

Hardware Set 06
3 @ A2, B1, B6, F1, C1, M3

Hardware Set 07
3 @ A4, B1, B6, C2, M1, M5, M4

Hardware Set 08
3 @ A3, B2, B3, B11, C2, M1, M5, M6

Hardware Set 09
6 @ A1, B1, B5, 2 @ C2, F2, F3, 2 @ J4, M8

Hardware Set 10
3 @ A1, B1, B12, C1, F1, J2, J4, J5

Hardware Set 11
3 @ A3, B1, D2, C1, C2, M2, M5, M6

Hardware Set 12
3 @ A1, B1, D3, C1, F1, M1, M5, M6

Hardware Set 12a
3 @ A1, D3, C1, M1, M5, M6

Hardware Set 13
3 @ A2, B1, B8, F1, J3

Hardware Set 14
3 @ A1, B1, B10, F4, F1

Hardware Set 15
2 @ H1

Hardware Set 16
6 @ A2, F2, F3, B6, 2 @ J4, M8, 2 @ F1

Hardware Set 17
3 @ A3, B1, B8, M2, M5, M4

Hardware Set 18
N1

Hardware Set 19
N2

END OF SECTION 08 71 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Windows	Section 08 50 00.
.2	Metal doors and frames	Section 08 11 00
.3	Aluminum Door and Frames	Section 08 11 16
.4	Flush Wood Doors	Section 08 14 16
.5	Aluminum Framed Entrances and Storefronts	Section 08 41 13
.6	Curtain Wall and Windows	Section 08 44 00

1.2 REFERENCES

.1 ASTM International

- .1 ASTM C 542-05, Standard Specification for Lock-Strip Gaskets.
- .2 ASTM D 790-07e1, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- .3 ASTM D 1003-07e1, Standard Test Method for Haze and Luminous Transmittance of Plastics.
- .4 ASTM D 1929-96(R2001)e1, Standard Test Method for Determining Ignition Temperature of Plastics.
- .5 ASTM D 2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
- .6 ASTM E 84-10, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .7 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .8 ASTM F 1233-08, Standard Test Method for Security Glazing Materials and Systems.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
- .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
- .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
- .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
- .5 CAN/CGSB-12.6-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-12.11-M90, Wired Safety Glass.
- .11 CAN/CGSB-12.12-M90, Plastic Safety Glazing Sheets.
- .12 CAN/CGSB-12.13-M91, Patterned Glass.

.3 Environmental Choice Program (ECP)

- .1 CCD-045-[95(R2005)], Sealants and Caulking Compounds.

.4 Glass Association of North American (GANA)

- .1 GANA Glazing Manual - 2008.
- .2 GANA Laminated Glazing Reference Manual - 2009.

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 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.

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 glazing 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 glazing and frames from nicks, scratches, and blemishes.
.3 Protect prefinished aluminum surfaces with wrapping.
.4 Replace defective or damaged materials with new.

1.6 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.

1.7 WARRANTY
.1 Provide manufacturer’s warranty in writing for insulating glass units against failure of seal of enclosed air space and deposits on inner faces of glass detrimental to vision for a period of 2 years from date of Substantial Performance of Work.

2.0 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 Size glass to withstand wind loads, dead loads and positive and negative live loads to National Building Code.

.3 Limit glass deflection to 1/200 with full recovery of glazing materials.

.2 Flat Glass:
- .1 Float glass: to CAN/CGSB-12.3, glazing quality, 6 mm thick.
- .2 Safety glass: to CAN/CGSB-12.1, transparent 6 mm thick.
  - .1 Type 2-tempered.
  - .2 Class B-float.
- .3 Silvered mirror glass: 6 mm thick.
  - .1 Type 1A-float glass for normal use Edges ground and polished.
- .4 Wired glass: to CAN/CGSB-12.11, 6 mm thick.
  - .1 Type 1-polished both sides (transparent).
  - .2 Wire mesh styles 3-square.

.3 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.

2.2 ACCESSORIES

.1 Setting blocks: neoprene Shore A durometer hardness to ASTM D 2240, minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height.

.2 Spacer shims: neoprene Shore A durometer hardness to ASTM D 2240, 75 mm 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 Shore A durometer hardness to ASTM D 2240; coiled on release paper; black colour. Width x thickness recommended by manufacturer to suit installation.

.4 Glazing splines: resilient neoprene, extruded shape to suit glazing channel retaining slot, black colour [as selected].

.5 Glazing clips: manufacturer's standard type.

.6 Lock-strip gaskets: to ASTM C 542.

.7 Mirror attachment accessories:
- .1 Stainless steel clips.
- .2 Mirror adhesive, chemically compatible with mirror coating and wall substrate.

3.0 EXECUTION

3.1 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 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- .3 Visually inspect substrate in presence of Departmental Representative.
- .4 Inform Departmental Representative 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 Departmental Representative.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

.1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and install against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at 1/3 points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of light or unit.

.5 Install removable stops, with spacer shims inserted between glazing and applied stops at 600 mm intervals, 6 mm below sight line.

.6 Fill gaps between light and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.

.7 Trim protruding tape edge.

3.4 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.

3.5 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.

3.6 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.

END OF SECTION 08 80 50

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Rough Carpentry Section 06 10 00

.2 Joint Sealants Section 07 92 00

.3 Ceramic Tiling Section 09 30 13

1.2 REFERENCES

.1 Aluminum Association (AA)

.1 AA DAF 45-03 (R2009), Designation System for Aluminum Finishes.

.2 ASTM International

.1 ASTM C 475-02 (2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C 514-04 (2009e1), 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 840-08, Standard Specification for Application and Finishing of Gypsum Board.

.5 ASTM C 954-07, 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 1002-07, 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 1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C 1280-99, Standard Specification for Application of Gypsum Sheathing.

.9 ASTM C 1177/C 1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.10 ASTM C 1178/C 1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.11 ASTM C 1396/C 1396M-09a, Standard Specification for Gypsum Wallboard.

.3 Association of the Wall and Ceilings Industries International (AWCI)

.1 AWCI Levels of Gypsum Board Finish-97.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.5 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.6 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.1 SCAQMD Rule 1113-A2007, Architectural Coatings.
.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.8 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 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.

1.4 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 gypsum board assemblies materials level off ground 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. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
.6 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees 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.

2.0 PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C 1396/C 1396M regular, 127mm and 19 mm thick and Type X, 127

mm and 19 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges tapered.

.2 Gypsum sheathing board: to ASTM C 1396/C 1396M, regular, 12.7mm and 18 mm thick and Type X, 12.7mm and 19 mm thick, 1200 mm wide x maximum practical length.

.3 Backing board and coreboard: to ASTM C 1396/C 1396M regular, 127mm 19 mm thick and Type X, 127mm and 9 mm thick, bevelled edges.

.4 Water-resistant board: to ASTM C 1396/C 1396M regular, 12.7mm and 19 mm thick and Type X, 12.7mm and 19mm thick, 1220 mm wide x maximum practical length.

.5 Glass mat water-resistant gypsum backing board: to ASTM C 1178/C 1178M, 12.7 and 19 mm thick, 1200 mm wide x maximum practical length.

.6 Resilient clips and drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.7 Nails: to ASTM C 514.

.8 Steel drill screws: to ASTM C 1002.

.9 Stud adhesive: to CAN/CGSB-71.25.

.10 Laminating compound: as recommended by manufacturer, asbestos-free.

.11 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.12 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.13 Polyethylene: to CAN/CGSB-51.34, Type 2.

.14 Insulating strip: rubberized, moisture resistant, 3 mm thick cork closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.15 Joint compound: to ASTM C 475, asbestos-free.

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

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 of each corner and at maximum [600] mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply single or double layer gypsum board to wood furring or framing using screw fasteners for first layer, screw fasteners for second layer. [Maximum spacing of screws 300 mm 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.
  - .3 Apply base layers at right angles to supports unless otherwise indicated.
  - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with [6] mm gap where boards abut other work.

.4 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to laundry sinks. 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.

.5 Apply 12 mm 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, and ducts, in partitions where perimeter sealed with acoustic sealant.

.6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.7 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.

.8 Install gypsum board with face side out.

.9 Do not install damaged or damp boards.

.10 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

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 on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.6 Provide continuous polyethylene dust barrier behind and across control joints.

.7 Locate control joints at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.

.8 Install control joints straight and true.

.9 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.10 Install expansion joint straight and true.

.11 Install cornice cap where gypsum board partitions do not extend to ceiling.

.12 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 300 mm on centre.

.13 Splice corners and intersections together and secure to each member with 3 screws.

.14 Install access doors to electrical and mechanical fixtures specified in respective sections.
.1 Rigidly secure frames to furring or framing systems.

.15 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.16 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
.1 Levels of finish:
.1 At water resistant backing at ceramic tile locations. 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.
.2 At typical wall locations. 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.

.17 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION 09 21 16

1.0 GENERAL

1.1 RELATED REQUIRMENTS

.1 Gypsum Board Assemblies Section 09 21 16

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
- .1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
- .2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
- .3 CTI A118.4-92, Specification for Latex Cement Mortar (included in ANSI A108.1).
- .4 CTI A118.5-92, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).
- .5 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 144-04, Specification for Aggregate for Masonry Mortar.
- .2 ASTM C 207-06, Specification for Hydrated Lime for Masonry Purposes.
- .3 ASTM C 847-06, Specification for Metal Lath.
- .4 ASTM C 979-05, 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 (AMEND.), 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, Asphalt Saturated Organic Roofing Felt.
- .2 CAN/CSA-A3000-03 (R2006), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.5 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.6 Terrazzo Tile and Marble Association of Canada (TTMAC)
- .1 Tile Specification Guide 09 30 00 2006/2007, Tile Installation Manual.
- .2 Tile Maintenance Guide 2000.

1.3 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 mortar and grout (Epoxy and Furan).
  - .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 Commercial cement grout.
.11 Organic adhesive.
.12 Slip resistant tile.
.13 Waterproofing isolation membrane.
.14 Fasteners.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
.1 Base tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
.2 Floor tile: submit duplicate, 300 x 300 mm 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 thick plywood and grout joints to represent project installation.

1.4 QUALITY ASSURANCE
.1 Quality Assurance Submittals:
.1 Manufacturer's Instructions: manufacturer's installation instructions.

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 Waste Management and Disposal:
.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 AMBIENT CONDITIONS
.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.7 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.
.3 Maintenance material same production run as installed material.

2.0 PRODUCTS

2.1 FLOOR TILE
.1 Porcelain tile: to CAN/CGSB-75.1, Type 4, Class MR (02 -3.0%), 305 mm x 610 mm. Colour

Black; Finish Matte, through-body; Tile Edge: Rectified. Matching square base, 9.5 x 305 mm x 100mm high.

2.2 WALL AND CEILING TILE

.1 Ceramic tile: to CAN/CGSB-75.1, Type Class MR 4. Matching bullnose edge trim to suit application.
Tile Pattern 1: Rooms 109, 110, 208, 209:
Tile 1: Size 101 mm x 406 mm x 6 mm; Gloss Finish; MR-4; Colours white, black as per drawings,
Tile 2: Size 63 mm x 267 mm x 8 mm, Gloss Finish; Colour red.
Tile Pattern 2: Rooms 212, 121, 122: size 229 mm x 101 mm Trapezoid, White, Gloss
Tile Pattern 3: Porcelain tile same as floor tile above. Rooms 121, 122: Size 305 mm x 610 mm x 9.5 mm, Colour black, Matte.
Tile Pattern 4: Rooms: 114,119,120,213: Size 101 mm x 406 mm x 6 mm; Gloss Finish; MR-4; Colour white.

2.3 MORTAR AND ADHESIVE MATERIALS

.1 Cement: to CSA-A5, type 10.

.2 Sand: to ASTM C 144, passing 16 mesh.

.3 Hydrated lime: to ASTM C 207, in accordane with TTMAC Installation Manual.

.4 Latex additive: formulated for use in cement mortar and thin set bond coat.

.5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

.6 Adhesives:
.1 Maximum VOC limit 65 g/L to SCAQMD Rule 1168.

2.4 BOND COAT

.1 In accordane with TTMAC Installation Manual.

2.5 GROUT

.1 Colouring Pigments:
.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C 979.
.2 Colouring pigments to be added to grout by manufacturer.
.3 Job coloured grout are not acceptable.
.4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.

.2 Cement Grout: to ANSI A108.1.
.1 Use one part white cement to one part white sand passing a number 30 screen.

.3 Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, sanded mix for floors, unsanded mix for walls and floors with polished tiles commercial tile grout.

2.6 ACCESSORIES

.1 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.

.2 Divider strips: n/a

.3 Transition Strips: purpose made metal extrusion; zinc type.

.4 Reducer Strips: purpose made metal extrusion; zinc type; maximum slope of 1:2.

.5 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.

.6 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .1 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.7 Floor sealer and protective coating: to tile and grout manufacturers recommendations.

2.7 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.
- .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.
- .1 Adhesives: maximum VOC limit to SCAQMD Rule 1168.

.4 Mix bond and levelling coats, and grout to manufacturer's instructions.

.5 Adjust water volumes to suit water content of sand.

2.8 PATCHING AND 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, being brought to feather edge, and being trowelled to smooth finish.

.4 Ready for use in 48 hours after application.

2.9 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 2006/2007, "Ceramic Tile", except where specified otherwise.

.2 Apply tile or backing coats to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

.5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Make internal angles square, external angles rounded.

.9 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.10 Install divider strips at junction of tile flooring and dissimilar materials.

.11 Allow minimum 24 hours after installation of tiles, before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

3.3 WALL TILE

.1 Install in accordance with TTMAC detail 305W-2009/10.

3.4 FLOOR TILE

.1 Install in accordance with TTMAC details 311F, 312F and 313F-2009/10.

3.5 BASE TILE

.1 Install in accordance with TTMAC detail 304w-2002.

3.6 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

3.7 FIELD QUALTIY 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.

3.8 CLEANING

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

END OF SECTION 09 30 13

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Cast-in-Place Concrete Section 03 33 00

.2 Concrete Finishing Section Section 03 35 00

.3 Gypsum Board Assemblies Section 09 21 16

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM F1303-[04(2014)], Standard Specification for Sheet Vinyl Floor Covering with Backing.

.2 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1113-[13], Architectural Coatings.

.2 SCAQMD Rule 1168-[A2011], Adhesive and Sealant 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 resilient sheet flooring and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, treads.

1.4 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% 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 Departmental Representative, upon completion of the work of this section.

.6 Store where directed by Departmental Representative.

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 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.

1.6 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.

2.0 PRODUCTS

2.1 MATERIALS

.1 Linoleum sheet flooring: composed of natural ingredients which are mixed and calendered onto a jute backing:

.1 Thickness: 2.5 mm.

.2 Colour: LINO1 – Dark grey slate c/w texture of stone.
LINO2 – Medium brown wood c/w texture grain finish.

.2 Sport Rubber Tiles:

.1 MAT.

.2 Pattern: speckled.

.3 Pattern Type: all over.

.4 Composition: recycled truck tire crumb rubber/urethane binder.

.5 Size: square edged glue-down tile – 610 mm x 610 mm.

.6 Colour: as chosen by Departmental Representative.

.3 Solid Vinyl Tile; to ASTM F1700

.1 VT

.1 Category: Conductive/Static Dissipative vinyl tile to ASTM F1700, Class I (monolithic) Type A – smooth surface.

.2 Minimum Binder Content: 34% each ply or layer.

.3 Size: 615 mm x 615 mm.

.4 Gauge: 2.0 mm.

.5 Fire Test Data: ASTM E648, Class I, ASTM E662, Smoke Developed 450 or less.

.6 Static Load Limit: ASTM F970, 250 psi (1500 lb/in^2)

.7 Slip Resistance: ASTM D2047, 0.6 for flat surface.

.8 Electrical Resistance: ASTM F150 1x10^6 – 10^8 ohms surface to ground.

.9 Recycled Content: 51% pre-consumer.

.10 Non-directional Pattern, color: dark grey.

.4 Resilient base: continuous, top set, complete with premoulded end stops and external corners:

.1 Type: rubber.

.2 Style: cove.

.3 Thickness: 3.17 mm.

.4 Height: 101.6 mm.

.5 Lengths: cut lengths minimum 2400 mm.

.6 Colour: burnt umber.

.5 Resilient Stair tread with Integral Riser: rubber, with raised round stair tread texture, visually impaired contrast colour strip, colour burnt umber with yellow contrast strip.

.6 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .1 Rubber floor adhesives:
  - .1 Adhesive: maximum VOC limit 60 g/L to SCAQMD Rule 1168.
- .2 Cove base adhesives:
  - .1 Adhesive: maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.7 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.

.8 External corner protectors: type recommended by flooring manufacturer.

.9 Edging to floor penetrations: type recommended by flooring manufacturer.

.10 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.
- .1 Sealer: maximum VOC limit 100 g/L to SCAQMD Rule 1113.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for resilient sheet flooring installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.3 PREPARATION

.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 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.4 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.5 Prime concrete slab to resilient flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

.1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring [with seams parallel to building lines] to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 Run sheets in direction of traffic. Double cut sheet joints heat weld according to manufacturer's printed instructions.

.5 Heat weld seams of linoleum sheet flooring in accordance with manufacturer's printed instructions.

.6 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.

.7 Cut flooring around fixed objects.

.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 Continue flooring over areas which will be under built-in furniture.

.11 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.12 Terminate flooring at centreline 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.

3.5 APPLICATION: STAIRS

.1 Install stair nosings, stair treads, stair risers, one piece for full width of stair. Adhere over entire surface and fit accurately.

3.6 APPLICATION: BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.8 Use toeless type base where floor finish will be carpet, coved type elsewhere.

.9 Install toeless type base before installation of carpet on floors.

.10 Heat weld base in accordance with manufacturer's printed instructions.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.

3.8 PROTECTION

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

.3 Use only water-based coating for linoleum.

3.9 SCHEDULES

.1 Refer to Finish Schedule on drawings.

END OF SECTION 01 11 55

1.0 GENERAL

1.1 REFERENCE STANDARDS

.1 American Association of Textile Chemists and Colorists (AATCC)
- .1 AATCC Test Method 16.1-2012(R2014), Colorfastness to Light: Outdoor.
- .2 AATCC Test Method 16.2-2012(R2014), Colorfastness to Light: Carbon-Arc.
- .3 AATCC Test Method 16.3-2012(R2014), Colorfastness to Light: Xenon-Arc
- .4 AATCC Test Method 23-2010(R2015), Colorfastness to Burn Gas Fumes.
- .5 AATCC Test Method 129-2010(R20156), Colorfastness to Ozone in the Atmosphere Under High Humidities.
- .6 AATCC Test Method 134-2013(2016), Electrostatic Propensity of Carpets.
- .7 AATCC Test Method 171-2014, Carpets: Cleaning of; Hot Water Extraction Method.
- .8 AATCC Test Method 175-2013, Stain Resistance: Pile Floor Coverings.
- .9 AATCC Test Method 189-2012, Fluorine Content of Carpet Fibers.

.2 ASTM International (ASTM)
- .1 ASTM D297-15, Standard Test Methods for Rubber Products-Chemical Analysis.
- .2 ASTM D1335-12, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
- .3 ASTM D 1667-05(R2011), Standard Specification for Flexible Cellular Materials-Poly (Vinyl Chloride) Foam (Closed-Cell).
- .4 ASTM D2661-14, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
- .5 ASTM D3574-11, Standard Test Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams.
- .6 ASTM D3936-12, Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
- .7 ASTM D 5116-10, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-4.2 No. 22-2004(2013), Textile Test Methods - Colourfastness to Rubbing (Crocking).
- .2 CAN/CGSB-4.2 No.27.6-M91-(R2013), Textile Test Methods - Flame Resistance - Methemine Tablet Test for Textile Floor Coverings.
- .3 CAN/CGSB-4.2 No. 76-94/ISO 2551: 1981 IDT (R2013), Textile Test Methods - Machine-Made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions.
- .4 CAN/CGSB-4.2 No.77.1-94/ISO 4919: 1978 (R2012), Textile Test Methods - Carpets - Determination of Tuft Withdrawal Force.

.4 Carpet and Rug Institute (CRI)
- .1 CRI 104 Standard for Installation of Commercial Carpet 2015.
- .2 CRI Green Label Plus Indoor Air Quality Testing Program.

.5 Environmental Choice Program (ECP)
- .1 CCD-152-2009, Flooring Products, Commercial Non-modular Textile Flooring.

.6 Health Canada
- .1 C.R.C., c.923-10, Hazardous Products Act - Carpet Regulations, Part II of Schedule 1.

.7 National Floor Covering Association (NFCA)
.1 National Floor Covering Specification Manual 2007.

.8 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
.1 SCAQMD Rule 1113-A2016, Architectural Coatings.
.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

. .9 ULC Standards(ULC)
.1 CAN/ULC-S102-11, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.2 CAN/ULC-S102.2-88, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS
.1 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 and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other construction subtrades.
.4 Review manufacturer's written installation instructions and warranty requirements.

.2 Sequencing: sequence with other work in accordance with Section 01 32 16 - Construction Progress Schedule. Comply with manufacturer's written recommendations for sequencing construction operations.

.3 Scheduling: schedule with other work in accordance with Section 01 32 16 - Construction Progress Schedule.

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 each carpet tile adhesive and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit 2 copies of WHMIS SDS

.3 Shop Drawings:
.1 Information on shop drawings to indicate:
.1 Nap: direction, open edges, special patterns.
.2 Cutouts: show locations where cutouts are required.
.3 Edgings: show location of edge moldings and edge bindings.

.4 Samples:
.1 Submit 2 samples for review and acceptance of each accessory.
.2 Submit 2 samples of each type of carpet tile specified and duplicate tiles for each colour selected.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test and Evaluation Reports:
.1 Certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Manufacturer's Instructions: submit manufacturer's installation and storage instructions.

.8 Manufacturers Reports:
.1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance with specifications.

.9 Qualification Statements:
.1 Compliance: to CAN/ULC-S102 and CAN/ULC-S102.2.
.2 Testing: passes Green Label Plus Indoor Air Quality Testing Program.
.3 Tuft bind: meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1.

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 installed products for incorporation into manual.

.3 Warranty Documentation: submit warranty documents specified.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra stock materials: deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
.1 Quantity: provide minimum 5% of:
.1 Carpet tile.
.2 Adhesives.
.2 Delivery, storage and protection: comply with Owner's requirements for delivery and storage of extra materials.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Regulatory Requirements:
.1 Prequalification: compliance with Health Canada regulations under "Hazardous Products Act", Part II of Schedule 1.

.3 Qualifications:
.1 Manufacturer: capable of providing field service representation during construction and approving application method.
.2 Flooring Installer:
.1 Experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.
.2 No sub-contract labour without written approval of Departmental Representative.

.3 Responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturer's written instructions.

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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

.3 Store and protect carpet tile and adhesive in original containers or wrapping with manufacturer's seals and labels intact.

.4 Store and protect carpet tile and accessories in location as directed by Departmental Representative.

.5 Store carpet and adhesive at minimum temperature of 18 degrees C and relative humidity of maximum 65% for minimum of 48 hours before installation.

.6 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.7 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.8 Replace defective or damaged materials with new.

1.8 SITE CONDITIONS

.1 Moisture: substrate within moisture limits and alkalinity limits recommended by manufacturer. Prepare moisture testing and provide report to Departmental Representative.

.2 Temperature: maintain ambient temperature of minimum 18 degrees C from 48 hours before installation to minimum 48 hours after completion of work.

.3 Relative humidity: maintain between 10% and 65% for 48 hours before, during and 48 hours after installation.

.4 Ventilation:

.1 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities. Provide fans with HEPA filters.

.3 Provide continuous ventilation during and after carpet application. Run ventilation system during installation; provide continuous ventilation for 7 days after completion of carpet installation.

.5 Install carpet after:

.1 Space enclosed and weatherproof.

.2 Wet-work in space completed and nominally dry.

.3 Work above ceilings complete.

1.9 WARRANTY

.1 Manufacturer's warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty in addition to and not limit other rights Owner may have under Contract Documents.

2.0 PRODUCTS

2.1 MATERIALS

.1 Manufacturers:

.1 Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

.2 Description:

.1 Adhesives: Maximum VOC limit 50g/L to SCAQMD Rule 1168.

.2 Primer: in accordance with manufacturer's recommendations for surface conditions:

.1 VOC limit: maximum 100g/L to SCAQMD Rule 1113

.3 Carpet and Accessories:

.1 Green Label Plus certified.

2.2 PERFORMANCE

.1 Flammability: certified for flammability to Health Canada regulations under "Hazardous Products - Carpet Regulations", Part II of Schedule 1.

.2 Flame Spread: maximum flame spread rating 300, maximum smoke developed classification 500, when tested to CAN/ULC-S102.2.

.3 Smoke Development: Maximum 450 to ASTM E662.

.4 Dry Breaking Strength: to ASTM D2661, minimum acceptable tear strength in both length and width:

.1 11.3 kg for carpets installed by glue down installation.

.5 Wear: maximum 10% loss of pile face fibre by weight for 10 years.

.6 Edge Ravel: none for 10 years.

.7 Static Resistance: permanent static control to AATCC 134, 3000 V maximu at 20% RH and 22 degrees C.

.8 Static Generation: less than 3.0 kV per AATCC 134 for 10 years.

.9 Tuft Bind: Tuft Lock: to ASTM D1335 CAN/CGSB-4.129, minimum acceptable 1.6 kilograms for cut pile product 3.6 for loop pile product.

.10 De-lamination of Secondary Backing: Lamination Strength of Secondary Backing: to ASTM D3936, minimum acceptable peel strength of 1.6kg/25 mm.

.11 Stain resistance: to AATCC 175.

.12 Soil Resistance: Fluorine Durability Level to AATCC 189.

.13 Colorfastness, dimensional stability, permanency of finishes, and ease of cleaning: to AATCC 171.

.14 Colourfastness to light: to CAN/CGSB-4.2 No.18.3

.15 Colourfastness to atmosphere: to AATCC 129.

.16 Colourfastness to crocking: to CAN/CGSB-4.2 No. 22.

.17 Cleaning of Carpets with Hot Water Extraction Method: to AATCC 171.

.18 Indoor Air Quality Certification: certified to CRI Green Label Plus IAQ requirements.

2.3 FABRICATION

.1 Carpet 1: Product size 30.5cm x 121.9cm
Capet A: Product size 61cm x 61cm

.2 Face construction:
.1 Tufted

.3 Pile Surface Appearance:
.1 Multi-level loop: pattern loop.

.4 Pile fibre: to CAN/CGSB-4.129.
.1 Nylon

.5 Face Fiber Content: eco solution nylon.

.6 Dyeing Method: solution dyed.

.7 Tufted Carpet Backing: to CAN/CGSB-4.129.
.1 Primary backing:
.1 Synthetic.

.8 Woven Carpet Backing: to CAN/CGSB-4.129.
.1 100% moisture resistant warp, filling and stuffer yarns.

.9 Secondary and Unitary Backings: to CAN/CGSB-4.129.

.10 Stitches: Carpet 1: 37 per 10cm; Carpet 2: 41 per 10cm.

.11 Gauge: Carpet 1: 47.2 per 10cm; Carpet 2: 31.5 per 10cm.

.12 Pile Weight Density: Carpet 1: 648.1 gms/sgm; Carpet 2: 678.1gm/sgm

.13 Finished Pile Thickness: Carpet 1: 1.35mm; Carpet 2: 2.29mm.

2.4 ACCESSORIES

.1 Edge Strips: Vinyl:
.1 Beveled floor flange minimum 50mm wide.

.2 Beveled surface to finish flush with carpet tile for tight joint and other side to floor finish.
.3 Colour: As chosen by Departmental Representative.

.2 Adhesive:
.1 Multi-purpose Adhesive Type: recommended by carpet tile manufacturer for direct glue down installation.
.2 Pressure Sensitive Type: recommended by carpet tile manufacturer for direct glue down installation of speciality backed carpet tiles.
.3 Mill-applied Adhesive Type: fully cured. Combination of pre-applied adhesive and tile to meet carpet only VOC emissions criteria of Carpet and Rug Institute Green Label Plus Indoor Air Quality Certification Program.
.4 Pre-applied Adhesive: non-transferable.
.5 On site application VOC limit: 150g/L maximum to SCAQMD Rule 1168.
.6 Adhesive in compliance with CCD-152.

.3 Carpet protection: non-staining heavy duty kraft paper.

.4 Concrete floor sealer:
.1 VOC limit: 100g/L maximum.

.5 Subfloor patching compound: Portland cement base filler, mix with latex and water to form cementitious paste.

3.0 EXECUTION

3.1 INSTALLERS
.1 Experienced and qualified technicians to carry out assembly and installation of tile carpet.

3.2 EXAMINATIONS
.1 Examine conditions, substrates and work to receive work of this Section, co-ordinate with Section 01 71 00 - Examination and Preparation.

.2 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for carpet tile installation in accordance with manufacturer's written instructions.
.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.2 Proceed with installation only after unacceptable conditions remedied [and after receipt of written approval to proceed from Departmental Representative.

3.3 PREPARATION
.1 Subfloor Preparation:
.1 Inspect concrete and determine special care required to make it a suitable for carpet installation.
.2 Fill and level cracks 3mm wide or protrusions over 0.8mm with appropriate and compatible polymer fortified patching compound.
.3 Comply with manufacturer's written recommendations for maximum patch thickness.
.4 Prime large patch areas with compatible primer.
.5 Ensure concrete substrates cured, clean and dry.

.6 Ensure concrete substrates free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that interfere with bonding of adhesive.

.7 Where powdery or porous concrete surface encountered, apply primer compatible with adhesive to provide suitable surface for glue-down installation.

.2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.

.1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

.3 Tile Carpeting Preparation:

.1 Pre-condition carpeting following manufacturer's written instructions.

3.4 INSTALLATION

.1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI Carpet Installation Standard and co-ordinate with Section 01 73 00 - Execution.

.2 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.

.3 Install carpet tile after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets installed.

.4 Install carpet tile in accordance with manufacturer's recommendation and as determined by Departmental Representative. This can include quarter-turn 90 degree format, monolithic, random, quarter turn ashlar, horizontal, herringbone or vertical ashlar. Allow for different pattern in Carpet 1 and Carpet 2 areas.

.5 Snugly join carpet tiles in completed installation.

.1 Measure distance covered by 11 carpet tiles (10 joints) and ensure distance is compliance with manufacturer specifications.

.2 Trapping yarn between carpet tiles is prohibited.

.6 Apply thin film of pressure-sensitive adhesive according to manufacturer's recommendations.

.7 Finished installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.8 Use material from same dye lot.

.1 Colour, pattern and texture to match within visual areas.

.2 Maintain constant pile direction.

.9 Fit around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.10 Install carpet tiles to underfloor duct system access covers.

.11 Install carpeting in pan type floor access covers.

.12 Extend carpet tiles into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.13 Install carpet tiles smooth and free from bubbles, puckers, and other defects.

.14 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

3.5 SITE QUALITY CONTROL.

.1 Site Tests and Inspections:

.1 Co-ordinate site test with Section 01 45 00 - Quality Control.

.2 Manufacturer's Field Services:

.1 Co-ordinate manufacturer's services with Section 01 45 00 - Quality Control. Have manufacturer review work involved in handling, installation / application, protection and cleaning of its product, and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Manufacturer's field services: provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Schedule site visits:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which Work of this Section depends, complete but before installation begins.

.2 Upon completion of Work, after cleaning carried out.

.4 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Vacuum carpets clean immediately after completion of installation.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Prohibit traffic on carpet for minimum period of 24 hours after installation and until adhesive is cured.

.3 Install carpet protection as directed by Departmental Representative

.4 Repair damage to adjacent materials caused by tile carpeting installation.

END OF SECTION 09 68 13

1.0 GENERAL

1.1 RELATED SECTION

.1 Section 09 68 13.

1.2 REFERENCE STANDARDS

.1 Aluminum Association (AA)
- .1 DAF 45-[03], Designation System for Aluminum Finishes.

.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-1.104-[M91], Semigloss Alkyd Air Drying and Baking Enamel.
- .4 CAN/CGSB-51.34-[M86], Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.3 CSA Group (CSA)
- .1 CAN/CSA-Z809-[08], Sustainable Forest Management.

.4 Ceilings and Interior Systems Construction Association (CISCA)
- .1 Recommended Test Procedures for Access Floors - [2007].

.5 Environmental Choice Program (ECP)
- .1 CCD-046-[95], Adhesives.

.6 Forest Stewardship Council (FSC)
- .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.

.7 Green Seal Environmental Standards (GS)
- .1 GS-36-[11], Standard for Adhesives for Commercial Use.

.8 National Research Council Canada (NRC)
- .1 National Building Code of Canada [2015] (NBC).

.9 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

.10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
- .1 SCAQMD Rule 1168-[A2005], Adhesives and Sealants Applications.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: convene pre-installation meeting after Award of Contract and prior to commencing work of this Section to verify project requirements, substrate conditions and co-ordination with other building sub-trades, and to review manufacturer's written installation instructions.
- .1 Convene pre-installation meeting prior to installation.
- .2 Notify attendees prior to meeting and ensure meeting attendees include as minimum:
  - .1 Departmental Representative.
  - .2 Access flooring subcontractor.
  - .3 General Contractor.

.3 Ensure meeting agenda includes review of methods and procedures related to access flooring installation including co-ordination with related work.

.4 Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

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 and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS. Indicate VOC's:

.1 For caulking materials.

.2 For adhesives.

.3 Shop Drawings:

.1 Submit drawings showing intended installation.

.2 Take measurements from finished area at site. Indicate, where applicable, information as follows:

.1 Layout of work.

.2 Sizes and details of components.

.3 Anchorage methods.

.4 Edge and fascia details.

.5 Elevation differences.

.6 Stair, handrail and ramp framing and details.

.7 Lateral bracing.

.8 Typical cutout details.

.9 Gasketting, return air details, supply air registers and perforated panels. Include air transfer capacity of grilles, registers and panels.

.10 Floor finishes.

.11 Location of connection to building grounding electrode.

.4 Samples:

.1 Submit one full size sample consisting of 4 panels of complete access flooring system, including finishes.

.2 Submit one of each of following components.

.1 Full size floor panel.

.2 Pedestal.

.3 Stringer member.

.4 Carpet.

.5 Fasteners.

.6 Cove base 300 mm long.

.7 Accessories.

.3 Submit duplicate samples of each type floor covering.

.1 Carpet: 200 x 300 mm, of each type of carpet specified.

.5 Manufacturers' Field Reports: submit copies of manufacturers field reports.

.6 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.7 Certificates: submit certification, to demonstrate compliance of access flooring system to specification as follows:
- .1 CSA or ULC certification.
- .2 Independent testing agency test reports certifying that the product meets standard.
- .3 Letter of certification from responsible official of manufacturer.
- .4 Method for testing access flooring in accordance with Ceilings and Interior Systems Construction Association (CISCA) standard test procedures.

.8 Sustainable Design Submittals:
- .1 Construction Waste Management:
  - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect access flooring from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse pallets, crates and packaging materials as specified in Construction Waste Management Plan.

2.0 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Pedestals: pedestal assembly to support a concentrated live load of 8.9 kN without going out of alignment.
  - .1 Pedestals, when secured to subfloor, to resist a 0.09 kN force applied horizontally at top of pedestal.
  - .2 Ultimate load carrying capacity: not less than twice design strength.
- .2 Stringers:
  - .1 Assembly to remain completely braced and rigid after a maximum of eight abutting panels are removed.
  - .2 Stringers to support a mid-span force of 2.22 kN minimum.
- .3 Floor Panels:
  - .1 Uniformly distributed load of 12 kPa minimum: maximum deflection of 1 mm.
  - .2 Concentrated load of 4.4 kN applied over area of 25 x 25 mm at any location: maximum deflection of 2.54 mm.
  - .3 Rolling load of 2.2 kN on 76 mm diameter caster with bearing area of 1.27 mm^2 anywhere on panel without damage maximum deflection of 2.54 mm.
  - .4 Permanent deflection: 0.5 mm maximum at design load.

.5 Ultimate strength of the panel: provide safety factor of 3.0 times its design load without failure.

.4 Allowable Tolerances:

.1 Flatness of floor panels: plus or minus 0.5 mm in any direction.

.2 Surface Dimension: plus or minus 0.5 mm of all panels.

.3 Finished floor level tolerance: plus or minus 3 mm for overall floor, and plus or minus 1 mm in 2000 mm in any direction.

.4 Squareness: plus or minus 0.5 mm in surface dimension and 0.25 mm measured diagonally.

.5 Fire Resistance:

.1 Floor panels, less finished flooring: flame spread rating of 5; fuel contribution of 10 and smoke development of 15.

.6 Electrical Resistance:

.1 From surface of floor covering through to understructure shall not exceed 2×10^{10} ohms nor be less than 5 x 10.

2.2 MATERIALS

.1 Pedestals: provide finish assembly height of 40 mm.

.2 Panels:

.1 Steel floor panels: compatible with pedestals.

.3 Finish flooring: as per finish schedule and specifications.

2.3 ACCESSORIES

.1 Base: as per finish schedule and specifications.

.2 Panel lifting device: per enclosed area manufacturer's standard equipment

3.0 EXECUTION

3.1 EXAMINATION

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

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 Install components in accordance with system manufacturer's written recommendations.

.2 Provide electrical grounding connectors.

.3 Adjust floor panel system for smooth, quiet operation.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.
  .1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
  .2 Clean aluminum with damp rag and approved non-abrasive cleaner.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - 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 access flooring installation.

END OF SECTION 09 69 00

1.0 GENERAL

1.1 RELATED REQUIRMENTS

.1 Metal Fabrications Section 05 50 00

.2 Metal Doors and Frames Section 08 11 00

1.2 REFERENCES

.1 Environmental Protection Agency (EPA)
- .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

.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 – November 2007.
- .2 Standard GPS-1- 05, MPI Green Performance Standard for Painting and Coatings.

.4 National Fire Code of Canada 2010.

.5 Society for Protective Coatings (SSPC)
- .1 Systems and Specifications, SSPC Painting Manual 2005.

1.3 QUALITY ASSURANCE

.1 Qualifications:
- .1 Contractor: to have a minimum of five years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.
- .3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.2 Conform to the standards contained in the Master Painters Institute Architectural Painting Specification Manual, latest edition (hereafter referred to as MPI Painting Specification Manual) for all painting products including preparation and application of materials. MPI Painting Specification Manual as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.3 All paint manufacturers and products used shall be as listed under the “Approved Products” section of the MPI Painting Specification manual.

.4 Other paint materials shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.5 Single-Source Responsibility: provide primers and undercoat paint produced by the same manufacturer as the finish coat.

.6 All painting and decorating work shall be inspected by Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. The painting contractor shall notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.7 All surfaces requiring painting or repainting shall be inspected by the inspection agency who shall

advise on all aspects of painting work including preparation, notifying the Departmental Representative, the Contractor and the Trade Contractor of any defects or problems prior to commencing painting work or after the prime coat shows defects in the substrate, and as the work progresses.

.8 Standard of Acceptance:
- .1 Wall: No defects visible from a distance of 1000mm at 90° to surface.
- .2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.9 Mock-Ups:
- .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .1 Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.
  - .2 Mock-up will be used:
    - .1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
  - .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.

.10 Pre-Installation Meeting:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart
  - .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.

.11 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.4 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:
- .1 Provide paint products meeting MPI "Environmentally Friendly”E2 ratings based on VOC (EPA Method 24) content levels.

.2 Green Performance in accordance with MPI Standard GPS-1.

1.5 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about building.

1.6 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.

.3 Samples:
- .1 Submit manufacturer's standard range of color choices on each specified color type as listed in Colour Schedule of this section for selection, review and acceptance of each color.
- .2 Submit triplicates 200 x 300 mm sample panels of each paint with specified paint in colours, gloss/sheen and textures required, based on selected colors, to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
  - .1 1 mm plate steel for finishes over metal surfaces.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .1 Lead, cadmium and chromium: presence of and amounts.
  - .2 Mercury: presence of and amounts.
  - .3 Organochlorines and PCBs: presence of and amounts.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .7 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 - 4 litre (1 gallon) 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 Departmental Representative requirements for delivery and storage of extra materials.

1.8 DELIVERY, STORAGE & 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 Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative
.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 19 - 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.

1.9 AMBIENT CONDITIONS
.1 Heating, Ventilation and Lighting:

.1 Perform no painting work unless a minimum lighting level of 323 Lux is provided 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 specifying body, Paint Inspection Agency and, applied 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 are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.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 Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.10 GUARANTEE

.1 Furnish either the local MPI Accredited Quality Assurance Association’s two (2) year guarantee, or, alternatively, a 100% two (2) year Maintenance Bond – both in accordance with MPI Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with MPI Painting Manual requirements

.2 All painting and decorating work shall be in accordance with MPI Painting Manual requirements and shall be inspected by the local MPI Accredited Quality Assurance Association’s Paint Inspection Agency (inspector), whether using either the MPI Accredited Quality Assurance Association’s guarantee, or the Maintenance Bond option. The cost for such inspections, and for either the local MPI Accredited Quality Assurance Association’s Guarantee, or the Maintenance

Bond, shall be included in the Base Bid Price.

.3 Painting and decorating Subcontractors choosing the Maintenance Bond option shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified check are not acceptable in lieu of surety consent.

2.0 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 “Environmentally Friendly" ratings are acceptable for use on this project.

.4 Use only MPI listed materials.

.5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
- .1 Be water-based.
- .2 Be non-flammable biodegradable.
- .3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
- .4 Be manufactured without compounds which contribute to smog in the lower atmosphere.
- .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.6 Water-borne 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.

.7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.8 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.

.9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
- .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.10 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.

.11 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.

.12 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 Departmental Representative will provide Colour Schedule after Contract award. Submit proposed Colour Schedule to Departmental Representative for approval.

.2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colors 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 manufacturers full range of colours.

.4 Where specific products are available in restricted range of colours, selection will be based on limited range.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative'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 Departmental Representative.

.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 @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 Matte	Max.5	Max.10
Finish (flat) Gloss Level 2 -Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 -Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 -Satin-Like Finish	20 to 35	Min.35

Gloss Level 5 -Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 -Gloss finish	70 to 85	
Gloss Level 7 -High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications:

.1 EXT 5.1B - Waterborne light industrial, gloss level 6 coating (over inorganic zinc).

.2 Galvanized Metal: not chromate passivated

.1 EXT 5.3G - Waterborne light industrial, gloss level 6 coating.

.3 Concrete Horizontal Surfaces

.1 EXT 3.2A latex floor paint, low gloss level.

.4 Plastic (PVC Rain Water Lead)

.1 EXT 6.8 D High Performance Architectural Latex (gloss level 5)

.5 All paint systems to be MPI Premium Grade 3 coat system.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

3.3 EXAMINATION

.1 Exterior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency minimum of one week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.

.2 Exterior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

3.4 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 Departmental Representative.

.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 Departmental Representative.

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
- .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of 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.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 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.

3.7 RESTORATION & CLEANING

.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 Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

.6 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.

3.8 COLOUR SCHEDULE

.1 All colours to be chosen by Departmental Representative. Refer to 2.2.

.2 Metal doors / frames: allow for frames to be different from doors.

3. Metal handrails and guardrails: allow for a deep colour.

.4 Metal bollards: paint traffic yellow.

.5 Paint parking lot work yard painted lines: typical traffic white unless noted as otherwise.

.6 Metal Components on Dock: paint. Colour TBD.

END OF SECTION 09 91 13

1.0 GENERAL

1.1 SUMMARY

.1 Sustainable requirements for construction and verification:

.1 Refer to requirements of Sustainable Requirements Section 01 47 17: Contractor's Verification.

.2 Related Requirements

.1 Metal Fabrications Section 05 50 00
.2 Finish Carpentry Section 06 20 00
.3 Architectural Woodwork Section 06 40 00

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, latest edition.

.5 National Fire Code of Canada - 1995

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

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 trades person in accordance with trade regulations.

.2 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart

.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.

.3 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.4 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.5 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.

.3 Samples:
.1 Submit full range colour sample chips to indicate where colour availability is restricted.
.2 Submit triplicates 200 x 300 mm sample panels of each paint, stain, or clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
.1 3 mm plate steel for finishes over metal surfaces.
.2 13 mm fir plywood for finishes over wood surfaces.
.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
.4 10 mm cedar plywood for finishes over wood surfaces.
.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
.4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
.1 Lead, cadmium and chromium: presence of and amounts.
.2 Mercury: presence of and amounts.
.3 Organochlorines and PCBs: presence of and amounts.
.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.6 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.
.7 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.

1.6 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 Departmental Representative requirements for delivery and storage of extra materials.

1.7 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 degrees C to 30 degrees 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 Type ABC 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 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 materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.
.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. Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

1.8 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:
.1 Provide heating facilities 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.
.2 Provide continuous ventilation for seven days after completion of application of paint.
.3 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
.5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:
.1 Unless pre-approved written approval by Paint Inspection Agency Authority and product manufacturer, perform no painting when:
.1 Ambient air and substrate temperatures are below 10 degrees C.
.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if

the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself 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 Meter. 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.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

2.0 PRODUCTS

2.1 MATERIALS

.1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.3 Provide paint materials for paint systems from single manufacturer.

.4 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.5 Conform to latest MPI requirements for interior painting work including preparation and priming.

.6 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.7 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.

.8 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA

Method 24) content levels.

.9 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.10 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
- .1 Water-based.
- .2 non-flammable.
- .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.

.11 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.12 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.13 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.

.14 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

.15 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 50.0ppm weight/weight total product.
- .3 Cadmium in excess of 1.0ppm 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 Departmental Representative will provide Colour Schedule after Contract award. Submit proposed Colour Schedule to Departmental Representative for approval.

.2 Colour schedule will be based upon selection of three base colours and maximum five accent colours. No more than ten colours will be selected for entire project and no more than four 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 Departmental Representative 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.

.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 @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 Matte	Max.5	Max.10
Finish (flat) Gloss Level 2 -Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 -Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 -Satin-Like Finish	20 to 35	Min.35
Gloss Level 5 -Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 7 -High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete vertical surfaces: INT 3.1C - High performance architectural latex gloss level 3 finish.

.2 Concrete horizontal surfaces: floors and stairs:
.1 INT 3.2G - Waterborne concrete floor sealer.

.3 Structural steel and metal fabrications: columns, beams, joists:
.1 INT 5.1B - Waterborne light industrial gloss level 5 coating.

.4 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):
.1 INT 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.

.5 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
.1 INT 5.3K - Waterborne light industrial gloss level 3 coating (over waterborne primer).

.6 Glue laminated beams:

.1 INT 6.1D - Polyurethane varnish insert gloss level 5 finish at exposed areas only. Note no Finish to exposed wood columns.

.7 Dimension lumber: columns, beams, exposed joists, underside of decking:
.1 INT 6.2A - Latex gloss level 3 finish (over alkyd primer).

.8 Dressed lumber: including doors, door and window frames, casings, mouldings:
.1 INT 6.3A - High performance architectural latex gloss level 3 finish.

.9 Wood paneling and casework: partitions, panels, shelving, millwork, wood baseboards, matte finish at baseboards.
.1 INT 6.4J - Polyurethane varnish insert gloss level 5 finish at shelving, panels, millwork.

.10 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
.1 INT 9.2A - Latex insert gloss level 3 finish (over latex sealer).

.11 Canvas and cotton coverings.
.1 INT 10.1A - Latex gloss level 3 finish.

.12 Bituminous coated surfaces: cast iron pipe, concrete, etc.:
.1 INT 10.2A - Latex gloss level 3 finish.

2.6 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.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

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 Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, 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 Departmental Representative.
- .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 of Departmental Representative.

.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 wiping with dry, clean cloths or compressed air.
- .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.

.6 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.

.7 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 or vacuum cleaning.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.7 Finish closets and alcoves as specified for adjoining rooms.

.8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

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 at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 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 Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION 09 91 23

1.0 GENERAL

1.1 RELATED REQUIREMETNS

.1 Finish Carpentry Section 06 20 00

1.2 REFERENCES

.1 Aluminum Association (AA).
- .1 DAF 45-03, Designation System for Aluminum Finishes.

.2 American National Standards Institute (ANSI).
- .1 ANSI 208.1-79, Particleboard, Mat-formed Wood.
- .2 ANSI A208.2-2002, Medium Density Fiberboard for Interior Use.

.3 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-11.3-M87, Hardboard.
- .2 CGSB 41-GP-30M-82, Wall coverings, Vinyl-Coated Fabrics.

.4 Canadian Standards Association (CSA International).
- .1 CSA O121-M1978(R1998), Douglas Fir Plywood.
- .2 CSA O151-M1978(R1998), Canadian Softwood Plywood.

.5 Environmental Choice Program (ECP).
- .1 CCD-046-95, Adhesives.

.6 Underwriters' Laboratories of Canada (ULC).
- .1 CAN/ULC-S102-M88 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S706-02, Wood Fibre Thermal Insulation for Buildings.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For caulking materials during application
  - .2 For adhesives.

.2 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.

.3 Samples:
- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate mm sample of each type of tackboard fabric.

.4 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: submit copies of manufacturers field reports.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Surface burning characteristics of materials: listed and labelled 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.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.

.2 Remove from site packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

2.0 PRODUCTS

2.1 MATERIALS

.1 Laminating adhesive: to manufacturer's standard.

.2 Mounting adhesive: to manufacturer's standard.

.3 Material: Linoleum resilient tackable surface material.
- .1 Total thickness – 6.0 mm +/- 0.25 mm
- .2 Roll Width – 1.22 m (3 colors in 1.83m)
- .3 Roll length - $\leq$ 28m
- .4 Total Weight – 4.7 kg/m² +/- 10%
- .5 Flexibility – Ø 50 mm, according to method a
- .6 Sound absorption coefficient – α_w 0.1 (typical)
- .7 Thermal Conductivity – 0.10 W/m-k
- .8 Self-healing properties - yes
- .9 Force on pins – Perpendicular to pin direct – 25N (typical)
- .10 Force on pins – Perpendicular to pin at 7 mm – 10N (typical)
- .11 Force on pins – parallel to pin (pulling the pin out) – 15N (typical)
- .12 Bacteriostatic Properties – yes
- .13 Anti-static – yes
- .14 Construction - Linoleum resilient homogeneous tackable surface material of natural materials consisting of linseed oil, granulated cork, rosin binders and dry pigments, mixed and calendered onto a natural burlap (jute) backing. Uni-color shall extend throughout thickness of material.
- .15 Colour – Black Olive

2.2 COMPONENTS

.1 Extruded aluminum: aluminum Association alloy AA 6063-T5. Minimum 1.5 mm wall thickness.

.2 Tackboard trim and framing: perimeter trim or frame of manufacturer's standard sections appropriate for installation conditions.

2.3 FABRICATION

.1 Fabricate tackboard panels to sizes indicated.

.2 Adhere tackable directly to wall surface or display cabinet as indicated.

.3 Make finished panels flat and rigid.

.4 Tack board material to be installed in Main Entrance Display Cabinets and West Wall of Reception 103.

3.0 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 Install tackboards in accordance with manufacturer's instructions, parallel to floor plumb and level, to provide rigid, secure surface.

.2 Adhesive attachment:

.1 Use contact adhesive per manufacturers instructions to adhere tackboard to GWB at reception wall and to backs of display cases at entry. Seams shall be minimal, tight, and symmetrical.

.3 Mechanical attachment:

.1 Install edge guards to reception wall to conceal edges of tackboard.

.2 Install display cases at entry securely to wall framing.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 10 11 23

1.0 GENERAL

1.1 DESCRIPTION

.1. General

.1 Furnish and install a manually-operable partition with suspension system located between rooms 201 and 202. Provide all labor, materials, tools, equipment, and services for operable walls in accordance with provisions of contract documents.

1.2 RELATED WORK BY OTHERS

.1 Preparation of opening will be by General Contractor. Any deviation of site conditions contrary to approved shop drawings must be called to the attention of the Departmental Representative.

.2 All header, blocking, support structures, jambs, track enclosures, surrounding insulation, and sound baffles as required in 1.4 Quality Assurance.

.3 Pre-punching of support structure in accordance with approved shop drawings.

.4 Paint or otherwise finishing all trim and other materials adjoining head and jamb of operable partitions.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE

.1 Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

.2 The partition STC (Sound Transmission Classification) shall be achieved per the standard test method ASTM E90-99 and E413-87. Test run under ASTM procedures prior to E90-99 shall not be permitted. All tests must be from an independent, currently operating, NIST-accredited Laboratory available to verify results.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

.1 Proper storage of partitions before installation, and continued protection during and after installation will be the responsibility of the General Contractor.

1.6 WARRANTY

.1 Partition panels shall be guaranteed for a period of two years from spring commencement with drive unit, mechanical parts including track and carriers guaranteed for a period of five years. This guarantee is against defects in material or workmanship of manufacturer's product.

2.0 PRODUCTS

2.1 MATERIALS

.1 Product to be top supported panels:

.1 Panels will be nominally 117mm (4 5/8") thick in manufacturer's standard widths. Channels made of 1.3mm (18 gauge) steel will be installed horizontally inside every panel and spaced at 610mm to 762mm (24" to 30") c/c. Channel dimensions will be 51mm X 51mm (2" X 2") and will insure a higher impact and torsional capacity. Panel faces must be removable and replaceable on site.

.2 The sound reverberation paneling must have a fiberglass underlay with a minimum density of 112kg/m3 (7lb/3ft) and shall be covered with a fabric finish selected by the consultant. This paneling must be anchored in place with PVC rounded-edge moulding all around its perimeter. This reinforcement moulding is unseen, as it is tucked behind the covering fabric around all edges, on both sides of the partition's panels. These moulding are designed to prevent the warping and compression of the underlying fiberglass panel. The fabric facing of each panel is devoid of apparent stitching or joints and composed of

one unique piece. The fabric covering of these fiberglass panels must be easily replaceable and removable on site.

.3 Frames shall fully enclose all edges of the surface material, in order to provide protection upon handling and stacking of the operable partition. The panels frames will be made of a minimum of 1.6mm (16 gauge) steel with a powder coated finish. Colour selected by the Consultant. Trim less panels not providing finish and edge protection are not acceptable. All trims and seals shall match the colour of the panel framing.

.4 Vertical sound seals between panels will incorporate an alignment moulding made of unbreakable PVC. This moulding will be installed on the edge of each panel in order to ensure a good vertical sound seal and proper alignment when setting up the partition.

.5 Horizontal seals must not exceed the panel width, to prevent damage while handling. Retractable bottom seals are made from formed steel, incorporating 6mm (1/4") vinyl strips for proper acoustical seal upon activating.

.2 Suspension System:

.1 Suspension system shall consist of anodized thermally treated architectural grade extruded aluminum track (painted steel track not acceptable), connected to the structural support by pairs of threaded steel rods. Guide pins ensure perfect alignment of track joints. Friction disc puck type carrier and track systems are not allowed. Track design shall be clear anodized aluminum, provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. L or T intersections shall be factory assembled and welded. A section of track will be removable in order to make it possible for a panel to be removed from the track for later maintenance.

.2 Each panel shall be supported by two wheeled counter-rotating horizontal carriers. Wheels to be of precision ground steel ball bearings with heat treated and hardened races encased with molded polymer tires. A report showing that a reliability test covering a distance of 160 Kilometers (100 miles) was completed and must be available on request.

.3 Finishes:

.1 Face finish shall be:

.1 Factory applied reinforced vinyl wall-covering with woven backing, weighing 20 oz. or more per lineal yard (465 g/m). Colour shall be selected by Departmental Representative from manufacturer's standard colour selection.

.2 Frame colour shall be clear anodized aluminum.

.3 Aluminum track and soffit shall be clear anodized.

2.2 OPERATION

.1 Partitions shall be top supported, manually operated individual panels. Friction disc/puck type carrier and track systems are not allowed. Bottom horizontal seals will be operated by a removable handle located approximately 1066mm (42") from the floor at panel edge. Operation of the seals requires no more than 180 degree turn of the handle. Horizontal bottom seals to provide 51mm (2") nominal operating clearance in order to make manipulation of the panels easier and to accommodate a deflection of the support beam or out of level floor. A stabilizing pressure shall be exerted when lowering seals. Automatic or foot pedal type activation of seals is not acceptable.

.2 An expandable closure panel will ensure the final acoustical seal. It will have the same finish as the operable partition. A removable lever accessible from both sides of the partition will activate it. It shall compensate for out-of-plumb conditions or minor wall irregularities and provide a positive pressure seal to achieve maximum sound control. It will provide a minimum of 250 lbs. (113.4kg) seal force against the adjacent wall or pocket doors for optimal sound control. No permanently fixed, wall-mounted jambs are allowed.

.3 Acoustical integrity of the first panel will be ensured by:

.1 Dual bulb seals against the wall.

.2 Permanently fixed wall jamb.

2.3 ACOUSTICAL PERFORMANCE

.1 Acoustical performance shall have been tested at an NIST-accredited, independent laboratory in accordance with ASTM E90-99 or more recent Test Standards. Standard panel construction shall have obtained an STC rating of 55.

.1 Copies of the written test report are to be made available upon request. Tests must have been conducted at a laboratory available for verification of results.

3.0 EXECUTION

.1 Installation

.1 The complete installation of the operable wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, and recommendations

.2 Cleaning

.1 All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.

.2 Packing and other installation debris shall be removed from the job site.

.3 Training

.1 Installer shall demonstrate proper operation and maintenance procedures to Departmental Representative.

.2 Operating keys and owner's manuals shall be provided to Departmental Representative.

END OF SECTION 10 22 26

1.0 GENERAL

1.1 DOCUMENTS

.1 This section forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUMMARY

.1 Section Includes:

.1 Supply and install stainless steel surface-mounted corner guards as specified herein at locations noted on the drawings, complete with all appropriate mounting systems and accessories.

.2 Installers shall be experienced in the installation of these products.

.2 Related Requirements:

.1	Section 06 10 00	Rough Carpentry
.2	Section 09 21 16	Gypsum Board Assemblies
.3	Section 09 91 23	Interior Painting

1.3 SHOP DRAWINGS

.1 Submit shop drawings or catalogue illustrations in accordance with Section 01 33 00

.2 Submit shop drawings showing proposed installation details, including type, size, spacing or method of fastening.

1.4 REFERENCE STANDARDS

.1 Fire–rated to meet or exceed all the requirements of ANSI/U.L.® Test No. 263 and ASTM E–119.

.2 Impact ratings in conformance to design use, and not less than 27.9 based on ASTM D—256.

.3 Self–extinguishing based on ASTM D—635.

.4 Flame spread of less than 25 per U.L.C.®—723, ASTM E—84, or NFPA 255.

1.5 SOURCE QUALITY

.1 Label compliance must be attached to production material.

2.0 PRODUCTS

2.1 SURFACE MOUNTED CORNER GUARDS

.1 Corner Guards to provide the following:

.1 Fabricate of 2.0 mm thick (14 gauge) stainless steel.

.2 Stainless steel to be: ASTM A167, Type 316

.3 Form guards with 50 mm (2”) return on wall surface beyond each corner.

.4 Guards to terminate at height of the finished ceiling with guard starting above the wall base

.5 Guards to wrap end walls and outside corners completely.

.6 Finish: Colour: Black.

2.3 ACCESSORIES

.1 Use sealants and adhesives as recommended by the manufacturer to provide a finished, moisture resistant installation.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install corner wall guards on West Reception Wall with tack board material from top of base trim to ceiling surface using both adhesive and mechanical fasteners.

3.2 CLEANING

.1 At the completion of the installation, clean surfaces in accordance with the manufacturer's recommendations and maintenance instructions.

END OF SECTION 10 26 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Rough Carpentry Section 06 10 00

.2 Finish Carpentry Section 06 20 00

1.2 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 456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A 653/A 653M-09, 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-09, 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 CSA International

.1 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 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.

.3 Shop Drawings:

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

.5 Sustainable Standards Certification:

.1 Low-Emitting Materials: submit listing of laminate adhesives used in building, verifying that they contain no urea-formaldehyde.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 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 Departmental Representative.

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 Store materials off ground in dry location 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 of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

2.0 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 Sustainability Characteristics:

.1 Laminate Adhesives.

.1 Urea Formaldehyde Free.

.4 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.

.5 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 COMPONENTS

.1 Toilet tissue dispenser: single roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.

.2 Paper towel dispenser: for double fold paper towels, stainless steel cabinet, hinged front panel, lock and key, surface mounted.

.3 Towel ring: Round closed loop, square escutcheon concealing wall mounting plate, bright polished die cast zamac.

.4 Towel bar: 19 mm square chrome plated steel tubing, chrome plated cast brass end brackets, concealed fasteners, 610 mm long.

.5 Robe hook: chrome plated cast bronze with 75 mm projection.

.6 Medicine cabinet: swing door cabinet, recessed, two glass adjustable shelves toothbrush holder, mirror. Cabinet completely reversible.

.1 Size: 355 x 460 x 90 mm.
.2 Cabinet: 0.5 mm thick steel.
.3 Mirror: plate glass, 6 mm, stainless steel frame.
.4 Hinges: 1 mm stainless steel piano type, with 105 degrees internal stop.
.5 Latch: magnetic.
.6 Shelves: 5 mm glass, rolled edges.
.7 Cabinet: finished in baked white enamel over primer.

.7 Mop Hook Utility Shelf: 34" (863mm) with one utility shelf, 4 mop holders and three rag hooks, shelf stainless steel; MOP holders spring – activated rubber cams Janitor room one and two.

.8 Heavy Duty Clothes Hooks:
.1 Exposed monitoring, projection from wall 87mm, hook and flange one piece brass casting with satin nickel plated finish, designed to support 300 lbs (136kg) in downward motion.

.9 Waste Receptacle: Freestanding waste receptacle shall be fabricated of heavy gauge stainless steel with exposed surfaces in satin finish. Equipped with vinyl wall bumper strip and rubber feet, swing top allows access from two sides. Capacity (13 gal.) 1.8 cu. ft.

.10 Grab Bars (GB): 30/32 mm dia x 1.6mm wall tubing of stainless steel, peened gripping surface, 38 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided steel back plates and all the accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2kN. Configurations and sizes as indicated.
.1 GB1 (Toilet Side Wall Grab Bar): 120 Degree "L" Shape Wall Rail.
.2 GB2 (Toilet back Wall Grab Bar): 610 mm L or 2 x 305 mm L to suit site condition, horizontal installation.

.11 Mirror (MR): One-piece roll-formed construction with continuous integral stiffener on all sides, Type 304 stainless steel channel frame size is 19 x 19 x 9.5mm with vertical-grain satin finish and mitred corners. No. 1 quality, 6mm glass mirror electrolytically copper plated; guaranteed against silver spoilage for fifteen years. Mirror corners and back protected by shock absorbing material. Back is galvanized steel, secured to concealed wall hanger with two theft-resistant locking screws. Mirror size to be 610mm wide x 915mm high.

.12 Shower curtains (SC): Opaque white vinyl 0.2mm thick shower curtains, containing anti-bacterial and flame-retardant agents with nickel-plated brass grommets along top. Hemmed bottom and sides minimum 1830mm high width to suit shower opening. Complete with type 304 1.2mm stainless steel satin-finish heavy duty shower curtain rod, 30mm outside diameter, length to suit, and hooks from same manufacturer. Refer to drawings for shower rod hanging height.

2.3 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 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.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B 456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

3.0 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.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

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 Use tamper proof screws/bolts for fasteners.

.3 Fill units with necessary supplies shortly before final acceptance of building.

.4 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 19 - 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 and as follows. Exact locations determined by Departmental Representative.

.2 Toilet tissue dispenser: one in each washroom.

.3 Paper towel dispenser: one in Washrooms 1 (RM109), 2 (RM110), 3 (RM208) and 4 (RM209). Maximum height of dispenser and operable part from floor 1100 mm.

.4 Towel ring: One at washroom sink, Washroom 5 (RM212).

.5 Towel bar: One in Washroom 5 (RM212).

.6 Robe hook: one in each washroom mounting height 1400 mm above finished floor.

.7 Medicine cabinet: Where indicated. One in washroom 5 (RM212) with shower.

.8 MopHook/Utility Shelf: One in each Janitor Room 1 (RM114) and 2 (RM119).

.9 Heavy Duty Coat Hooks: As indicated on drawings – Locker Ready Rooms 1 (RM121) and 2R(RM122).

.10 Waste Receptacles: All Washrooms

.11 Grab Bars: Washrooms in RM 108 and RM 208.

.12 Mirror: All Washrooms : RM109, RM110, RM208, RM209.

.13 Shower curtain, shower rod, shower hooks: as indicated on drawings.
Locker Ready Room 121: two rods.
Locker Ready Room 122: two rods
Washroom 5 (RM212): 1 rod.

END OF SECTION 10 28 10

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 62 20 00 Finish Carpentry

1.2 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

1.3 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.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Provide shop drawings.

.4 Quality control 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.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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 recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Type 2A10BC 5lb.

2.2 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.3 INDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508.

.2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets in accordance with NFPA 10.

.2 Install 4 fire extinguishers for the Operations Building and 3 fire extinguishers in the Residence Building. Confirm locations with Departmental Representative.

END OF SECTION 10 44 16.19

1.0 GENERAL

1.1 REFERENCES

.1 The Aluminum Association (AA)
- .1 AA DAF-45-R2003, Designation System for Aluminum Finishes - 9th Edition.

.2 ASTM International
- .1 ASTM A 53/A 53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A 480/A 480M-10a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .4 ASTM B 241/B 241M-02, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

.3 Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.

1.2 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 flag poles 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 British Columbia, Canada.
- .2 Indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpoles.
- .3 Submit duplicate copies of drawings of flagploes and bases, showing general layout, jointing and complete anchoring and supporting systems.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions for each type of flagpole.

.5 Sustainable Design Submittals:
- .1 Construction Waste Management:
  - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.3 QUALITY ASSURANCE

.1 Provide each flagpole as complete unit produced by single manufacturer, including fittings, accessories, bases and anchorage devices.

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 Spiral wrap each flagpole with heavy kraft paper, wood strip and steel band, or

polyethylene wrap and pack in tubing for shipment.

.2 Deliver flagpole in 2 pieces.

.1 When more than one piece is required, provide precision joints with self-aligning internal splicing sleeve arrangement.

.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 flagpoles from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan [Waste Reduction Workplan in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

.1 Aluminum:

.1 Aluminum Association alloy AA 6063-T5 seamless extruded aluminum tubing.

.2 Fabricated from seamless extruded tubing in accordance with ASTM B 241, alloy 6063 T6, having minimum tensile strength not less than 20 MPa and a yield point of 17 MPa. Heat treated and age hardened after fabrication.

.2 Isolation coating: alkali-resistant bituminous paint or epoxy resin solution.

2.2 DESIGN CRITERIA

.1 Flagpole, bases and anchorage devices to resist minimum wind velocity of180 km/h unflagged, 130 km/h flagged.

.2 Description:

.1 Nautical Flagpole:

.2 Exposed Height: 9.144m (30’)

.3 Butt Diameter: 5”.

.4 Tilting Style.

.5 Yard arm included.

.6 Gaff included.

.7 Flag Size: 4.5” x 9”.

2.3 FABRICATION

.1 Swaged sectional flagpole:

.1 Telescoped or stepped.

.2 Join pipe sections of consecutively decreasing diameters.

.3 Form tight shop and field joints between inserted sections with shrunk or closely telescoped fit attained by reducing diameter of outer section where required by hydraulic bell-die swaging.

.4 Provide internal rest collar welded to inside of pipe for field joints.

.5 Weld exposed edge of section joint to form neat continuous bevelled weld.

.1 Grind smooth.

.6 Make joints air and water tight.

.2 Weld in accordance to appropriate CSA Standard, by welders certified by Canadian Welding Bureau. Finish exposed welds flush and smooth.

2.4 ACCESSORIES

.1 Finial: 150 mm diameter ball, to match flagpole finish.

.2 Truck assembly: cast aluminum, stainless steel ballbearing, nonfouling, revolving double truck assembly, finish to match flagpole.

.3 Cleats: 230 mm size, two per halyard, finish to match flagpole.

.4 Halyard: external, cotton, braided, with steel or bronze core.

.5 Swivel snaps: two per halyard; aluminum with neoprene or vinyl covers.

.6 Cleats only, no cleat box with hasp.

2.5 FINISHES

.1 Aluminum:

.1 Clear anodic finish.

2.6 FIELD FABRICATION

.1 Fabricate ground-set foundation assembly for sleeve

3.0 EXECUTION

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Shop apply isolation coating to metal surfaces of flagpole [and base] that will be encased in concrete

.2 Install flagpoles, base assemblies and fittings to shop drawings and manufacturer's instructions.

.3 Provide ground stakes for positive lightning ground for each [ground set] flagpole installation.

.4 Check and adjust installed fittings for smooth operation of halyards.

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 recycling in accordance with Section 01 74 19 - 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 flagpole installation.

END OF SECTION 10 75 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Gypsum Board Assemblies Section 09 21 16.

1.2 REFERENCES

.1 Aluminum Association (AA).

.1 DAF 45-03, Designation System for Aluminum Finishes.

1.3 SUBMITTALS

.1 Product Data.

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:

.1 For caulking materials during application.

.2 For adhesives.

.2 Shop Drawings.

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate, by large scale details, materials, finishes, dimensions, anchorage and assembly.

.3 Manufacturer's Instructions.

.1 Submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2.0 PRODUCTS

2.1 MATERIALS

.1 Modular raised floor system:

.1 Model and Description: Type 304 stainless steel per ASTM A 276 available in 16 mm depth.

.1 Construction: Surface Wires: .093” (2.4mm) by 0.156” (4mm) wire with 0.70” (1.8mm) support bars spaced 1” (24mm) o.c. Spacing between wires shall be 0.140” (3.6mm).

.2 Lockdowns: Hidden

.3 Tread wires shall be resistance welded at each joint.

.4 Fasteners: Non-corrosive screws and anchors for securing frames together and to floors.

.5 Rail finish shall be mill.

.6 Unit must meet rolling load of 1000lb/wheel. Uniform load of 1000lbs/sq.ft.

.2 Level Bed Stainless Steel frame, Type 304 stainless steel; 1/8” profile; 3/4” depth. Finish: Finish #4 Satin.

.2 Benches:

.1 Cedar Seats: Clear S4S solid cedar, 1 piece nominal 2 x 10, rounded corners and sanded.

.2 Marine grade varnish.
.3 Lengths as follows
4 units @ 18” (457 mm) high x 60” (1524 mm) long (V.I.F.)

.3 Hazardous Materials Shed:
.1 Provide engineered shop drawings signed and sealed by an engineer licensed in the Province of British Columbia.
.2 Include a spill response kit capable of absorption and removal of 25% of the aggregate storage or 25% of the volume of the largest container, whichever is greater. Confirm storage containers with Departmental Representative.
.3 Include fire extinguisher to a minimum 40-B, C.
.4 Provide housekeeping pad to exceed footprint of shed by 305mm all sides.
.5 Sub structure: Skid Beam.
.6 Tie-down to foundations as required by National Building Code.
.7 Touch up paint after installation.
.8 Install as per manufacturer’s instructions and include
.1 Sump integrity test.
.2 Install heating assembly.
.3 Lifting by installation.
.4 Install adjustable shelving.
.5 Connection of electrical and grounding.
.6 Completion of emergency sticker signage.
.9 Accessories included:
.1 Insulation to R11 minimum
.2 Portable eyewash system
.3 Loading ramp
.4 Three (3) adjustable shelving of 12 gauge steel
.5 Lighting, explosion proof
.6 Sumpliner
.10 Listed to ULC/ORD-C142.6 and FM 6049.
.11 Features
.1 10 ga sectional sump
.2 14ga welded steel wall construction, all seams caulked
.3 12 ga Heavy duty roof design
.4 Chemical resistant paint
.5 Static ground connection
.6 Natural ventilation louvres
.7 Three point locking hardware on doors
.8 Galvanized floor grating
.9 Floor grating hook.
.10 Storage volume 1,168 litres.
.11 Size: 1524 mm (5’0”) x 1,828 mm (6’0’) x 2337 mm (7’8”) minimum.

.4 Hoist
.1 Span: 20’-0”
.2 Load: 2.2-TON
.3 Lifting Height: 16’-5 ½”
.4 Hoisting Speed: 30.0/5.2 ft/min 2-speed
.5 Traversing Speed: 65/17 ft/min 2-Speed inverter
.6 Travelling Speed: 100 ft/min stepless
.7 Weight of Trolley: 476 lbs.
.8 Weight of Bridge: 1832 lbs.
.9 Crane Classification: CMAA Class C
.10 Power Supply: 575/ 115V; 60 Hz

2.2 ACCESSORIES

.1 Fasteners: self-tapping stainless steel flush mounting.

.2 Adhesive: water resistant type as recommended by manufacturer for substrate.

3.0 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 Install units on solid backing and erect with materials and components straight, tight and in alignment.

.2 Install Hoist Crane as per manufacturer's written instructions.

.1 On completion of installation and following an inspection of the work for conformity to this specification, demonstrate to the Department Representative by actual loaded operation of the hoist that it will accomplish the duties as specified herein for each item, including the correct functioning of all safety devices. In the event that the installation does not meet the Acceptance Tests, immediately make the necessary corrections, free of charge to the Owner, in order to meet the requirements of this specification. Supply all test loads required for the tests. The tests shall conform to CSA B167.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 10 80 00

1.0 GENERAL

.1 THE FALL PROTECTION SYSTEM IS TO BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA IN ACCORDANCE WITH WORKSAFE BC OHS REGULATIONS AND CAN/CSA-S16 AND CAN/CSAS-136 TO RESIST FORCES AND ALLOW FOR REQUIRED MOVEMENTS.

.2 DESIGN AND DETAILING OF THE SYSTEM SHALL MEET THE REQUIREMENTS OF THE ROOFING CONTRACTORS ASSOCIATION OF BRITISH COLUMBIA (RCABC) ROOFING PRACTICES MANUAL AND THE BUILDING ENVELOPE DETAILS AND SPECIFICATIONS FOR THE PROJECT.

.3 THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AS SPECIFIED UNDER "SUBMITTALS" TO THE PROJECT ENGINEER FOR REVIEW PRIOR TO FABRICATION. SHOP DRAWINGS SHALL INDICATE ALL COMPONENTS, CONNECTIONS, FASTENERS, MATERIAL SPECIFICATIONS, FINISHES AND DETAILS. DETAILS SHALL INCLUDE CONNECTIONS TO THE PRIMARY STRUCTURAL SUPPORT ELEMENTS AND THE ASSOCIATED LOADS AND MOMENTS. THE DESIGN IS TO BE COORDINATED WITH THE WORK OF OTHER TRADES.

.4 THE CONTRACTOR IS TO PROVIDE ALL NECESSARY LABOUR, MATERIALS AND EQUIPMENT FOR THE FABRICATION AND INSTALLATION OF THE FALL PROTECTION SYSTEM. THIS SHALL INCLUDE A TEMPORARY FALL PROTECTION SYSTEM IF REQUIRED.

.5 PROVIDE THE ARCHITECT WITH WRITTEN TESTING SCHEDULE AND PROCEDURES CERTIFIED BY THE SPECIALTY ENGINEER. COORDINATE TESTING WITH THE OWNERS REPRESENTATIVE AND WORKSAFE BC. PROVIDE SAFE ACCESS AND WORKING AREAS FOR SITE TESTING.

.6 TEST REPORTS ARE TO BE SUBMITTED TO THE ARCHITECT WITHIN ONE WEEK OF TEST DATE. FALL PROTECTION ELEMENTS WHICH FAIL ARE TO BE REPAIRED OR REPLACED AND RE-TESTED AT NO EXPENSE TO THE OWNER.

.7 UPON COMPLETION OF THE WORK, THE SPECIALTY ENGINEER IS TO PROVIDE THE ENGINEER OF RECORD WITH A SCHEDULE "S" STATING THAT THE FALL PROTECTION SYSTEM HAS BEEN INSTALLED, FIELD REVIEWED AND TESTED IN ACCORDANCE WITH THE DESIGN DOCUMENTS AND ALL RELEVANT STANDARDS.

.8 SUBMIT OPERATION AND MAINTENANCE INSTRUCTIONS TO THE ARCHITECT AND RECEIVE APPROVAL FOR SAME. OPERATIONAL CRITERIA TO BE IN ACCORDANCE WITH WORKSAFE BC.

1.1 GENERAL REQUIREMENTS

.1 Comply with the conditions of the Contract and Division 1- General Requirements.

1.2 SECTION INCLUDES

.1 Work of this section includes the design, supply and installation of fall arrest equipment. Scope of Work includes: Bosun's Chair Window Cleaning, Roof Top Maintenance, and Powered Platform Unscheduled Maintenance.

1.3 RELATED SECTIONS

.1	Submittals	Section 01 33 00
.2	Flashing and Sheet Metal	Section 07 60 00

1.4 REFERENCES

.1 Worker's Compensation Board of British Columbia Occupational Health & Safety Regulations, Part 11 Fall Protection.

.2 CSA S16.1 "Steel Structures for Buildings".

.3 CSA S136 "Design of Steel Structural Members, Light Gauge".

.4 CISC 2 "Standard Practice for Steel, Structural, for Buildings".

.5 CSA W59 "Welded Steel Construction," and CSA W47 "Certification of Companies for Fusion Welding of Steel Structures".

.6 CAN3-S157-M83 "Strength Design in Aluminum".

.7 CAN3-S244-1969 "Welded Aluminum Design".

.8 CSA-W47.2-1967 "Aluminum Welding Qualification Code".

.9 CSA G164 "Galvanizing, Hot Dip, of Irregularly Shaped Articles".

1.5 DESIGN REQUIREMENTS

.1 Design fall arrest system to suit building and in accordance with plans, specifications, standards, and regulations/codes contained in sections 1.4 and 1.9.

.2 Locate anchorages to suit fall arrest equipment that will be used on the building with respect to items such as reach, rigging, spacing, roof edge condition, and similar items.

.3 Design all anchor components to provide adequate attachment to the building and suited to current fall arrest practices. Ensure compatibility with industry standard equipment.

.4 Ensure all anchor components conform to proper engineering principles and have been designed by a Professional Engineer Registered in the Province of British Columbia qualified in the design of fall arrest equipment, its application and safety requirements.

.5 Design system fall arrest safety anchors and equipment supports to comply with the following structural requirements:

.6 Fall Arrest Safety Anchors: designed to a maximum fall arresting force of typically 8.0kN (1800 lbs) when wearing a body harness with a safety factor of 2 without any permanent deformation and to 22.24kN (5000 lbs) against fracture or detachment.

1.6 SHOP DRAWINGS AND ENGINEERING CERTIFICATION

.1 Submit shop drawings in accordance with Section 01 33 00 and showing complete layout and configuration of complete fall arrest system, including all components and accessories. Clearly indicate design and fabrication details, hardware, and installation details.

.2 Shop drawings to include installation and rigging instructions and all accessories Restrictive and Non-Restrictive Working Usage Notes and General Safety Notes.

.3 Shop drawings to be reviewed by a Professional Engineer, registered in the Province of British Columbia.

1.7 QUALIFICATIONS

.1 Manufacturer: Work of this Section to be executed by manufacturer specializing in the design, fabrication and installation of fall arrest systems having a minimum of 5 years documented experience.

.2 Loading and safety assurance: Work of this Section to meet the requirements of governing codes and jurisdiction to comply with properly engineered loading and safety criteria for the intended use.

.3 Insurance: Manufacturer to carry specific liability (products and completed operations) in the amount of $5,000,000.00 to protect against product/system failure.

.4 Welding to be executed by certified welders in accordance with CSA W59 and CSA W47.2 requirements.

1.8 MAINTENANCE DATA

.1 Submit 1 copy of system Equipment Manual & Inspection Log Book, with “Initial Inspection-Certification for Use” and “Inspection Sign-Off” forms completed.

.2 Submit 2 copies of reduced plastic laminated as-built shop drawings showing equipment locations and details. This drawing is to be posted near exits onto the roof.

1.9 REGULATORY REQUIREMENTS

.1 Comply with the following regulations:

.2 Worker’s Compensation Board of British Columbia Occupational Health & Safety Regulations, Part 11 Fall Protection.

2.0 PRODUCTS

2.1 MANUFACTURER

.1 Companies, such as miscellaneous metal fabricators, who are not normally engaged in the design and manufacture of fall arrest equipment are not permitted to bid.

2.2 EQUIPMENT

.1 Safety & Tie-Back Anchors.

.2 Horizontal Cable Lifeline System.

2.3 SAFETY & TIE-BACK ANCHORS

.1 Safety U-bars: Stainless steel to ASTM A276, Type 304 with 35 Ksi (240 Mpa) minimum yield strength.

.2 U-bar 0.75 inches (19mm) minimum diameter material with 1.5 inches (38mm) eye opening.

2.4 DOUBLE LANYARD HORIZONTAL CABLE LIFELINE SYSTEM

.1 Hollow steel (HSS) pier supports: galvanized mild steel as above with yield strength of 300 MPa (50 Ksi). Wall thickness to suit application.

.2 Base plate and all other sections: galvanized mild steel as above with yield strength of 300 Mpa (44 Ksi). Thickness and securement to suit application.

.3 Securement bolts: mild steel, Type 300W with yield strength of 300 MPa (44 Ksi), hot dipped galvanized to CSA G164.

.4 Safety U-bars: Type 304 stainless steel with yield strength of 240 Mpa (35 Ksi). U-bar to be not less than 19mm (3/4") diameter material with 38 mm (1-1/2") eye opening.

.5 Cable: 8mm (5/16") dia. Galvanized steel with minimum breaking strength of 85 kN (19,125 lbs.), complete with matching permanently swedged or mechanically swedged cable ends.

.6 Data plate: cable system entry points to be equipped with prominently displayed non-corrosive date plate clearly stating Maximum Service Capacity and Number of Users.

.7 Tensioner: steel turnbuckle, same material as cable.

3.0 EXECUTION

3.1 EXAMINATION

.1 Examine surfaces and areas upon which the work of this section depends. Report to the Contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions, which would cause defective installation of products, or cause latent defects in workmanship and function.

.2 Verify site dimensions.

.3 Commencement of work will imply acceptance of prepared work.

3.2 INSTALLATION

.1 Install equipment in accordance with approved shop drawings and manufacturer's recommendations.

.2 Co-ordinate installation with work of related trades.

.3 Install all work true, level, tightly fitted and flush with adjacent surfaces as required.

.4 Deform threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal or vandalism.

.5 Manufacturer to assist and/or supervise installation of fall arrest equipment installed by others.

.6 Structural steel to receive safety anchors to have adequate bearing surface as indicated on shop drawings and/or to ensure 100% weld.

3.3 FINAL ADJUSTING AND INSPECTION

.1 Adjust and leave equipment in proper working order.

.2 Complete "Initial Inspection-Certification for Use" form included in Equipment Manual & Inspection Log book.

3.3 TESTING

.1 All anchors relying upon chemical adhesive fasteners to be 100% tested on site using load cell test apparatus in accordance with manufacturer's recommendations.

END OF SECTION 11 24 23.

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Architectural Woodwork Section 06 40 00

1.2 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

.2 Underwriters' Laboratories Canada (ULC).

.1 CAN/ULC-S102-1988 (R2000), Standard Method of Test for Surfaces Burning Characteristics of Building Materials and Assemblies.

.3 Energy Star, guide NrCan Office of Energy Efficiency.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.3 Supply model numbers of appliances.

.4 Supply instructions detailing procedures for maintenance and operations.

1.4 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.

.4 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 MATERIALS

.1 Dishwasher, Fridge, Range/Oven and microwave to be supplied by the same manufacturer.

.2 All appliances to have stainless steel fronts.

.3 Washer, Dryer to be supplied by the same manufacturer.

2.2 DISHWASHERS

.1 Standard Dishwasher, - built in under cabinet – a capacity equal to or greater than eight place settings plus six serving pieces as specified in CSA/C73-04.

.2 Basic Model to meet minimum Energy Star Qualification of less than or equal to 16.09 litres per cycle and less than or equal to 295 kWh per year, as tested by CSA/C373-04.

.3 Nominal size 660mm width.

.4 Schedule- one in Kitchenette.

2.3 REFRIDGERATOR

.1 Fridge (Compact)

.1 Energy Star Certified.
.2 2 Half-Width White, 1 Full Width White door racks.
.3 1 Adjustable Glass/1 Fixed Removable Glass refrigerator shelves; 1 clear fruits and vegetables drawer; 8-Can Capacity can rack.
.4 Color-coordinated door color, black cabinet color, recessed handle, white cabinet liner.
.5 Reversible door swing and door stops.
.6 Capacity (cu.ft.) Total 4.5; Freezer 0.7; Refrigerator 3.8.
.7 Defrost: Automatic
.8 Power Supply Connection Location: Right Bottom Rear.
.9 Voltage Rating: 120V/60Hz/15A.
.10 Minimum Circuit Required (Amps):15
.11 Shipping Weight (Approx): 31kg (69 Ibs)
.12 Size: 860mm H x 540mm W x 584mm D.
.13 Schedule – One (1) – Kitchenette

.2 Fridge (Apartment Size)

.1 Energy Star Certified.
.2 ADA Complaint: With accessible shelving, and controls that are positioned with arm's reach and allow one-hand operation.
.3 Full-width gallon size door shelf and door bins.
.4 2 Full-width freezer racks and 1 adjustable wire shelf; 2 refrigerators adjustable/1 fixed glass shelves, 2 clear fruits and vegetables drawers.
.5 Color-coordinated door handle, door hinge covers and smooth cabinet finish.
.6 Reversible door-swing and door stops.
.7 Ready-select temperature control.
.8 Capacity (cu.ft.): Total 11.5; Freezer 3.1; Refrigerator 8.4.
.9 Defrost: Frost-free.
.10 Power Supply Connection Location: Right Bottom Rear.
.11 Voltage Rating: 115V / 60Hz / 15A
.12 Minimum Circuit Required (Amps): 15.
.13 Shipping Weight (Approx.):68 kg (150 Ibs)
.14 Size: 1500mm H x 610 mm W x 730mm D.
.15 Schedule – One (1) – Kitchen.

2.4 RANGE OVEN

.1 Smooth top or ring burner, min four burners; electric.

.2 Single oven.

.3 Self-cleaning.

.4 Nominal Width-30" (762mm)

.5 Schedule- One (1): 1 in Kitchen.

.6 Energy Star certified.

2.5 MICROWAVE

.1 Minimum 1000 Watt power.

.2 C/W centre turntable.

.3 Minimum 1.1 cu ft capacity.

.4 Provide one (1) in kitchenette one – counter top and one (1) in Kitchen mounted above range.

2.6 STACKABLE WASHER DRYER

.1 Energy Star certified.

.2 7.4 cu. Ft. Stackable vented dryer.

.3 Dryer – Aluminized Alloy Steel Drum.

.4 Electric – 240V, 30 Amps.

.5 686mm x 991mm x 769mm

.6 Stacking kit.

.7 5.2 cu ft. Stackable front-loading washer.

.8 Electric – 120V, 10 Amps

.9 686mm x 991mm x 769mm

.10 Provide one in Laundry Rm 120 and one in Laundry 2 Rm 213

3.0 EXECUTION

3.1 INSTALLATION

.1 Uncrate and unpack all appliances and locate in final location.

.2 Assemble and install all racks, shelves and accessories.

.3 Connect to Power receptacle if applicable.

3.2 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturers recommended cleaning procedures.

.3 Upon completion of installation, remove surplus materials, rubbish, and tools.

END OF SECTION 11 31 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section Finish Carpentry 06 20 00

1.2 REFERENCES

.1 ASTM International

.1 ASTM D 1784-08, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for horizontal louver blinds and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Installation Drawings:

.1 Indicate on drawings dimensions in relation to window jambs, operator details, head and sill anchorage details, hardware and accessories details.

.4 Samples:

.1 Submit one representative working sample of each type horizontal louvre.

.2 Submit duplicate samples of manufacturer's standard colours for selection by Departmental Representative.

.3 After approval samples will be returned for incorporation into Work.

.5 Sustainable Design Submittals:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

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 Store and protect horizontal louvre blinds from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer pallets, crates, padding, and

packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 DESIGN CRITERIA

.1 Design horizontal louvre blinds to following requirements:
- .1 Allow wear susceptible parts to be replaceable by either user or manufacturer.
- .2 Guarantee of at least five-years of available replacement parts following discontinue of products manufacture.
- .3 Include instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.
- .4 Allow for refurbishing or return of used vertical louvre blinds.
- .5 Permit effective disassembly of components in for recycling of materials.
- .6 Include stamps on major plastic components indicating composition code to facilitate recycling efforts.

2.2 MATERIALS AND FABRICATION

.1 Slats: 50 mm wide x 2.7 mm . Edges, smooth, sanded and coated on both sides. Comes with UV coating moisture content for interior use.
- .1 Hard wood, Native wood, FSC soft wood

.2 Mounting Materials:
- .1 Swivel bracket for either on -or-in recess mounting
- .2 Material: steel, zinc plated, thickness 1.5 mm.
- .3 Installation and intermediate brackets. Material: steel, zinc plated.

.3 Headrails:
- .1 Roll formed steel U section with a dimension of 51 x 57 mm (w x d), stove-enamelled in colour.

.4 Bottom rail:
- .1 Same wood species as the wooden slats.

.5 System:
A steel tilt shaft ensures a uniform tilting action and holds the required position. Tilt operation by a polyester cord for blinds equipped with string tapes or cords for blinds with plastic tapes. The moving parts require lubrication throughout their lifetime. The self-locking worm gear ensures positive slat tilting so that the position of the slats cannot be changed unitentinally.

.6 Tilt rods: solid steel.

.7 Pulleys: designed to permit ease of operation with minimum wear to cord.

.8 Valance: Made of same wood species. Wood is stained with a natural finish and covered with a polyurethane lacquer or end brackets.

.9 Tilters:
- .1 Fully enclosed and lubricated, with positively locked to drum to prevent slippage and ensure accurate timing.
- .2 Use anti-friction materials for worm and gear.

.10 Cord locks: designed to provide smooth operation with feature to prevent accidental dropping of blinds.

.12 Ladder cap: designed to provide sufficient retention when snapped onto bottom rail to hold ladders in proper position.

.13 Installation brackets: end and centre type complete with safety locking caps to secure headrail and valance.

.14 Cord Operation: tilting by tilt cord, diameter 3 mm.

.15 Operation: Manual operated. Mechanism of snap-in type entirely enclosed within headrail. Made of plastic. Metal parts protected against corrosion. Lift operation by means of 3 mm polyester cords via a strong cord lock provided with smooth plain metal dogs. Dogs are actuated and released with cords in vertical position.

.16 Colour: As chosen by the Departmental Representative from the manufacturer's full colour choices.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive horizontal louvre blinds previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to horizontal louvre blinds installation.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval from Departmental Representative.

3.2 INSTALLATION

.1 Install blinds on all exterior windows except clerestory windows in 116 Boat Maintenance and 123 Rack Storage.

.2 Include centre brackets where necessary to prevent deflection of headrail.

.3 Adjust to provide for operation without binding.

.4 Use non corrosive metal fasteners for installation, concealed in final assembly.

3.3 ADJUSTING

.1 Adjust horizontal louvre blinds components 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 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 horizontal louvre blinds installation.

END OF SECTION 12 21 13

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes: Electric Traction Elevators.

.2 Products Supplied But Not Installed Under this Section:
- .1 Hoist Beam
- .2 Pit Ladder
- .3 Inserts mounted in block walls for rail attachments

.3 Work Supplied Under Other Sections:
- .1 Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
- .2 Main line disconnects for each elevator.
  - .1 One fused three phase permanent power in building electrical distribution room
  - .2 One non fused three phase permanent power in hoist way at top landing
- .3 Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
- .4 Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.

.4 Related sections:
- .1 Section 03 30 00 - Cast-in-Place Concrete:
- .2 Section 06 10 00 - Rough Carpentry
- .3 Section 26 - Electrical

.5 Industry and government standards:
1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

1.2 DESCRIPTION OF ELEVATOR

.1 Elevator Equipment: gearless traction elevator

.2 Equipment Control: as per manufacturer

.3 Landings: 2

.4 Openings: Front Openings

.5 Travel: 378 mm

.6 Rated Capacity: 1587 kg

.7 Rated Speed: 0.76 m/s

.8 Clear Inside Dimensions (W x D): [1295 mm x 2032 mm

.9 Cab Height: 3048 mm

.10 Entrance Type: left

.11 Entrance Height: 2743 mm

.12 Main Power Supply: 208 Volts + 5%, three-phase

.13 Machine Location: Inside the hoistway mounted on car guide rail

.14 Control Space Location: Control Location chosen by user

.15 Elevator Equipment shall conform to the requirements of seismic zone: 4

.16 Maintenance Service Period: 12 months

1.3 PERFORMANCE REQUIREMENTS

.1 Car Performance

.1 Car Speed ± 5% of contract speed under any loading condition or direction of travel.

.2 Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

.2 System Performance

.1 Vertical Vibration (maximum): 25 mg
.2 Horizontal Vibration (maximum): 25 mg
.3 Jerk Rate (maximum): 1 m/sec3
.4 Acceleration (maximum) .4 m/sec2
.5 In Car Noise: = 55 dB(A)
.6 Leveling Accuracy: ±0.2 inches
.7 Starts per hour (maximum): 120

1.4 SUBMITTALS

.1 Comply with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit manufacturer's product literature for each proposed system.

.1 Cab design, dimensions and layout.
.2 Layout, finishes, and accessories and available options.
.3 Controls, signals and operating system.
.4 Color selection charts for cab and entrances.

.3 Shop Drawings:

.1 Clearances and travel of car.
.2 Clear inside hoistway and pit dimensions.
.3 Location and layout of equipment and signals.
.4 Car, guide rails, buffers and other components in hoistway.
.5 Maximum rail bracket spacing.
.6 Maximum loads imposed on building structure.
.7 Hoist beam requirements.
.8 Location and sizes of access doors.
.9 Location and details of hoistway door and frames.
.10 Electrical characteristics and connection requirements.

.4 Operation and maintenance data:

.1 Provide manufacturer's standard maintenance and operation manual.

.5 Diagnostic Tools

.1 Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional

wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Minimum of 5 years' experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.

.2 Installer: The equipment manufacturer shall install the elevator.

.3 Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Comply with manufacturer's recommendations for delivery, storage and handling.

.2 If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.

.3 Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.7 WARRANTY

.1 Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.8 MAINTENANCE SERVICE

.1 The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.

.2 Maintenance service shall be performed during regular working hours of regular working days and shall include regular time call back service.

.3 Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

2.0 PRODUCTS

2.1 MANUFACTURER

.1 Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification.

2.2 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

.1 Controller: Provide microcomputer based control system to perform all of the functions.

- .1 All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
- .2 Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
- .3 Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
- .4 Variable field parameters and adjustments shall be contained in a non-volatile memory module.

.2 Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

.3 Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. A separate control space should not be required.

2.3 EQUIPMENT: HOISTWAY COMPONENTS

.1 Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

.2 Governor: Friction type over-speed governor rated for the duty of the elevator specified.

.3 Buffers, Car and Counterweight: Polyurethane buffer.

.4 Hoistway Operating Devices:

- .1 Emergency stop switch in the pit
- .2 Terminal stopping switches.
- .3 Emergency stop switch on the machine

.5 Positioning System: System consisting of magnets and proximity switches.

.6 Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.4 EQUIPMENT: HOISTWAY ENTRANCES

.1 Hoistway Entrances

- .1 Sills: extruded.
- .2 Doors: Hollow metal construction with vertical internal channel reinforcements.
- .3 Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
- .4 Entrance Finish: Brushed Stainless Steel.
- .5 Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.5 EQUIPMENT: CAR COMPONENTS

.1 Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.

.2 Platform: Platform shall be all steel construction.

.3 Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

.4 Steel Cab Finish: Brushed Stainless Steel.
- .1 Car Wall Finish: Brushed Stainless Steel with red panel at back wall.
- .2 Car Front Finish: Brushed stainless steel.
- .3 Car Door Finish: Brushed stainless steel.
- .4 Ceiling:
  - .1 Round LED Down Light Drop Ceiling - LF-88: Satin Finished Stainless Steel three panel suspended ceiling with [two] [three] holes per panel for Round LED lights.
- .5 Handrail:
  - .1 Rails to be located on back of car enclosure.
- .6 Flooring: See finish schedule.
- .7 Threshold: Aluminum

.5 Emergency Car Signals
1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
- .2 Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
- .3 Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
- .4 Ventilation: Fan.

2.6 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

.1 Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be: Textured Stainless Steel.
- .1 Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. All buttons to have raised text and Braille marking on left hand side. The car operating panel shall have a brushed stainless steel finish.
- .2 Additional features of car operating panel shall include:
  - .1 Car Position Indicator within operating panel.
  - .2 Elevator Data Plate marked with elevator capacity and car number on car top.
  - .3 Help buttons with raised markings.
  - .4 In car stop switch per local code.
  - .5 Firefighter's hat symbol.
  - .6 Firefighter's Phase II Key-switch.
  - .7 Call Cancel Button.
  - .8 Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where

personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.

.9 Firefighter's Phase II emergency in-car operating instructions.

.2 Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish.

.1 Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature illumination.

.3 Hall Lanterns and Chime: A vandal resistant directional lantern visible from the corridor shall be provided at each hall entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Steel finish.

2.7 EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER

.1 Elevator Operation

.1 Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

.2 Standard Operating Features to include:

1. Full Collective Operation
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection
5. Top of Car Inspection Station.

.3 Additional Operating Features to include:

.1 Hoistway Access Bottom Landing

.2 Emergency Battery Power Supply

.1 When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker (if used) will be provided by others.

.4 Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.
3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation.

2.8 EQUIPMENT: DOOR OPERATOR AND CONTROL

.1 Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors

simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

.2 The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

.3 Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

.4 Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

.5 Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

3.0 EXECUTION

3.1 EXAMINATION

.1 Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

.2 Do not proceed with work until unsatisfactory conditions are corrected.

.3 Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 mm +50 mm. Do not begin work of this section until dimensions are within tolerances.

.4 Prior to start of Work, verify projections greater than 50 mm must be beveled not less than 75 degrees from horizontal.

.5 Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

.6 Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

.7 Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.

.8 Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.2 PREPARATION

.1 Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.3 INSTALLATION

.1 Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

.2 Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

.3 All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

.4 Lubricate operating system components in accordance with manufacturer recommendations.

.5 Perform final adjustments, and necessary service prior to substantial completion.

3.4 CONSTRUCTION

.1 Interface with Other Work:

.1 Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.

.1 Ensure adequate support for entrance attachment points at all landings.

.2 Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.

.3 Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.

.4 Coordinate interface of elevators and fire alarm system.

.5 Coordinate interface of dedicated telephone line.

.6 Coordinate the installation of the non fused three phase permanent power disconnect in hoist way at top landing

3.5 TESTING AND INSPECTIONS

.1 Perform recommended and required testing in accordance with authority having jurisdiction.

.2 Obtain required permits and provide originals to Owner's Representative.

3.6 DEMONSTRATION

.1 Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION 14 21 00

1.0 GENERAL

.1 This section covers items common to all sections of Divisions 22.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 45 00 – Quality Control

.4 Section 01 61 00 – Common Product Requirements

.5 Section 01 74 19 – Waste Management and Disposal.

.6 Section 01 78 00 – Closeout Submittals

.7 Section 09 91 23 – Interior Painting.

1.3 SUBMITTALS

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

.2 Shop drawings; submit drawings stamped and signed for approval by Departmental Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 Operation data to include:
- .4 Control schematics for systems including environmental controls.
- .5 Description of systems and their controls.
- .6 Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .7 Operation instruction for systems and component.
- .8 Description of actions to be taken in event of equipment failure.
- .9 Valves schedule and flow diagram.
- .10 Colour coding chart.

.11 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.12 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.13 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.14 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.6 Site records:

.1 Provide sets of white prints as required for each phase of work on site at all times. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

.4 Make available for reference purposes and inspection.

.7 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.6 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29- Health, Safety, and Emergency Response Procedures.

1.5 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading: Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management And Disposal, and with the Waste Reduction Workplan.

.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.

2.0 PRODUCTS

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

2.2 GENERAL STANDARDS

.1 Piping shall be in accordance with the following current editions or applicable revisions:

.1 Copper Pipe (Certified) - ASTM B42-10, CAN/CSA-B602-10

.2 Cast Iron Drainage Pipe - ASTM A74 - 09, CSA B70-12.

.3 Plumbing Fixtures – CAN/CSA-B45 Serries-02 (R2008)

2.3 PIPE AND FITTINGS

.1 Sanitary Drainage and Vent Piping Above Grade:

SIZE	PIPE	FITTINGS/NOTES
Up to 4"	“System 15”	“System 15”
All Sizes	ABS DWV	Solvent Weld one step or two step cement
All Sizes	Cast Iron Class 4000	Mechanical joints with butyl rubber and Stainless Steel Couplings

.2 Sanitary Drainage Below Grade or Outside of Building:

SIZE	PIPE	FITTINGS/NOTES
All Sizes	ABS DWV	Solvent Weld one step or two step cement

.3 Combined Domestic & Fire Suppression Supply Water Piping Inside Building Above Grade:

Size	Pipe Material	Fittings /Notes
Up to 8”	Ductile Iron	Threaded

.4 Domestic Hot, Cold and Re-circulation Water Piping (Above Ground):

SIZE	PIPE	FITTINGS/NOTES
Up to 4"	PVC Schd.40	Socket Fitting and solvent welded joints
Up to 1"	PEXa	Within Suites Only, Brass cold-expansion compression-sleeve design or as per Pipe manufacturer’s system requirements
Up to 4”	Type "L" Hard Copper	Wrought bronze or cast Brass

.5 Domestic Hot, Cold and Re-circulation Water Piping (Below Ground):

SIZE	PIPE	FITTINGS/NOTES
Up to 4"	PVC Schd.40	solvent welded pipe in long lengths and with no buried joints
Up to 1"	PEXa	no buried joints, PVD Pipe Sleeves at concrete/ground penetration

.6 Hot Water Heating (between boiler and tank)

Size	Pipe Material	Fittings /Notes
Up to 3”	Steel, grey iron	Threaded fittings
Up to 3”	Type "L" Hard Copper	Wrought bronze or cast Brass

.7 Rain Water Leaders (RWL) Outside of Building:

SIZE	PIPE	FITTINGS/NOTES
2-3/4"x4-1/4"	Corrugated Pre-finished	0.025"thick Aluminum

.8 Rain Water Leaders (RWL) Inside of Building Above Grade:

SIZE	PIPE	FITTINGS/NOTES
All Sizes	“System 15”	“System 15”
All Sizes	Cast Iron Class 4000	Mechanical joints with butyl rubber and Stainless Steel Couplings

.9 Foundation Drain:

SIZE	PIPE	FITTINGS/NOTES
4"	Perforated PVC SDR35	Solvent Weld CSA-B182.1.

2.4 PIPE INSULATION

.1 Insulate all DCW, DHW, DHWR and NPW-cold, NPW-hot and RWL lines with the following

.1 Up to 2”(50mm) – 1”(25mm) Fiberglas with vapour barrier jacket.

.2 Over 2”(50mm) – 2”(50mm) Fiberglas with vapour barrier jacket

.2 Insulate all sanitary waste lines in unheated areas with the following:

.1 Up to 2”(50mm) – 1”(25mm) Fiberglas with vapour barrier jacket.

.2 Over 2”(50mm) – 2”(50mm) Fiberglas with vapour barrier jacket.

2.5 HEAT TRACE

.1 Self Regulating Heat trace cable c/w hard wired power connection into standard junction box (120V, 6W/ft, 0.025amp/ft) on all water pipes outside of building envelope, excluding RWL's

.2 Heat trace cable c/w integrated temperature control and hard wired power connection into standard junction box (120V, 7W/ft) on all water (condensate pipes inside walk in freezers.

.3 Coordinate with electrical for junction box locations.

2.6 VALVES

.1 Valves on cold, hot and recirculation service rated at 150 psi (1034 kPa) and be suitable for service. Provide all valves of same type by one manufacturer.

.2 Standard of Acceptance for Valves 2" (50 mm) & Under:

.1 Gate: Crane 428 or 1320C, Jenkins 810 or 813, Emco 12630 or 12600, Red & White/Toyo 281 or 293.

.2 Globe Straight: Crane 1310, Jenkins 106A or 106AP, Emco 11500 or 11530, Red & White/Toyo 212 or 220.

.3 Globe Angle: Crane 17 or 1311, Jenkins 108A or 108AP, Red & White/Toyo 260.

.4 Swing Check: Crane 37 or 1342, Jenkins 92 or 92P, Red & White/Toyo 236 or 237.

.5 Ball Valves: Two piece brass ball valve, blow-out proof stem, PTFE seats, brass chrome plated ball, lever handle operator. Solder joint - Red & White/Toyo Fig. 5049A or approved equivalent. Screwed - Red & White/Toyo Fi9. 5044A or approved equivalent

.3 Standard of Acceptance for Valves 2-112" 65 mm & Over:

.1 Gate Wedge: Crane 465, Jenkins 454, Red & White/Toyo421A.

.2 Globe: Crane 351, Jenkins 142, Red & White/Toyo 400A.

.3 Check: Crane 373, Jenkins 587, Red & White/Toyo 435A.

.4 For domestic hot water service, all composition disc globe valves shall be fitted with discs suitable for hot water to a maximum temperature of 150°C.

.5 Valves shall be designed so that they may be packed under full pressure while wide open. Gate valves shall not be used as throttling valves. Install with items above horizontal.

3.0 EXECUTION

3.1 GENERAL

.1 Provide water, waste and other plumbing connections as required, including shut-off valves with unions or flanges to all equipment installed under this contract or by other trades. Ensure adequate

space for servicing. Extend drain piping to discharge into hub or funnel drains do not run along floor in access walkways.

.2 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly; remove any foreign material from piping.

.3 Unless otherwise noted, drainage lines shall grade at minimum 2% up to 6" (150 mm) and larger pipe at 1%. Plug or cap pipe and fittings to keep out debris during construction.

.4 Make joints on cast iron drainage pipes with gasket material suitable for service and with stainless steel clamp type mechanical fastener. Cast iron soil pipe with mechanical joints shall be supported by means of two hangers located on each side of joint. Fittings for copper drainage lines shall be recessed drainage pattern type. Joints in copper drainage tube shall be made in accordance with the manufacturer’s recommendations, using soft lead free solder Silvabrite 100, or equivalent.

.5 Make reductions in horizontal water piping with eccentric reducing fittings installed to provide drainage and eliminate air pockets; allow 2% slope on water lines for drainage. Install three elbow swing or swivel joints to connect risers to mains. Provide for proper expansion and contraction of hot water lines using pipe loops or offsets as required.

.6 Joints in copper pressure pipe shall be soldered using 95-5 solder and flux or Silvabrite 100. Flux shall be full strength when applied and not diluted. Joints for plastic piping shall be in accordance with the manufacturer's recommendations with a copy to be kept at the site.

.7 Wherever dissimilar metals are jointed or supported, the piping shall have non-conducting type connections and hangers to prevent galvanic corrosion. Brass adapters and valves are acceptable for pipe connections.

.8 Provide shut-off valves as indicated on drawings; mount valve with stems upright or horizontal, not inverted. Provide drain valves with cap at low points of systems where required. Provide isolation valves in main lines and vertical risers to permit isolation of zones for servicing; provide drain valves with cap for draining of lines.

.9 Provide clean-outs in accordance with Code and local authority requirements. Clean-outs shall be located above the flood level of all fixtures, complete with access panels as required.

.10 Provide slip-metal adapters on all fixture traps for easy removal.

3.2 PAINTING, REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 CLEANING

.1 Upon completion, water piping systems shall be flushed thoroughly with water to remove any foreign material in the piping before the installation of fixtures; use non-foaming phosphate-free detergent as required to clean system. All plumbing fixtures and equipment shall be thoroughly cleaned and left in good operating condition.

3.4 SCHEDULES

.1 Refer to the following equipment schedules - Mechanical and Plumbing drawings

END OF SECTION 22 05 00

1.0 GENERAL

.1 This section covers items common to the Concrete Float Water Distribution.

.2 Except as noted differently herein, Section 22 05 00 - Common Work Results for Plumbing applies to this work.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 78 00 – Closeout Submittals

.5 Section 22 05 00 Common Work Results for Plumbing

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 22 05 00 Common Work Results for Plumbing.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Pipe certification to be on pipe.

.3 Closeout Submittals

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves.

.3 Operation and Maintenance Data: submit operation and maintenance data for pipe and valves for incorporation into manual.

.4 Maintenance Materials Submittals

.1 Tools: provide tools as follows:

.1 Tee-handle operating keys for valves

.2 Required spare parts for 2year period.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading: Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.4 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 water distribution piping from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2.0 PRODUCTS

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

2.2 PIPE AND FITTINGS

.1 Domestic Water Piping

Item	Size	Description
General	All	1. Piping to be Black HDPE DR 11 Rated. 2. Steel Pipe will be considered with Departmental approval.
	All	Pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier expect for expansion joints and valves where SS 316 flanges shall be provided c/w SS 316 hardware. Materials in contact with potable water shall conform to NSF 61 acceptance.
Pipe	All	1. ASTM D3350, high density polyethylene, maximum allowable hoop stress 5.5 MPa (800 psi) at 23 ^{o}C. 2. Polyethylene resins shall conform to Type PE 3408 or better. 3. Protection shall be provided against ultraviolet light degradation using carbon black, not less than 2 percent well dispersed in the resin. 4. Pipe wall thickness shall reflect the required SDR* and diameter, as shown in Table 8, ASTM F714. 5. Design Stress Rating: ASTM F714, 5.5 MPa (800 psi) hydrostatic. Pressure Rating — SDR*: 200 — 9 160 — 11 130 — 13.5 100 — 17 80 — 21 65 — 26 50 — 32.5 * SDR: standard dimension ratio = OD/thickness
Fittings	150mm & Smaller	Molded fittings, butt fusion joined, conforming to ASTM D3261.

Flanges	All	Van Stone type, cast ASTM A351/A351M, Type 316 stainless steel backing ring, IPP Deltaflex convoluted design or equal for bolting to ASME B16.1, Class 125; ASME B16.5, Class 150; and AWWA C207, Class E. Pressure performance of the backing ring equal to SDR rating of the pipe with safety factor of two. Stub ends same grade HDPE and pressure rating as pipe.
Expansion Joints	All	Proco Style 261R-EE Molded Wide Arch Expansion Joints c/w 150 lb SS 316 flanges and backing rings or approved equal
Bolting	All	.1 General Conditions: Stainless Steel hardware. .2 Washers shall be same material as bolts.
Gaskets	All	Flat ring, 3 mm ethylene propylene rubber (EPR)

.2 Flexible Hose		
Item	Size	Description
General	All	Provide smooth, white, phthalate free, taste free food quality synthetic rubber complete with reinforcement: High-tensile steel wire helix embedded between layers of synthetic textile cords. The cover on the hose shall be blue, wrapped finish, ozone and weather resistant synthetic rubber.
	All	.1 Temperature Range: -30°C (-22°F) to 100°C (212°F). .2 Pressure rating: 150 psi or more.
	All	Design Standard: Greenline Model G1041 or approved equal

.3 Flexible Connectors to be field measured. Allow for slack when the hoses are in the most taught position.

.1 Complete hard pipe installation prior to ordering flexible hoses. Measure actual distances and elevations in field. Order hose lengths in consultation with the hose manufacturer that result in the least stresses on the hoses at the crimp connections for the full range of tide excursions.

.2 Provide one union for pipe diameters less than or equal to 65mm per flexible connector as appropriate to minimize the possibility of torque damage during installation.

2.3 HANGER AND SUPPORT SELECTION

.1 Hangers and supports shall withstand all static and specified dynamic conditions of loading to which the piping and associated equipment may be subjected. As a minimum, consideration shall be given to following conditions:

.1 Weights of pipe, valves, fitting, insulating materials, suspended hanger components, and normal fluid contents.

.2 Weight of hydrostatic test fluid or cleaning fluid if normal operating fluid contents are lighter.

.3 Reaction forces due to the operation of safety or relief valves.

.4 Wind, snow or ice loadings on outdoor piping.

.2 Size hangers and supports to fit the outside diameter of pipe, tubing, or where specified, the outside diameter of insulation.

.3 Design the system to support the operating loads with a safety factor of 4.0.

.4 Use stock hanger and support components wherever practical.

.5 Provide supplementary structural members, where structural bearings are not in suitable locations.

.1 Make provision for expansion, contraction, slope and anchorage.

.2 Where necessary, pipe support systems shall withstand the additional load of electrical or instrumentation trays. Coordinate with other divisions. Design and provide support system accordingly.

.6 Pipe Hangers and Supports

.1 Type 1 - Clevis Pipe Hanger: Provide carbon steel clevis hangers with configuration and components as follows:

.1 Steel pipe (insulated) - B-Line B3100, Grinnell Figure 260, Superstrut C-710 or Unistrut No. 24 with insulation shield.

.2 Steel pipe (uninsulated) - B-Line B3100, Grinnell Figure 260, Superstrut C-710 or Unistrut No. 24.

.3 Plastic pipe - B-Line B3100, Grinnell Figure 260 or Unistrut No. 56.

.2 Type 2 - "J" Pipe Hanger: Provide carbon steel hangers with configuration and components equivalent to MSS Type 5. Use only on uninsulated pipe, with configuration and components as follows:

.1 Steel pipe - B-Line B3690, Grinnell Figure 67, Superstrut C-711 or Unistrut J1205- J1280 Series.

.2 Copper and plastic pipe - B-Line B3690 (Plasticoat) Grinnell Figure 67 (plastic coated), Superstrut C-711P or Unistrut J 1205N-J1280N series.

.3 Type 3 - Double Bolt Pipe Clamp: Provide carbon steel pipe clamps, with configuration and components as follows:

.1 Steel pipe (insulated) - B-Line B3144 or Grinnell Figure 295, with insulation shield. Insulation shield is optional for hot and ambient systems.

.2 Steel pipe (uninsulated - B-Line B3144 or Grinnell Figure 295.

.4 Type 4 - U-Bolt: Provide carbon steel U-bolts with configuration as follows:

.1 Steel pipe (uninsulated) - Grinnell Figure B-Line B3188 or Superstrut H-115.

.2 Steel pipe (insulated) - Grinnell Figure 137, B-Line B3188 or Superstrut H-115 with insulation shield.

.3 Plastic pipe - Grinnell Figure 137C, B-Line B3188 or Superstrut H-115 (with plastic coating).

.5 Type 5 - Offset Pipe Clamp: Provide carbon steel pipe clamps with con-figuration and components as specified and to the most standard design manufactured by a pipe hanger component manufacturer:

.1 Steel pipe (insulated) - B-Line B3148 or Grinnell Figure 103 or with insulation shield.

.2 Steel pipe (uninsulated) - B-Line B3148 or Grinnell Figure 103.

.3 Plastic pipe - B-Line B3148 or Grinnell Figure 103.

.6 Type 6 - Framing Channel Pipe Strap: Provide carbon steel pipe strap with configuration as follows:

.1 Steel pipe (uninsulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series.

.2 Steel pipe (insulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series with insulation shield.

.3 Plastic pipe - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series.

.7 Acceptable Manufacturers:

.1 B-Line, Grinnell, Powerstrut, Superstrut, Unistrut

.8 Support Spacing:

Pipe Size (Nominal) mm	Maximum Spacing (M)	
	PVC	Steel
30 and Under	1.4	2.1
30 to 40	1.5	2.1
40-50	1.6	2.1

.9 Provide additional supports at any valves or other heavy piping elements.

.10 Pipe Support Materials

.1 Exterior, Submerged or Corrosive Environments:

.2 Pipe hangers, supports, structural attachments, fittings, accessories and hardware are all stainless steel.

.3 Any areas that may be considered corrosive and are in question should be reviewed with the Engineer in advance of securing the materials.

2.4 VALVES

.1 Provide valves of the same type, size range and service from a single manufacturer.

.2 Provide new, unused valves for the Work.

.3 Valve materials to be free from defects or flaws, with true alignment and bores.

.4 Unless otherwise indicated, valves shall be the same size as the pipe run in which they are to be installed.

.5 Clearly mark valve bodies in raised lettering to indicate the valve type, rating, and where applicable, the direction of flow. Conform to MSS SP25.

.6 Valves to open counter-clockwise.

.7 Use flanged joints for buried and exterior valves. The flanges are to be compatible with the pipe and jointing technique used. Provide valves with manual operators unless specifically indicated otherwise on the process schematic Drawings or mechanical Drawings.

.8 Provide valves with manual operators unless specifically indicated otherwise on the process schematic Drawings or mechanical Drawings.

.1 For hand wheels, clearly show the direction of opening in raised lettering and symbols.

.2 Hand wheel diameter to conform to the following:

Nominal Valve Diameter (mm)	Minimum Hand Wheel Diameter (m)
12	50
20	50
25	60
38	75
50	85

.9 Supply stem extensions and valve boxes for buried valves and stem extensions for submerged valves.

.1 Provide valve stem extensions where additional clearance is required for pipe insulation, for all submerged or buried valves and other locations where valve operation without the extension is difficult, and in manholes.

.10 Lever operators to conform to the following dimensions:

Nominal Valve Diameter (mm)	Minimum Hand Wheel Diameter (m)
6	80
12	80
20	100
38	150
50	150

.1 Quarter turn lever operators to be perpendicular to the pipe run when the valve is closed.

.2 Lever operators on ball valves to be two position.

.11 Valve Boxes

.1 Provide valve boxes for all buried valves.

.2 Coordinate with Civil for appropriate box and installation detail.

.12 Valve Specifications:

Type of Valve	Operating Limits		Design limits	
Ball Valve	Pressure (kPag)	Temp (°C)	Pressure (kPag)	Temp (°C)
	800	0-40	1000	40
Valve Materials			Description	
Item	Material		Ref. Doc	Body Material - ASTM A351
Body	Stainless Steel		Size Range	19mm - 50mm

Ball	316 Stainless Steel 304 Stainless Steel	Rating	Class 150
Packing	Reinforced	Body/Valve Ends	Female Threaded
Seats	Reinforced TFE	Pattern	Full Port
Acceptable Products: Watts, Nibco, Brinnell			

Type of Valve	Operating Limits		Design limits	
Stop and Waste Valve	Pressure (psi)	Temp (°C)	Max Pressure (psi)	Max Temp (°C)
		0-40	150	82
Valve Materials			Description	
Item	Material		Ref. Doc	ASTM B584 alloy C87850
Body	Lead Free Brass		Size Range	19mm - 50mm
Bonnet	Lead Free Brass		Rating	
Packing	Graphite Impregnated, Asbestos-Free		Body/Valve Ends	Female Threaded
Seats Disk/Screw	EPDM/Stainless Steel		Pattern	Full Port
Stem	Lead Free Brass			
Hand Wheel	Epoxy Coated Zinc Allow			
Acceptable Products: Watts, Nibco, Brinnell				

3.0 EXECUTION

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Clean pipes, fittings, valves and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Departmental Representative.

.2 Remove defective materials from site as directed by Departmental Representative.

3.3 PIPE INSTALLATION

.1 Lay pipes to manufacturer's standard instructions and specifications.

.1 Do not use blocks except as specified.

.2 Join pipes in accordance with AWWA C901, C906 and manufacturer's recommendations.

.3 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.4 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.5 Position and join pipes with equipment and methods approved by Departmental Representative.

.6 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.7 Align pipes before jointing.

.8 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.9 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.10 Complete each joint before laying next length of pipe.

.11 Minimize deflection after joint has been made.

.12 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

3.4 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 In horizontal pipe runs other than in locations where space does not permit, mount all valves with a vertical operating shaft with the actuator at the top. Avoid installing install a valve with the operator shaft pointing down.

.3 Mount valves in a position for easy access to the operators and maintenance personnel.

.4 When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.

.5 Support valves in position using temporary supports until valves are fixed in place.

3.5 HANGER AND SUPPORT LOCATION AND INSTALLATION

.1 Locate hangers and supports as near as possible to concentrated loads such as valve, flanges, etc. Locate hangers, supports and accessories within the maximum span lengths specified on drawings to support continuous pipeline runs unaffected by concentrated loads.

.2 Provide hangers and/or base supports within 1m of each change in direction on each leg, on one side of each valve, and on the first spool piece or fitting extending from a piece of equipment.

.3 Locate hangers and supports to ensure that connections to equipment, tanks, etc. are substantially free from loads transmitted by the piping.

.4 Ensure that where piping is connected to equipment, a valve, piping assembly etc. that will require removal for maintenance, the piping will be supported in such a manner that temporary supports will not be necessary for this procedure.

.5 Support piping so that no pockets will be formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

.6 Install spring hangers where required to offset expansion in horizontal runs which follow long vertical risers.

.7 Aluminum or galvanized steel clips shall be used to support piping from aluminum or steel structural members. Where metals of different type are to be connected, provide isolation to prevent galvanic corrosion.

.8 Hanger and support components in contact with plastic pipe shall be free of burrs and sharp edges.

.9 Adjust hangers and supports to obtain required pipe slope and elevation. Use shims made of material that is compatible with the piping material. Adjust stanchions prior to grouting of baseplates.

3.6 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify Departmental Representative at least 24 hours in advance of proposed tests.

.1 Perform tests in presence of Departmental Representative.

.4 Leave valves, joints and fittings exposed.

.5 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

.6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.7 Open valves.

.8 Expel air from main by slowly filling main with potable water.

.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.

.2 Remove stops after satisfactory completion of test and seal holes with plugs.

.9 Thoroughly examine exposed parts and correct for leakage as necessary.

.10 Apply hydrostatic test pressure of 1378 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.11 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.12 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.13 Repeat hydrostatic test until defects have been corrected.

.14 Define leakage as amount of water supplied from water storage tank metre in order to maintain test pressure for 2 hours.

.15 No leakage is allowed.

.16 Locate and repair defects if leakage is greater than amount specified.
Repeat test until leakage is within specified allowance for full length of water main.

3.7 FLUSHING AND DISINFECTING

.1 As per notes on Civil Plans and Specifications.

3.8 CLEANING

.1 Upon completion, water piping systems shall be flushed thoroughly with water to remove any foreign material in the piping before the installation of fixtures; use non-foaming phosphate-free detergent as required to clean system. All plumbing fixtures and equipment shall be thoroughly cleaned and left in good operating condition.

END OF SECTION 22 11 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittals.

.2 Section 01 74 19 - Waste Management and Disposal.

.3 Section 01 78 00 – Closeout Submittals

.4 Section 23 05 00- Common Work Results for HVAC.

.5 Section 23 05 05 – Installation of Pipework

1.2 REFERENCES

.1 ASTM D 2665-11, Specification for Polyvinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

.2 ASTM D 2321-11 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

.3 ASTM D 3311-11 Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit data for following: pipe, tube, fittings, couplings and valves.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 PIPING APPLICATIONS

.1 Domestic hot, cold and recirculation systems, within building:

.1 Above ground: schedule 40 PVC Pipe and socket fittings and solvent welded joints.

.2 Buried or embedded: solvent welded schedule 40 PVC pipe in long lengths and with no buried joints.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code.

.2 In accordance with Section 23 05 05 – Installation of Pipework

.3 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.4 Assemble all piping using fittings manufactured to ANSI standards.

.5 Install DCW piping below and away from DHW and DHRW and other hot piping so as to maintain temperature of cold water as low as possible.

.6 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.7 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

3.2 HANGER AND SUPPORT INSTALLATION

.1 Install hangers for **PVC** piping with the following maximum horizontal spacing and minimum rod diameters:

.2 NPS 1-1/2 and NPS 2 : 48 inches with 3/8-inch rod.

.3 NPS 3: 48 inches with 1/2-inch rod.

.4 NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

.5 NPS 6 : 48 inches with 3/4-inch rod.

.6 NPS 8 to NPS 12 : 48 inches with 7/8-inch rod.

.7 Install supports for vertical PVC piping every 48 inches

3.3 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 00 - Common Work Results.

.2 Test pressure: greater of 1 1/2 times maximum system operating pressure or 860 kPa.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to jurisdiction approval of Departmental Representative.

3.7 PROTECTION

.1 Exposed **PVC** Piping: Protect piping exposed to sunlight with two coats of water-based latex paint

3.8 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitations.

.3 Bring HWS storage tank up to design temperature slowly.

.4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify performance of temperature controls.

.4 Verify compliance with safety and health requirements.

.5 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets.

.6 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.3 Reports:

.1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION 22 11 16

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 – Waste Management and Disposal.

.3 Section 01 78 00 – Closeout Submittals.

.4 Section 01 91 13 – General Commissioning (CX) Requirements

.5 Section 22 05 00 – Common Work Results for Plumbing

.6 Section 23 05 00 – Common Work Results - HVAC.

.7 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

.1 ASME/ANSI B16.15 - 1985 (R1994) - Cast Bronze Threaded Fittings.

.2 ASME/ANSI B16.18 - 1984 (R1994) - Cast Copper Alloy Solder Joint Pressure Fittings

.3 ANSI B16.18-1984, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22-1995, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ASME/ANSI B16.5 - 1996 - Pipe Flanges and Flanged Fittings ANSI B16.24-1979, Bronze Pipe Flanges and Fittings, Class 150 and 300.

.6 ASTM B88M - 05(2011) Standard Specification for Seamless Copper Water Tube (Metric) ASTM B88M-89, Specification for Seamless Copper Water Tube (Metric).

.7 B242-05 (R2011) - Groove-and Shoulder-Type Mechanical Pipe Couplings CSA B242-M1980, Grooved and Shoulder Type Mechanical Pipe Couplings.

.8 MSS-SP-70-2011, Cast Iron Gate Valves, Flanged and Threaded Ends.

.9 MSS-SP-71-2011, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.10 MSS-SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.

.11 ANSI/AWWA C111/A21.11-06. Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit data for following: valves.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management And Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type K: to ASTM B88M.

.2 Buried or embedded: solvent welded schedule 40 PVC in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.5

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: roll grooved to CSA B242.

2.3 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to ANSI/AWWA C111/A21.11-06.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Teflon tape: for threaded joints.

.4 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.1 Standard of Acceptance: Victaulic 606.

.5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

.6 Standard of Acceptance: Victaulic 47.

2.4 GATE VALVES

.1 NPS2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.

.2 NPS2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.

.3 NPS2-1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 – Valves – Cast Iron.

.4 NPS2-1/2 and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 – Valves – Cast Iron.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 – Valves – Bronze.

.2 Lockshield handles: as indicated.

.2 NPS2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 – Valves – Bronze.

.2 Lockshield handles: as indicated.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.

.2 NPS2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 – Valves - Bronze.

.3 NPS 2 and under, push-to-connect, lift-disc type:

.1 To MSS-SP-80, 1380 kPa CWP, bronze body, stainless steel disc, spring, and shaft, suitable for installation in horizontal or vertical lines.

.4 NPS2-1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, or renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 – Valves – Cast Iron.

2.7 BALL VALVES

.1 NPS2 and under:

.1 As specified Section 23 05 23.01 – Valves - Bronze.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code.

.2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.3 Assemble all piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.6 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

.7 Buried Tubing

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 00 - Common Work Results.

.2 Test pressure: greater of 1 1/2 times maximum system operating pressure or 860 kPa.

3.4 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.5 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory for bacteriological testing to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2hr, then draw off another sample for testing.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to jurisdiction approval of Departmental Representative.

.2 Coordinate with Section 33 11 17 – Site Water Utility Distribution Piping and Section 22 31 16 – Incoming Site Water Utility Distribution Piping

3.7 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitations.

.3 Bring HWS storage tank up to design temperature slowly.

.4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify performance of temperature controls.

.4 Verify compliance with safety and health requirements.

.5 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets.

.6 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.3 Reports:

.1 In accordance with Section 01 91 13 – General Commissioning (CX) Requirements: using report forms as specified in Section 01 91 13 – General Commissioning (CX) Requirements.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION 22 11 18

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 35 29 - Health, Safety, and Emergency Response Procedures

.3 Section 01 74 19 - Waste Management and Disposal

.4 Section 23 05 05 - Installation of Pipework.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA)

.1 CSA-B1800 Series, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.2 CSA-B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.3 Underwriters Laboratory of Canada (ULC)

.1 CAN/ULC-S102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.3 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.4 SUBMITTALS:

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

2.0 PRODUCTS

2.1 PIPING AND FITTINGS

.1 For buried DWV piping to:

.1 CSA-B181.1-11 Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings

.2 CSA-B181.2-11 Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings

.3 CSA-B182.1-11 Plastic drain and sewer pipe and pipe fittings

.2 For aboveground DWV piping for combustible construction to:

.1 CSA – B181.2-11 Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings

.3 For aboveground DWV piping for non-combustible construction:

.1 Flame spread rating less than 25 and smoke developed classification less than 50.

.2 CSA B181.2-11 Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) drain, waste, and vent pipe and pipe fittings

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564- 04(2009)e1 Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.1 NPS 1 ½ to 6: one step or two step cement

.2 NPS 8 and above: two step cement.

.2 Solvent weld for ABS: to ASTM D2235 - 04(2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

3.0 EXECUTION

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework and certified journeyperson.

.2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling in accordance with Canadian Plumbing Code.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows in accordance with Section 23 05 54 - Mechanical Identification.

.6 Provide copies of test reports for Commissioning Manuals.

END OF SECTION 23 13 18

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 19 –Management and Disposal.

.3 Section 01 78 00 – Closeout Submittals.

.4 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CAN/CSA C22.2 No.110, Construction and Test of Electric Storage Tank Water Heaters.

.3 CAN/CSA-C191 Series, Performance of Electric Storage Tank Water Heaters for Household Service.

.4 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

.2 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled, installation procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DIPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 –Waste Management And Disposal, and with Waste Reduction Workplan.

.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 for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Owner’s Representative.

1.6 WARRANTY

.1 For the Work of this Section 22 30 05 - Domestic Water Heaters, warranty for 5 years from date of Substantial Completion.

2.0 PRODUCTS

2.1 ELECTRIC

.1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with immersion type elements, KW rating as indicated and surface mounted or immersion type adjustable thermostats.

.2 Tank: glass lined steel, or stainless steel, 50 mm mineral wool or fibreglass insulation, anode, enameled steel jacket, 5-year warranty certificate, capacity and size as indicated.

.3 Acceptable Product: A.O. Smith, John Wood, Giant, Rheem/Ruud.

2.2 TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 1 with hose end.

.2 Thermometer: to Section 23 05 19.01 – Thermometers and Pressure Gauges – Piping Systems.

.3 Thermowell filled with conductive paste for control valve temperature sensor.

.4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.5 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

2.3 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other Divisions.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.

.3 Provide insulation between tank and supports.

.4 Provide expansion tank sized for full capacity of heater.

.5 Provide drain pan min. 2" (50mm) larger than the tank and min. 1" (25mm) deep.

.1 Pan drain pipe drain pipe minimum of two sizes larger than the relief valve discharge pipe and located directly under the relief valve discharge pipe and that discharges directly to a floor drain within 8" (200mm) of pan.

.6 Seismically restrain hot water tank.

.7 Set temperature to 60°C. (140°F)

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's trained and certified Engineer to start up and commission DHW heaters, as per Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION 22 30 05

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 74 19 - Waste Management and Disposal.

.5 Section 01 91 13 - General Commissioning (CX) Requirements

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A 126-04(2009), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B 62-09, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 AWWA C700-09, Cold Water Meters-Displacement Type, Bronze Main Case.

.2 AWWA C701-12, Cold Water Meters-Turbine Type for Customer Service.

.3 AWWA C702-10, Cold Water Meters-Compound Type.

.3 Canadian Standards Association (CSA)

.1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.

.2 CSA-B79-08 Commercial and residential drains and cleanouts.

.3 CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Plumbing and Drainage Institute (PDI)

.1 PDI-G101-10, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

.2 PDI-WH201-06, Water Hammer Arresters Standard.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 For product data, indicate dimensions, construction details and materials for all items specified herein.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Data to include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management And Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 SCHEDULES

.1 Refer to the following equipment schedules - Mechanical and Plumbing drawings

2.2 FLOOR DRAINS

.1 Floor drains and trench drains: to CSA B79.

2.3 WATER HAMMER ARRESTERS:

.1 Provide air chamber of same size as supply line, minimum 3/4" (20 mm) diameter and 450 mm long, on water lines to individual or groups of fixtures. Provide bellow type stainless steel arresters with isolation valve and access door on water lines connected to all solenoid valves and flush valves on fixtures; Zurn 2-1700 series stainless steel type.

2.4 BACK FLOW PREVENTERS

.1 Protect water distribution system against contamination in accordance to BCBC Plumbing Code and the local authority having jurisdiction. I

.2 Provide an approved backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination.

.3 Backflow preventers shall be selected and installed in accordance with CAN/CSA-B64.10.

.1 Domestic water:

.1 Reduced pressure principle type consisting of a pressure differential relief valve located between two independently operated spring-loaded centre guided check valves. Ductile iron construction with FDA approved fusion epoxy coat inside and out. Compound check. Single access cover. Maximum temperature range: 0.5ºC to 60ºC. Maximum pressure: 1205 kPa. CSA certified.

.2 Acceptable Product: Wilkins Model 375L, Watts, Zurn.

.2 Fire protection water:

.1 Same as above except without compound check and with FM and ULC approval for fire protection service.

.2 Acceptable Product: Wilkins Model 975L, Watts, Zurn.

2.5 ESCUTCHEONS

.1 On pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.

.3 Outside diameter to cover opening or sleeve. Inside diameter to fit around finished pipe.

2.6 DIELECTRIC COUPLINGS

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.3 Pipes NPS 2 and under: isolating unions.

.4 Pipes NPS 2-1/2 and over: isolating flanges.

2.7 CLEANOUTS

.1 In finished areas, covers shall have depressed centre to accept floor finish being provided. Zurn ZN-1508 or equivalent.

.2 Wall cleanouts shall have a chrome plated cap.

.3 Provide access doors as required to clean-outs, valves, etc.

.4 Provide clean-outs in accordance with Code and local authority requirements.

.5 Cleanouts are to be same size as the pipe, up to 4", but not less than 4" for larger pipe.

.6 Cleanouts shall be easily accessible and shall be gas-tight and watertight. Provide a minimum clearance of 24" for rodding.

.7 Fixtures clean-outs shall be located above the flood level of all fixtures. Provide access doors as required.

.8 Verify cleanout rods can probe as far as the next cleanout.

2.8 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 24" x 24" for body entry and 12"x 12" for hand entry unless otherwise noted. Doors to open 180 deg, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material: Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Departmental Representative. Remaining areas: use prime coated steel.

.4 Installation: Locate so that concealed items are accessible and so that hand or body entry (as applicable) is achieved.

2.9 VACUUM BREAKERS

.1 Atmospheric vacuum breaker on inlet to domestic hot water tanks:

.1 Plain brass body with silicone disc. Suitable for temperatures up to 82ºC., Maximum operating pressure: 860 kPa Size: NPS ¾.

.2 Acceptable Product: Watts Series 288a, Wilkins, Jay R. Smith, MIFAB.

.2 Hose connection vacuum breaker:

.1 NPS ¾ female hose thread inlet, NPS ¾ male hose threat outlet, brass finish.

2.10 TRAP PRIMERS

.1 Provide trap primers for every floor drain.

.2 All brass, with integral vacuum breaker, NPS ½ solder ends, NPS ½ drip line connection.

.3 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.4 Install plastic tubing to floor drain.

2.11 WATER HAMMER ARRESTORS

.1 Provide premanufactured water hammer arrestor at all supply riser terminations and at the termination of all hot and cold water branch lines serving groups of fixtures or any fixture with a solenoid valve such as a dishwasher or clothes washer. Field fabricated arrestors are not permitted.

.2 Stainless steel construction, bellows type: to PDIWH 201 Standard of Acceptance: Watts, Zurn.

.3 Provide access covers.

2.12 PRESSURE REGULATORS

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.2 Capacity: as indicated. Inlet pressure: 1034 kPa. Outlet pressure: 413 kPa.

.3 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62, strainer and stainless steel strainer screen.

.4 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B, strainer. Semi-steel spring chambers with bronze trim.

2.13 PLUMBING FIXTURES

.1 Provide as per Fixture Schedule on drawings.

.2 Alternates to be approved by Departmental Representative prior to ordering.

.3 Fixtures must be free from flaws or blemishes. Surface must be clear, smooth, and bright, and have dimensional stability. Materials to Plumbing Fixtures - CAN/CSA-B45 Series-02 (R2013)

.4 Install fixtures plumb, level, square and in accordance with manufacturers' rough-in dimensions.

.5 Determine exact location of fixtures from architectural drawings. Immediately consult Mechanical Consultant if there appear to be conflicts between architectural and mechanical drawings.

.6 Supply and install hangers, supports, brackets, 14-gauge steel back-up plates, etc, for the proper installation and support of such fixtures and their respective supply fittings.

.7 Unless otherwise specified, hot and/or cold water connections to fixtures shall be 3/8" (9 mm) chrome plated flexible supplies with stops.

.8 Provide escutcheon plates for all service lines penetrating wall surfaces.

.9 All exposed plumbing brass and metal work shall be chrome plated.

.10 Ensure piping is securely attached prior to installation of fixtures.

.11 Where plumbing fixtures come in contact with wall and/or floor, seal joint with silicone (GE SCS-1200 or Dow Corning 780) and beaded smooth in a neat workmanlike manner by the Plumbing Sub-trade.

.12 Provide chair carriers for wall-mounted fixtures.

2.14 NON FREEZE WALL HYDRANTS

.1 Exposed non-freeze wall faucet complete with exterior chrome finish, brass casing, all bronze interior parts, operating rod with free-floating compression closure valve, wall support, replaceable seat washer

.2 Combination 3/4" female solder inlet and 3/4" male IP inlet connection, and 3/4" male hose connection.

.1 Install 24" above grade unless otherwise indicate

2.15 THERMOSTATIC MIXING VALVE - POINT OF USE

.1 A Thermostatic Mixing Valve shall be installed on the hot water supply to hand washing fixture.

.2 The valve shall be ASSE Standard 1070 and IAPMO cUPC listed and control the temperature of the hot water.

.3 Lead Free* brass 4-port, “H” pattern body.

.4 integral check valves, integral screens and an adjustment nut with locking feature.

.5 3/8" (10mm) male compression or Quick- connect fittings.

.6 Standard of Acceptance: Watts Series LFUSG-B.

2.16 SINK, FIXED-POSITION, PLUMBED EYEWASH:

.1 Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 20 minutes.

.2 Supply Connection: 55/64-27 stainless steel adaptor for mounting to faucet.

.3 Spray-Head Assembly: Single stainless-steel spray head.

.4 Mounting: Attached to sink receptor.

.5 Basis-of-Design Product: Haws Corporation; Model 7620:

.6 Alternate manufactures: Acorn Safety, Bradley Corporation, Guardian Equipment Co.

2.17 WATER-TEMPERING EQUIPMENT FOR EYEWASH

.1 Hot- and Cold-Water, Water-Tempering Equipment

.2 Thermostatic Mixing Valve: Designed to provide 68 °F (20 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 20-minute test period, and in case of unit failure to continue tepid flow, cold water would continue through cold water bypass.

.3 Supply Connections: For ½" (12m)hot and cold water.

.4 Basis-of-Design Product: Haws Corporation; Model 9201EW.

.5 Alternate manufactures: Acorn Safety, Bradley Corporation, Guardian Equipment Co.

2.18 POTABLE WATER THERMAL EXPANSION TANK

.1 ASME Section VIII construction and label.

.2 Tank volume: as indicated, Acceptance volume: as indicated.

.3 Acceptable Product: Amtrol, Taco, S. A. Armstrong, Bell and Gossett.

2.19 DOMESTIC HOT WATER CIRCULATING PUMPS

.1 Construction: closed-coupled, in-line centrifugal, all bronze or stainless steel, construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 860 kPa wp and 105°C continuous service.

.2 Motor: drip proof, with thermal overload protection.

.3 Supports: provide as recommended by manufacturer.

.4 Acceptable Product: Armstrong, Bell & Gossett, Taco, Grundfos.

.5 Balance flows using circuit setter balancing valves.

.6 Ensure pump and motor assembly do not support piping

3.0 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 FIXTURES

.1 Mounting heights: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Adjusting:

.1 Conform to water conservation requirements specified this section.

.2 Adjustments.

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.3 Checks.

.1 Aerators: operation, cleanliness.

.2 Water closets, urinals: flushing action.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.3

3.3 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 NON FREEZE WALL HYDRANTS

.1 Install 600 mm above finished grade unless otherwise indicated.

3.5 WATER HAMMER ARRESTERS

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.6 BACK FLOW PREVENTORS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain or service sink.

3.7 TRAP SEAL PRIMERS

.1 Install for all floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install plastic tubing to floor drain.

3.8 START-UP

.1 General:

.2 In accordance with Section 01 91 13 - General Commissioning (CX) Requirements, supplemented as specified herein.

.1 Timing: Start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.5 Provide continuous supervision during startup.

.3 Rectify start-up deficiencies.

3.9 COMMISSIONING

.1 In context of this paragraph, "verify" to include "demonstrate" to Consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Adjust to suit site conditions, including, but not necessarily limited to, the following:

.1 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, remove ability of strainer.

.5 Clean out basket

.2 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.3 Roof drains:

.1 Check location at low points in roof.

.2 Check security, remove ability of dome.

.3 Adjust weirs to suit actual roof slopes, meet requirements of design.

.4 Clean out sumps.

.5 Verify provisions for movement of roof systems.

.4 Access doors:

.1 Verify size and location relative to items to be accessed.

.5 Cleanouts:

.1 Verify covers are gas tight, secure and easily removable.

.2 Verify that cleanout rods can probe as far as next cleanout.

.6 Non-freeze wall, ground hydrants:

.1 Verify complete drainage.

.2 Verify operation of vacuum breaker.

.7 Water hammer arresters:

.1 Verify accessibility.

.2 Verify proper installation of correct type of water hammer arrester.

.8 Trap seal primers:

.1 Verify operation.

.2 Adjust flow rate to suit site conditions.

.9 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions

.10 Eyewash:

.1 Verify operation.

.2 Set running temperature.

.3 Confirm duration of min 68 °F (20 °C) flow.

3.10 COMMISSIONING REPORTS:

.1 In accordance with Section 01 91 13 - General Commissioning (CX) Requirements: Reports, supplemented as specified herein.

.1 Record all results on approved report forms.

.2 Include signature of tester and supervisor.

.3 To be countersigned by Departmental Representative.

.4 Verification:

.1 Notify Consultant 24 h before commencing tests.

.2 All tests and procedures to be witnessed by Consultant or by their specified representative.

.5 Training:

.1 In accordance with Section 01 91 13 - General Commissioning (CX) Requirements: Training of O&M Personnel, supplemented as specified herein.

.2 Demonstrate full compliance with Design Criteria.

.3 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

END OF SECTION 22 42 01

1.0 GENERAL

.1 This section covers items common to all sections of Divisions 23.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 45 00 – Quality Control

.4 Section 01 61 00 – Common Product Requirements

.5 Section 01 74 00 – Cleaning and Waste Management

.6 Section 01 74 19 – Waste Management and Disposal

.7 Section 01 78 00 – Closeout Submittals

.8 Section 01 91 51 – Building Management Manual (BMM)

.9 Section 09 91 23 – Interior Painting

.10 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

.11 Section 23 09 33 – Electric and Electronic Control Systems for HVAC

1.3 SHOP DRAWINGS

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

.2 Shop drawings; submit drawings stamped and signed for approval by Departmental Representative.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

1.4 CLOSEOUT SUBMITTALS:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 Operation data to include:

- .1 Control schematics for systems including environmental controls.
- .2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

1.5 AS-BUILT/RECORD DRAWINGS

.1 Site records:

.1 Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 On a weekly basis, transfer information to reproducible, revising reproducible to show all work as actually installed.

.3 Use different color waterproof ink for each service.

.4 Make available for reference purposes and inspection at all times.

.2 As-built/record drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB; finalize production of as built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 TAB to be performed using record drawings.

.5 Submit completed reproducible as-built drawings with Building Management Manual (BMM) as per Section 01 91 51 - Building Management Manual (BMM)

.3 Submit copies of record drawings for inclusion in final TAB report.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures .

1.7 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

1.9 WASTE MANAGEMENT AND DISPOSAL:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

1.10 EQUIPMENT LIST

.1 Complete list of equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

.2 Submit to Departmental Representative for approval within 10 days after award of contract.

2.0 PRODUCTS

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 If delivery of specified motor would delay delivery or installation of any equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 373 W: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.4 Motors 373 W and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 °C , 3 phase, 208 V, unless otherwise specified or indicated.

2.3 GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm dia. holes on both shaft centers for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

2.4 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180 deg, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

- .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Departmental Representative.
- .2 Remaining areas: use prime coated steel.

.4 Installation:

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.3 Installation is specified in applicable sections.

.4 Standard of Acceptance: Acudor, Maxam.

3.0 EXECUTION

3.1 EQUIPMENT INSTALLATION

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Provide Neoprene flexible connections to all ducted mechanical equipment

.3 Line the first 2m of supply and return plenums with 25mm of acoustic lining

.4 Thermally wrap all ductwork in unheated attic or crawl spaces.

.5 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.6 Equipment drains: pipe to floor drains.

.7 Install equipment, rectangular clean outs and similar items parallel to or perpendicular to building lines

3.2 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

3.3 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.4 TESTS

.1 Give 24h written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by Departmental Representative.

.3 Conduct tests in presence of Departmental Representative.

.4 Bear costs including retesting and making good.

3.5 ELECTRICAL

.1 Electrical work to conform to including the following:

.2 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in electrical divisions except for conduit, wiring and connections below 50 V which are related to control systems specified in 23 09 33 Electric and Electronic Control System for HVAC. Refer to electrical divisions for quality of materials and workmanship.

3.6 PAINTING, REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged. Finishes that have been damaged too extensively shall not be merely primed and touched up.

3.7 CLEANING

.1 Clean mechanical (building) systems in accordance with Section 01 74 00 - Cleaning and Waste Management

.2 Clean interior and exterior of all systems including strainers. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts. If dust or dirt is detected prior to startup, vacuum interior of all ducts and air handling units. Prior to vacuuming use video camera to record condition of ductwork. Also use video camera to record condition of ducts after cleaning.

.3 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping

3.8 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use Building Management annual (BMM), record drawings, and audio-visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, Departmental Representative may record these demonstrations on video tape for future reference.

END OF SECTION 23 05 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Waste Management and Disposal

.2 Section 01 74 00 - Cleaning and Waste Management

.3 Section 07 84 00 – Fire Stopping

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

1.4 QUALITY ASSURANCE

.1 Installers to be certified to journeyperson.

2.0 PRODUCTS

.1 Not Used

3.0 EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated or specified otherwise.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above a floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install automatic air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.6 PIPEWORK INSTALLATION

.1 Screwed fittings to be jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install so that equipment can be isolated and removed without interruption to operation of any other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of the main.

.1 Hole saw (or drill) and ream main so as to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Except where indicated otherwise, slope piping in direction of flow for positive drainage and venting.

.9 Except where indicated, install so as to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated and specified.

.14 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above the horizontal position unless otherwise indicated.

.4 Valves to be accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

.15 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Sleeves to be concentric with pipe.

.3 Pipe sleeves for floors and interior walls shall be a minimum15mm thick galvanized sheet steel with lock seam joints.

.4 Pipe sleeves for perimeter walls and foundation walls shall be cast iron sleeve or Schedule 40 steel pipe with annual fin continuously welded at midpoint. Annular fin shall be embedded into centre of wall.

.5 Pipe sleeves for wet or wash down floor areas such as washrooms, janitors' rooms, laboratories and mechanical equipment rooms shall be Schedule 40 steel pipe.

.6 Except as otherwise noted, pipe sleeves are not required for interior concrete walls or floors

.7 Construction: Foundation walls and where sleeves extend above finished floors - to have annular fins continuously welded on at mid-point.

.8 Sizes: 6 mm minimum clearance all round between sleeve and un-insulated pipe or between sleeve and insulation.

.9 Installation:

.1 Pipe sleeves shall extend 50mm above floors in unfinished areas and wet areas and 10mm above floors in finished areas.

.2 Pipe sleeves shall extend 25mm on each side of walls in unfinished areas and 10mm in finished areas.

.3 Sleeve Size: 12mm clearance all around, between sleeves and pipe or between sleeve and pipe insulation.

.4 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.

.10 Fill voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for fire stopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Where sleeves (including concrete sleeves) pass through non-rated fire separations and through non-rated walls or floors, the space between sleeve and pipe or between sleeve and pipe insulation shall be tightly packed with mineral wool insulation - Manson "Cerafibre" or Carborundum "Fiberfax" to the full depth of sleeve to prevent transmission of sound and/or passage of smoke. Packing shall be sealed on both ends of sleeve with resilient silicone base sealing compound.

.5 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and pipe or between sleeve and pipe insulation shall be caulked with water proof fire retardant non-hardening mastic.

.6 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

.7 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181-99

3.8 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Plates shall be stamped steel, split type, chrome plated, or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface. For all pipes passing through suspended ceilings and un-insulated piping passing through walls. Outside diameter shall cover opening or sleeve.

.3 Where sleeve extends above finished floor, escutcheons or plates shall clear sleeve extensions.

.4 Do not install escutcheons and plates in concealed locations.

3.9 PREPARATION FOR FIRE STOPPING

.1 Fire stopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation: specified in Section 07 84 00 - Fire Stopping.

.2 Un-insulated unheated pipes not subject to movement: no special preparation.

.3 Un-insulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging fire stopping material.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 – Cleaning and Waste Management.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 22 & 23.

.3 Maintain specified test pressure without loss for four 4 hours minimum unless specified for longer period of time in relevant sections of Division 15.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Bear costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION 23 05 05

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 74 19 – Waste Management and Disposal

.4 Section 01 78 00 – Closeout Submittals

.5 Section 23 05 05 – Installation of Pipework

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

- .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch.)
- .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings
- .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials (ASTM)

- .1 ASTM A 276, Specification for Stainless Steel Bars and Shapes.
- .2 ASTM A536, Specification for Ductile Iron Castings.
- .3 ASTM B 16, Specification for Free-Cutting Brass Rod Bar and Shapes for Use in Screw Machines.
- .4 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
- .5 ASTM B 283, Specification for Copper and Copper Alloy Die Forgings (Hot Pressed)
- .6 ASTM B 505/B505M, Specification for Copper-Base Alloy Continuous Castings.
- .7 ASTM B584, Specification for Copper Alloy Sand Castings for General Applications.

.3 Canadian Standards Association (CSA)

- .1 CSA B242, Groove and Solder Type Mechanical Pipe Couplings.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
MSS SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.

- .1 MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .2 MSS SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

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

.2 Product Data:

- .1 Submit WHMIS MSDS – Material Safety Data Sheets.
- .2 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Submit data for valves specified this section.
- .4 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

.3 Closeout Submittals

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health, Safety, and Emergency Response Procedures .

.2 All grooved joint couplings, fittings, valves, and specialties to be the products of a single manufacturer. Grooving tools to be of the same manufacturer as the grooved components.

1.5 DELIVERY, STORAGE AND DISPOSAL

.1 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal .

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 MAINTENANCE

.1 Extra Materials

.1 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size. Minimum 1.

.2 Discs: one for every 10 valves, each size. Minimum 1.

.3 Stem packing: one for every 10 valves, each size. Minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.6 Grooved couplings: IPS and copper-tube dimensioned, one for every 10 (ten) grooved joints.

2.0 PRODUCTS

2.1 MATERIALS

.1 Except for specialty valves, to be single manufacturer.

.2 All products to have Canadian registration numbers (CRN).

.3 End Connections

.1 Connection into adjacent piping/tubing:

.2 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.

.3 Copper tube systems.

.1 Solder ends ANSI/ASME B16.18.

.2 Grooved ends to copper tube dimensions and CSA B242.

.3 Push-to-connect ends to ANSI/ASME B16.22 and manufacturer’s standards.

.4 Lockshield Keys

.1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

2.2 GATE VALVES

.1 Requirements common to all gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Bonnet: with hex. shoulders.
.3 Connections: with hex. shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: high grade non-asbestos packing.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.8 Glass 125, WP=860 kPa steam, 1.4 mPa WOG
.9 Class 150 WP=1.03 mPa steam, 2.07 mPa WOG.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.
.2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
.3 Operator: Handwheel

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.
.2 Operator: Handwheel

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet.
.2 Operator: Handwheel

2.3 GLOBE VALVES

.1 Requirements common to all globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hex. shoulders.
.3 Connections: screwed with hex. shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: non-asbestos.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.8 Glass 125, WP=860 kPa steam, 1.4 mPa WOG
.9 Class 150 WP=1.03 mPa steam, 2.07 mPa WOG.

.2 NPS 2 and under, composition disc, Class125:

.1 Body and bonnet: screwed bonnet.
.2 Disc and seat: renewable rotating PTFE disc regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel.

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
.3 Operator: Handwheel

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.
.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
.3 Operator: Handwheel

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.
.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
.3 Operator: Handwheel.

2.4 CHECK VALVES

.1 Requirements common to all check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.
.2 Connections: with hex agonal shoulders.
.3 Glass 125, WP=860 kPa steam, 1.4 mPa WOG
.4 Class 150 WP=1.03 mPa steam, 2.07 mPa WOG
.5 Class 200 1.4 mPa CWP

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.3 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head.

.4 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.5 NPS 2 and under, swing type, bronze disc:

.6 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head.

.7 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.8 NPS 2 and under, swing type, composition disc, Class 200:

.9 Body: Y-pattern with integral seat at 45°, screw-in cap with hex. head.

.10 Disc: renewable rotating disc, of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.11 NPS 2 and under, horizontal lift type, composition disc, Class150:

.12 Body: with integral seat, union bonnet ring with hex. shoulders, cap.

.13 Disc: renewable PTFE for steam, #6 composition rotating disc for water, oil or gas service in disc holder having guides top and bottom, of bronze to ASTM B62.

.14 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.15 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.16 NPS 2 and under, vertical or horizontal, lift type, 1380 kPa CWP.

.1 Disc: 301 stainless steel, center guided.

2.5 SILENT CHECK VALVES

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.
.2 Pressure rating: Class 125.
.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

2.6 BALL VALVES

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B16 or ASTM B62.
.2 Pressure rating: Class 125, 860 MPa steam.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders. Push-to-connect, Pressfit ends.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable stainless steel or hard chrome, plated brass solid ball and teflon seats.
.7 Stem seal: TFE, EPDM, Nitrile, Fluoroelastomer with with external packing nut.
.8 Operator: removable lever handle with extension for insulated pipe.
.9 Cap and drain for drain service.

2.7 BUTTERFLY VALVES

.1 NPS 2-1/2 through NPS 6.

.1 Body: cast bronze per CDA-836 (85-5-5-5).
.2 Pressure rating: 2065-kPa CWP.
.3 Connections: copper tube dimensioned grooved ends.
.4 Disc: ductile iron per ASTM A536 with elastomer coating.
.5 Stem: integrally cast with disc.
.6 Stem Nuts: nickel plated 416 stainless steel.
.7 Operator: gear operator, NPS and over.

2.8 ACCEPTABLE PRODUCT

.1 Acceptable Product: Jenkins, Crane, Watts, Newman Hattersley, Milwaukee, Conbraco, Kitz, Red White, M.A. Stewart, Nibco, Victaulic.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Adjoining tube, couplings, and fittings with grooved joint valves shall be copper-tube dimensioned. Flaring tube or fitting ends to accommodate IPS sized valves is not permitted.

.4 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

.1 Unions are not required in installations using grooved mechanical couplings. The couplings shall serve as unions.

3.2 COMMISSIONING

.1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

END OF SECTION 23 05 23.01

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 74 19 – Waste Management and Disposal

.5 Section 01 78 00 – Closeout Submittals

.6 Section 23 05 48 – Vibration Isolation and Seismic Control Measures

1.2 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1-2001, Power Piping, (SI Edition).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A 125-81(1988), Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A 307-10, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A 563-07, Specification for Carbon and Alloy Steel Nuts.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP-69-2002, Pipe Hangers and Supports - Erection and Application.

.3 MSS SP-89-2003, Pipe Hangers and Supports - Fabrication and Installation.

1.3 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer’s regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.

.3 Ensure that supports, guides and anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.4 DESIGN FOR SEISMIC EVENTS

.1 Design supports, platforms, hangers, to withstand seismic events as specified Section 23 05 48 – Vibration Isolation and Seismic Control Measures

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings: submit drawings stamped and signed for approval by Departmental Representative.

.3 Submit shop drawings and product data for following items:

.1 All bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

2.0 PRODUCTS

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: Suspension from lower flange of I-Beam.

.1 Cold piping HPS 2 maximum: Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed approved.

.2 Cold piping NPS 2 ½ or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP-58.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS-SP-69.

.2 Cold piping NPS 2 ½ or greater, all hot piping: Malleable iron top-of-beam jawclamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed approved to MSS-SP-69.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies.

.2 Steel brackets.

.3 Sway braces for seismic restraint systems.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel black.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP-69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for riveting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A 563.

.1 Finishes for steel pipework: black.

.2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSSSP- 58, type 42.

.3 Bolts: to ASTM A 307.

.4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in center plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A 125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops.

.4 Steel alloy springs: to ASTM A 125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

- .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, condensing units, and elsewhere as indicated.
- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
  - .1 transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Within 300 mm of each elbow.

.6 Maximum Spacing:

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	
Pipework greater than NPS 12: to MSS SP69		

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4deg from vertical.

.2 Where horizontal pipe movement is less than 13mm offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION 23 05 29

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 74 19 – Waste Management and Disposal

.5 Section 03 30 00 – Cast-in-Place Concrete.

.6 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

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

.1 Material Safety Data Sheets (MSDS)

.2 National Building Code of Canada (NBC)

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide system shop drawings complete with performance and product data.

.3 Provide detailed drawings of all seismic control measures for equipment and piping.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

1.6 WASTE MANAGEMENT AND DISPOSAL:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal

1.7 INSPECTION AND CERTIFICATION

.1 Seismic restraint systems shall be inspected and certified by Seismic Engineer after completion of work. Forward copy of certification to Departmental Representative before Substantial Completion.

2.0 PRODUCTS

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.

.1 Standard of Acceptance: Korfund, Mason, Vibro-Acoustic.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

.2 Standard of Acceptance: Korfund, Mason, Vibro-Acoustics.

2.4 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

.6 Acceptable Product: Korfund, Masdom, Vibron, Vibro Acoustics.

2.5 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30^{o} arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

.6 Acceptable Product: Korfund, Masdom, Vibron, Vibro Acoustics.

2.6 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty ductile and neoprene isolation material.

2.7 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.8 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm minimum.

.4 Acceptable Product: Korfund, Masdom, Vibron, Vibro Acoustics.

2.9 INERTIA BASE

.1 Type B3 - Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; spring mounted, carried by gusseted height-saving brackets welded to frame; and clear housekeeping pads by 50 mm minimum.

.2 Pump bases: "T" shaped, where applicable, to provide support for elbows.

.3 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

.4 Acceptable Product: Korfund, Masdom, Vibron, Vibro Acoustics.

2.10 ROOF CURB ISOLATION RAILS

.1 General: complete factory assembled without need for sub-base.

.2 Lower member: continuous rectangular steel tube or extruded aluminum channel.

.3 Upper member: continuous rectangular steel tube or extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene snubber bushings 6 mm thick to resist wind and seismic forces.

.4 Springs: steel, adjustable, removable, selected for 25 mm maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.

.5 High frequency isolation: 6mm minimum thick continuous gasket on top and bottom of complete assembly or pads on top and bottom of each spring. Material: closed cell neoprene.

.6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: aluminum neoprene.

.7 Hardware: cadmium plated or galvanized.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS 4: first 3 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 SEISMIC CONTROL MEASURES

.1 General:

.1 Seismic control systems to work in all directions.

.2 Fasteners and attachment points to resist same maximum load as seismic restraint.

.3 Drilled or power driven anchors and fasteners not permitted.

.4 No equipment, equipment supports or mounts to fail before failure of structure.

.5 Supports of cast iron or threaded pipe not permitted.

.6 Seismic control measures not to interfere with integrity of firestopping.

.2 Static equipment:

.1 Anchor equipment to equipment supports. Anchor equipment supports to structure.

.2 Suspended equipment Use one or more of following methods as indicated:

.1 Install tight to structure.

.2 Cross brace in all directions.

.3 Brace back to structure.

.4 Cable restraint system.

.3 Seismic restraints:

.1 Cushioning action to be gentle and steady.

.2 Shall never reach metal-like stiffness.

.4 Vibration isolated equipment:

.1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.

.2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.

.3 Piping systems:

.1 Fire protection systems: to ANSI/NFPA 13.

.2 All other piping systems: hangers longer than 300 mm; brace at each hanger.

.3 To be compatible with requirements for anchoring and guiding of piping systems.

.4 Bracing methods:

.1 Approved by Seismic Engineer.

.2 Structural angles or channels.

.3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

3.4 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Departmental Representative.

.2 Provide Departmental Representative with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.5 TESTING

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 – Testing Adjusting and Balancing.

.2 Provide Departmental Representative with notice 24 h in advance of commencement of tests.

.3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

3.6 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 05 48

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00 – Quality Control.

.3 Section 01 61 00 – Common Product Requirements.

.4 Section 01 74 19 – Waste Management and Disposal.

.5 Section 01 91 51 – Building Management Manual (BMM).

.6 Section 09 91 23 – Interior Painting.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 Canadian Gas Association (CGA).

.1 CAN/CGA B149.1-05.

.2 CAN/CGA B149.2-10.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data to include paint colour chips, all other products specified in this section.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples to include nameplates, labels, tags, and lists of proposed legends.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

1.7 WASTE MANAGEMENT AND DISPOSAL:

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

.2 Dispose of unused paint coating material at official hazardous material collections site approved by Engineer / Architect.

.3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

2.0 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Size (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: Use size #5.

.2 Equipment in Mechanical Rooms: Use size #9.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.

.2 Propane gas: to CSA/CGA B149.1 authority having jurisdiction.

.3 Sprinklers: to NFPA 13.

.4 Standpipe and hose systems: to NFPA 14.

.5 Medical Gas: to CAN/CSA Z7396.1.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150C and intermittent temperature of 200C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: To following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Raw water	Green	RAW WATER

Contents	Background colour marking	Legend
River water	Green	RIVER WATER
Sea water	Green	SEA WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam ___kPa	Yellow	___kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Non-Potable water	Yellow	NPW
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. ___ fuel oil suction	Yellow	# ___ FUEL OIL
No. ___ fuel oil return	Yellow	# ___ FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE

Contents	Background colour marking	Legend
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Compressed air (<700kPa)	Green	COMP. AIR ___ kPa
Compressed air (>700kPa)	Yellow	COMP. AIR ___ kPa
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO2
Instrument air	Green	INSTRUMENT AIR
Control air tubing	To Section 25 05 54 – EMCS: Identification	
Conduit for low voltage control wiring	To Section 25 05 54 – EMCS: Identification	
Medical Gases	To Code	
++ Add design temperature		

2.5 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

.3 Identify system: e.g. SUPPLY HRV-1, EXH EF-7.

2.6 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 LANGUAGE

.1 Identification to be in English.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after all painting specified in Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations: Conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs: Provide for nameplates on hot and/or insulated surfaces.

.3 Protection: Do not paint, insulate or cover in any way.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces, at entry and exit points, and at each access opening.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each Building Management Manual as per Section 01 91 51 - Building Management Manual (BMM).

.3 Number valves in each system consecutively.

3.7 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION 23 05 54

1.0 GENERAL

1.1 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 19 – Waste Management and Disposal

.3 Section 01 91 51 – Building Management Manual (BMM).

.4 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment

.5 Section 23 33 53 – Duct Liners

.6 Section 23 05 54 – Mechanical Identification.

1.3 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience. TAB contractor shall have a minimum of 5 years experience to AABC, NEBB or SMACNA.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.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.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in the TAB standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures and requirements are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or

SMACNA), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.6 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing all proposed procedures, which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in other Divisions.

1.9 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.10 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB only when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather stripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere.

.4 All provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums

.4 Correct fan rotation.

.5 Coil fins combed, clean.

.6 All outlets installed, volume

.3 Liquid systems

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves

.5 Calibrated balancing valves

.6 Chemical treatment systems complete, are airtight to within specified tolerances.

.7 Installed, open.

.8 Installed, at factory settings operational.

.4 Fire, volume control dampers installed and open.

.5 Access doors, installed, closed, control dampers open.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory HVAC systems: plus 10 %, minus 0 %.

.2 Other HVAC systems: plus 5 %, minus 5 %.

.3 Hydronic systems: plus or minus 10 %.

.4 Refrigeration systems: plus or minus 10%

1.12 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.13 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.14 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.16 TAB REPORT

.1 TAB report to show all results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.2 Submit TAB Report to Departmental Representative for verification and approval, in PDF format prior to inclusion in BMM as per Section 01 91 51 - Building Management Manual (BMM).

1.17 VERIFICATION

.1 All reported results subject to verification by Departmental Representative.

.2 Provide manpower and instrumentation to verify up to 30 % of all reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative.

.4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.19 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Departmental Representative.

1.20 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of this section or of AABC..

.2 Do TAB of all systems, equipment, components, controls specified in the Specification documents.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by AABC.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration amperage and volts for each stage of electrical heating coils.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At each controller, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Each main duct, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 DOMESTIC WATER SYSTEMS

.1 Meet requirements as specified for hydronic systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: inlet and outlet of heaters, tank, pump, circulator, at controllers, controlled device.

.3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.22 OTHER SYSTEMS

.1 Plumbing systems:

.1 Standard: National Plumbing Code.

.2 TAB procedures:

.3 Flush valves: adjust to suit project pressure conditions.

.4 Pressure booster systems: test for capacity and pressures under all conditions and at all times.

.5 Controlled flow roof drain systems: adjust weirs to suit actual roof conditions, slopes, areas drained.

.6 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates.

.7 Pressure reducing station.

.2 Refrigeration systems forming part of HVAC systems:

.1 Standard: CSA B52 – Mechanical Refrigeration Code.

.2 TAB procedures: Refer to Standard as follows:

.1 Suction Pressure and Temperature.

.2 Discharge Pressure and Temperature.

.3 Suction Superheat

.4 Evaporation Pressure and Temperature.

1.23 OTHER TAB REQUIREMENTS

.1 General requirements applicable to all work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.

.3 Zone pressure differences:

.1 Adjust HVAC systems, equipment, and controls to establish specified air pressure differentials, with all systems in all possible combinations of normal operating modes.

.4 Smoke management systems:

.1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified in other Divisions.

.5 Measurement of noise and vibration from equipment specified in Mechanical Division

.1 Standard: Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment and Section 23 33 53 Duct Liners.

.2 Vibration measurements around each piece of rotating equipment.

.3 Sound measurements in each octave band around each piece of rotating equipment.

.4 Induct sound measurements in each octave band at each fan inlet and discharge.

.5 Induct sound measurements in each octave band at each air handling unit intake, return and discharge.

.6 Sound measurements in each octave band for each normally occupied room with air handling equipment running.

1.24 POST- OCCUPANCY TAB

.1 Measure DBT, WBT, airflow patterns, and NC levels in occupied zones.

.2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

2.0 PRODUCTS (NOT USED)

3.0 EXECUTION (NOT USED)

END OF SECTION 23 05 93

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 19 – Waste Management and Disposal

.3 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment

.4 Section 23 33 53 – Duct Liners

.5 Section 23 05 54 – Mechanical Identification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547, Specification for Mineral Fibre Pipe Insulation.

.6 ASTM C553, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612, Specification for Mineral Fibre Block and Board Thermal Insulation.

.8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.9 ASTM C921, Standard Practice for Determining Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Thermal Insulation Polystyrene, Boards and Pipe Covering.

.6 Model National Energy Code of Canada for Buildings (MNECB)

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Commercial Round Ductwork,

.2 CRF: Commercial Rectangular Finish.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.2-M88, Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.

.2 CAN/CGSB-51.9-92, Mineral Fibre Thermal Insulation for Piping and Round Ducting.

.3 CAN/CGSB-51.10-92, Mineral Fibre Board Thermal Insulation.

.4 CAN/CGSB-51.11-92, Mineral Fibre Thermal Insulation Blanket.

.5 CAN/CGSB-51.12-M86, Cement, Thermal Insulating and Finishing.

.6 CAN/CGSB-51.40-M80, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-M88, Surface Burning Characteristics of Building Materials and Assemblies.

.5 American Society for Testing and Materials (ASTM).

.1 ASTM B 209M-92a, Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.2 ASTM C 335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C 411-82(1992), Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C 449M-88, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C 795-92, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.6 ASTM C 921-89, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.6 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-1989.

.7 Manufacturer's Trade Associations.

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00: Submittal procedures.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00: Submittal procedures.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00: Submittal procedures.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.7 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather, construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions required by manufacturer.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – 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.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.5 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

.6 Do no dispose of unused adhesive materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard..

2.0 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C°335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

.5 TIAC Code A.6: Flexible unicellular tubular elastomer.

.1 Jacket: to CGSB 51-GP-52 Ma.

.2 Maximum "k" factor: to CAN/CGSB 51.40.

.3 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

2.3 JACKETS

.1 Canvas:

.1 220gm/m cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.2 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.40 mm sheet.

.3 Finish: Stucco embossed or corrugated.

.4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

.3 Stainless steel:

.1 Type: 304 or 316 where additional corrosion protection is required.

.2 Thickness: 0.25 mm sheet.

.3 Finish: Corrugated or stucco embossed.

.4 Jacket banding and mechanical seals: 12mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C 921.

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m.

.6 Tape: self-adhesive, aluminum, plain, 75mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 12 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.12 Fasteners: 4mm diameter pins with 35mm diameter or square clips, length to suit thickness of insulation

3.0 EXECUTION

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, and free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers' instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.6 Fasteners: At 300 mm on center. in horizontal and vertical directions, minimum two rows each side.

3.3 DUCTWORK INSULATION SCHEDULES

.1 Insulation types and thicknesses: Conform to the following:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts (exposed)	C-1	yes	50

	TIAC Code	Vapour Retarder	Thickness (mm)
Round cold and dual temperature supply air ducts (concealed)	C-2	yes	50
Rectangular warm air ducts (exposed)	C-1	no	25
Round warm air ducts (exposed)	C-1	no	25
Rectangular cold and dual temperature supply air ducts (concealed)	C-2	Yes	25
Round cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Rectangular warm air ducts (concealed)	C-2	No	25
Round warm air ducts (concealed)	C-2	No	25
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	25
Exhaust duct between dampers and louvers	C-1	no	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Acoustically lined ducts	See Section 23 33 53- Duct Liners		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.2 Finishes: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	None	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION 23 07 13

1.0 GENERAL

1.1 SUMMARY

.1 The work of this section comprises the furnishing of all labour, materials, tools, and equipment necessary for the installation of a complete and operational control system.

.2 The control systems are to be complete with all necessary control components and connections to achieve the specified functions and to permit the HVAC systems to perform properly in the manner described and as hereinafter specified.

.3 The controls contractor shall be responsible for the design, installation, supervision and labour services, calibration, and checkout necessary for a complete and fully operational control system.

.4 The control system is to be set up and adjusted to achieve optimum operation of the HVAC systems. This includes sequencing, timing and readjustment as required.

.5 The control system shall be installed by a Certified Control Company, using competent personnel directly and regularly employed by this Company or Organization.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 61 00 – Common Product Requirements

.3 Section 01 74 00 – Cleaning and Waste Management

.4 Section 01 74 19 – Waste Management and Disposal

.5 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE SUBMITTALS

.1 Submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer’s installation instructions

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 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.

1.7 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 By Controls Contractor:

.1 All control system components to make a complete and operational system, except those supplied as part of the Packaged Equipment Controls, but including all auto-sequencing devices and electrical interlocks required to accomplish the sequences specified hereafter. Materials, equipment, connections and power not provided by Division 26 & 28 but required for the Control System shall be provided under this section.

.2 All control circuit transformers (120/1/60 or 24/1/60 and as designated), except where supplied with starters by Division 26.

.3 All control wiring to be plenum rated material for mechanical system controls.

.4 Supply and installation and connection of all electrical items including: motors, relays, outside sensors, sub-master control circuits, safety devices, wiring to terminal strips, controllers etc.

.5 Be responsible for coordinating with Division 26

.6 Electrical work installed under Division 23 shall be to the standards specified under Division 26.

.2 By Division 26:

.1 All power wiring and conduit power distribution system up to and including connection to all motors and starters.

.2 All disconnect switches required (unless specified as being integral with equipment).

.3 All motor protection switches, stop-start switches, magnetic starters, contactors and hand-off-automatic selector switches.

.3 Wiring: refer to Division 26.

1.8 IDENTIFICATION

.1 Identify all controls with symbols relating directly to the control diagram.

.2 All Manual switches shall be labelled with engraved lamacoid nameplates to clearly indicate service.

.3 Identify all unit control panels and associated devices with symbols relating directly to the control diagram.

2.0 PRODUCTS

2.1 THERMOSTAT (LINE VOLTAGE-HEATING AND COOLING)

.1 Line voltage, wall-mounted thermostat, for heating or cooling or heating-cooling as indicated with:

.1 Full load rating: 6 A at 120 V.

.2 Temperature setting range: 5 °C to 30 °C.

.3 Thermometer range: 5 °C to 30 °C.

.4 Markings in 5 degree increments.

.5 Differential temperature fixed at 1.1 °C.

2.2 THERMOSTAT (HEAVY-DUTY, LINE VOLTAGE, HEATING AND COOLING)

.1 Heavy-duty line voltage thermostat for heating, cooling, heating/cooling with manual changeover two-stage heating or cooling heating/cooling automatic changeover as indicated with:

.1 Full load rating: 16 A at 120 V.

.2 Temperature setting range: 5 °C to 30 °C.

.3 Thermometer range: 5 °C to 30 ° C.

.4 Markings in 5 degree increments.

.5 Differential temperature fixed at 1.1 °C.

2.3 THERMOSTAT (LINE VOLTAGE, HEATING)

.1 Line voltage wall mounted integral electric heating thermostat with:

.1 Full load rating: 22 A at 120 V.

.2 Temperature setting range: 5 °C to 30 °C.

.3 Single pole.

.4 Thermometer range: 5 °C to 30 °C.

.5 Scale markings: Off-5-10-15-20-25 °C.

2.4 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:

.1 For use on 24 V circuit at 1.5 A capacity.

.2 With heat anticipator adjustable 0.1 to 1.2 A.

.3 Temperature setting range: 10 °C to 25 °C.

.4 Without sub-base.

2.5 THERMOSTAT (REMOTE BULB)

.1 Line voltage remote bulb type thermostat with:

.1 30 A rating on 120 V.

.2 3 m copper capillary tube.

.3 Moisture and dust-resistant enclosure.

2.6 THERMOSTAT (FAN COIL)

.1 Line voltage fan coil heating-cooling thermostat with:

.1 Full load rating: 6 A at 120 V.

.2 Two rocker switches for "Heat-Off-Cool" and "Low-Medium-High" fan switching. Isolate heating and cooling circuits. "Off" switch to break power to fan and thermostat.

2.7 THERMOSTAT GUARDS

.1 Thermostat guards: lockable, clear plastic. Slots for air circulation to thermostat.

2.8 LOW LIMIT TEMPERATURE ALARM

.1 Low limit temperature alarm with:

.1 Rating: 10.2 A at 120 V.

.2 Sensing bulb and 6 m long capillary tube.

.3 Switching action: manual reset.

.4 Temperature setting range: 0 °C to 15 °C.

2.9 HIGH LIMIT TEMPERATURE ALARM

.1 High limit temperature alarm with:

.1 Rating 10 A at 120 V 6 A at 240 V.

.2 Positive lock-out.

.3 Manual reset only after 14 °C drop-in temperature.

.4 Cutout setting: 50 °C.

2.10 SAIL SWITCH

.1 Sail switch, mercury bulb type with stainless steel sail 79 mm width, adjustable range set for 3.8 m/s air velocity with upward flow. Full load: 16 A at 120 V. Maximum ambient temperature: 82 °C.

.2 Flow switch for water or glycol, pipe size as indicated, CSA Enclosure l, rated at 16 A at 120 V. Maximum liquid temperature: 121 °C. Maximum liquid gauge pressure of 1034 kPa ambient temperature range 0 °C to 82 °C. Ensure flow rate can activate flow switch at its minimum flow setting.

2.11 PRESSURE SWITCH

.1 Pressure switch for water, steam, air at range to suit application with auto manual reset, contacts open on rise. Maximum allowable gauge pressure of 1.2 MPa. Full load 16 A at 120 V, ULC rated.

2.12 TEMPERATURE SENSORS

.1 Temperature sensors supplied, installed and wired by Division 25. Component of EMCS System. Electrical Division to provide box and conduit to ceiling space only.

2.13 ELECTRIC HEATING RELAYS

.1 Low voltage solid state electric heating relays installed in ventilated enclosure, recess mounted, complete with power supply. Complete assembly to be CSA approved.

.2 Heating relays, c/w integral heat sink, over voltage protection and status LED.

.3 Relay to have veiled conductor connections. No exposed terminals permitted.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install control devices.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management .

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 09 33

1.0 GENERAL

1.1 RELATED SECTIONS:

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

.3 Section 01 74 00 – Cleaning and Waste Management

.4 Section 01 74 19 – Waste Management and Disposal.

.5 Section 01 78 00 – Closeout Submittals.

.6 Section 23 05 05 – Installation of Pipework.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.22, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.

.2 ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.3 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.

.4 ASME B31.5, Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B 280, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA)

.1 CSA B52, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.1 EPS1/RA/1, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

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

.1 Material Safety Data Sheets (MSDS).

.6 Province of Newfoundland and Labrador Boiler, Pressure Vessel and Compressed Gas Regulations

1.3 SUBMITTALS

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

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures .

.2 Trades people to be journeyperson and graduate from a recognized college refrigeration trade program.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - 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 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative

2.0 PRODUCTS

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type ACR B (nitrogenized).

.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121°C.

.2 Brazed:

.1 Fittings: wrought copper to ASME B16.22.

.2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 for copper to copper.

.3 Flanged:

.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300, tongue and groove type.

.2 Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 7/8 ODS (22mm) and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.

.2 Over 7/8 ODS (22mm): Class 375, 3 MPa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and forged brass bonnet, moisture-proof seal for below freezing applications, brazed connections, non-rotating, self aligning swivel disc, Teflon seat, -40^{0}C - 163^{0}C.

.3 Ball valves 7 3/8 ODS to 3 1/8 ODS: maximum WP 4MPa, -40^{0}C to 149^{0}C, live loaded stem seal, double “O” ring hermetically sealed body, blowout proof stem, seal cap “O” ring sealed, valve position indicators, forged brass body bonnet, brass cap, triple sealed plated steel item, Teflon ball seals and gasket, extended copper connections, helium leak test to maximum 0.28 g/yr.

.4 Check valves 7/8 ODS to 3 1/8 ODS cast bronze body, brass bonnet, Teflon seat, internal parts removable minimum opening pressure 3.5 kPa, maximum WP 3.5 kPa - 29^{0}C to 149^{0}C, UL and CSA approved.

.5 Check valves 3/8 ODS to 7/8 ODS: brass construction, Teflon seal, removable piston, maximum WP 3.5 kPa, -40^{0}C to 149^{0}C, suitable for high side, low side and hot gas. UL and CSA approved, maximum opening pressure 3.5 kPa.

3.0 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer’s written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

.1 In accordance with Section 23 05 05 – Installation of Pipework, supplemented as specified herein.

.2 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction, hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.2 Provide trap at base of risers greater than 1800 mm high and at each 6000 mm thereafter.

.3 Provide inverted deep trap at top of risers.

.4 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified above.

.2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa using nitrogen leave for 8 hours.

3.6 FIELD QUALITY CONTROL

.1 Site Tests/Inspection

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines for largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14 Pa absolute and hold for 4 h.

.2 Break vacuum with refrigerant to 14 KPa.

.3 Final to 5 Pa absolute and hold for at least 12 h.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit test results to Departmental Representative.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system in fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer’s operation and maintenance instructions.

.2 Record and report measurements to Departmental Representative.

.9 Manufacturer's Field Services:

.1 Have manufacturer of products, supplied under this Section, review work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review work, at stages listed:

.1 After delivery and storage of products, and when preparatory work, or other work, on which the work of this Section depends, is complete but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of the work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

3.7 DEMONSTRATION

.1 Instructions:

.1 Post instructions in frame with glass cover in accordance with Section 01 78 00 – Closeout Submittals and CSA B52.

.1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and Waste Management and in accordance with manufacturer's recommendations.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 23 00

1.0 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 74 19 – Waste Management and Disposal.

.4 Section 01 91 13 – General Commissioning (Cx) Requirements.

.5 Section 07 84 00 – Firestopping

.6 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.7 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

1.3 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A 480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A 635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A 653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA HVAC Air Duct Leakage Test Manual.

.3 IAQ Guideline for Occupied Buildings Under Construction, 1st Edition.

.7 Transport Canada (TC).

.8 Transportation of Dangerous Goods Act (TDGA)

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets for the following:

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.6 HEALTH AND SAFETY:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures .

.2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
> 1000	A
750	B
500	C
250	C
125	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, sealant tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30C to plus 93°C.

.1 Standard of Acceptance: Duro Dyne WB-S2, Foster 32-19

.2 Duct Leakage: In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm (2") wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius.

.2 Round: smooth radius.

.3 Mitred elbows, rectangular:

.1 To 400 mm: without turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct.

.2 Round main and branch: enter main duct at 45^0 with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20^0 maximum included angle.

.2 Converging: 30^0 maximum included angle.

.6 Offsets:

.1 Full radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

2.6 FIRESTOPPING

.1 Retaining angles all around duct, on both sides of fire separation in accordance with Section 07 84 00 – Firestopping.

.2 Firestopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A525M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA, proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Acceptable Product: Myatt, Grinnell, Hunt.

.2 For steel joist: manufactured joist clamp steel plate washer.

.1 Acceptable Product: Myatt, Grinnell, Hunt.

.3 For steel beams: manufactured beam clamps:

.1 Acceptable Product: Myatt, Grinnell, Hunt.

3.0 EXECUTION

3.1 GENERAL

.1 Do work in accordance with ANSI/NFPA 90A CSA B228.1 and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on each side of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where indicated.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations. Sealant and tape to be applied to full perimeter of duct.

3.4 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Do leakage tests in sections.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Install no additional ductwork until trial test has been passed.

.5 Test section minimum of 30 m long with not less then 3 branch takeoffs and 2 90º elbows.

.6 Complete test before insulation or concealment.

END OF SECTION 23 31 13.01

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29.06 – Health and Safety Requirements.

.3 Section 01 45 00 – Quality Control.

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.5 Section 01 78 00 – Closeout Submittals

.6 Section 02 62 00.01 – Hazardous Materials

1.2 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

.3 Sheet Metal and Air Conditioning National Association (SMACNA)

.4 SMACNA HVAC Duct Construction Standards, Metal and Flexible

.5 AMCA 99, Standards Handbook.

.6 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Rating.

.7 AMCA 300, Reverberant Room Method for Sound Testing of Fans.

.8 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.9 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Rating

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.5 Fan performance curves showing specified point of operation.

.6 Sound rating data.

.7 Capacity.

.8 Throw and terminal velocity.

.9 Noise criteria.

.10 Pressure drop.

.11 Neck velocity

.12 Face area

.3 Submit WHMIS MSDS in accordance with Section 02 62 00.01 – Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

.7 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction Demolition Waste Management and Disposal

.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 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

2.0 PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 25 mm (1") thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40C (-40F) to plus 90C (200F), density of 1.3 kg/m, ASTM E84 Rating (flame/Smoke) 10/55

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.

.3 Gaskets: Neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm (11 3/4" x 11 3/4"): 2 sash locks.

.2 301 to 450 mm (12" to 17 3/4") : 4 sash locks.

.3 451 to 1000 mm (18" to 39"): piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm (39") : piano hinge and 2 handles operable from both sides.

.5 Hold open devices.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST PORTS

.1 1.6 mm (1/16") thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm (1 3/32") minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

2.7 SINGLE BLADE DAMPERS

.1 Manufacture to SMACNA standards.

.2 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.3 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").

.4 Locking quadrant with shaft extension to accommodate insulation thickness.

.5 Inside and outside nylon end bearings.

.6 Channel frame of same material as adjacent duct, complete with angle stop

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Flexible connections:

- .1 Install in following locations:
  - .1 Inlets and outlets to supply air units and fans.
  - .2 Inlets and outlets of exhaust and return air fans.
  - .3 As indicated.
- .2 Length of connection: 100 mm (4").
- .3 Minimum distance between metal parts when system in operation: 75 mm (3").
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on each side of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:

- .1 Size:
  - .1 450 mm x 450 mm (18"x18") for person size entry.
  - .2 300 mm x 300 mm (12"x12") for viewing.
  - .3 As indicated.
- .2 Location:
  - .1 At fire and smoke dampers.
  - .2 At control dampers.
  - .3 At devices requiring maintenance.
  - .4 At locations required by code.
  - .5 At reheat coils.
  - .6 Elsewhere as indicated.
- .3 Instrument test ports. General:
  - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.
  - .4 Locations.
    - .1 For traverse readings:
      - .1 At ducted inlets to roof and wall exhausters.
      - .2 At inlets and outlets of other fan systems.
      - .3 At main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.

.2 In mixed air applications in locations as approved by Departmental Representative.

.1 At inlet and outlet of coils.

.1 Downstream of junctions of two converging air streams of different temperatures.

.2 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 FIELD QUALITY CONTROL

.1 Single Blade Dampers

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

Ensure damper operators are observable and accessible.

3.4 CLEANING

.1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and Waste Management and in accordance with Manufacturer’s recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 33 00

1.0 GENERAL

1.1 SUMMARY

.1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

.3 Section 01 45 00 – Quality Control.

.4 Section 01 74 00 – Cleaning and Waste Management

.5 Section 01 74 19 – Waste Management and Disposal.

.6 Section 01 78 00 – Closeout Submittals.

1.3 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

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

.1 Material Safety Data Sheets (MSDS).

1.4 PRODUCT DATA

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures

1.5 HEALTH AND SAFETY REQUIREMENTS:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - 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.

2.0 PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm.

.4 Bearings: pin in bronze bushings or self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage: 2 % at 500 Pa.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning and Waste Management.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 33 14

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

.3 Section 01 45 00 – Quality Control

.4 Section 01 61 00 – Common Product Requirements

.5 Section 01 74 00 – Cleaning and Waste Management.

.6 Section 01 74 19 – Waste Management and Disposal.

.7 Section 01 78 00 – Closeout Submittals

.8 Section 23 33 00 – Air Duct Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A 653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include following:

.1 Manufacturer's catalogue literature related to installation, and jointing recommendations, performance and product data

.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.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.6 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – 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.

2.0 PRODUCTS

2.1 MULTI-LEAF DAMPERS

.1 Opposed or parallel blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Performance:

.1 Leakage: in closed position to be less than 2%of rated air flow. 0.995 kPa differential across damper.

.2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s

.6 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

.3 Acceptable material: Honeywell, Johnson, T.A. Morrison, Tamco, Powers.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A 653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A 653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position to be less than 2 % of rated air flow at 500 Pa pressure differential across damper.

.2 Pressure drop: at fully open position to be less than 25 Pa differential across damper at 10 m/s.

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum or steel construction with nylon bearings, centre pivoted, spring assisted or counterweighted.

2.4 RELIEF DAMPERS

.1 Automatic multi-leaf steel or aluminum dampers with ball bearing centre pivoted and counter-weights set to open as indicated.

3.0 EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning and Waste Management.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 33 15

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 74 00 – Cleaning and Waste Management

.5 Section 01 74 19 – Waste Management and Disposal.

.6 Section 07 84 00 – Firestopping

.7 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

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

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112, Fire Test of Fire Damper Assemblies.
.2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
.3 ULC-S505, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Fire dampers.

.2 Fire stop flaps.

.3 Operators.

.4 Fusible links.

.5 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

.2 Certificates:

.1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide the following:

.1 Six (6) fusible links of each type.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

2.0 PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B or C, blades out of air stream listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Minimum rating 1½ hours, dynamically rated.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 Retaining angle iron frame, 40 x 40 x 3 mm, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed to prevent disruption of ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 FIRE STOP FLAPS

.1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.

.2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74 □C.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.

.5 Coordinate with installer of firestopping to Section 07 84 00 – Firestopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning and Waste Management.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 COMMISSIONING

.1 Commission in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION 23 33 16

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of flexible ductwork, joints and accessories.

1.1 RELATED SECTIONS

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.4 Section 01 74 19 – Waste Management and Disposal.

.5 Section 01 91 13 – General Commissioning (Cx) Requirements

.6 Section 01 78 00 – Closeout Submittals

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

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

.1 Material Safety Data Sheets (MSDS).

.3 National Fire Protection Association (NFPA).

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.4 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction.

.5 Underwriters' Laboratories Inc. (UL).

.1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.

.6 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S110, Fire Tests for Air Ducts.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS for the following:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating

1.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

1.4 SAMPLES

.1 Submit samples with product data of each different type of flexible duct being used in accordance with 01 33 00 - Submittal Procedures.

1.5 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

1.6 HEALTH AND SAFETY:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – 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.

2.0 PRODUCTS

2.1 GENERAL

.1 Factory fabricated to CAN/ULC S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Type 1: spiral wound flexible aluminum.

.2 Performance:

.1 Factory tested to 1000 Pa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

.1 Type 2: spiral wound flexible aluminum with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl or reinforced mylar/neoprene laminate jacket.

.2 Performance:

.1 Factory tested to 1000 Pa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Thermal loss/gain: 1.3 W/m2.0C. mean.

2.4 NON-METALLIC - UNINSULATED

.1 Type 3: non-collapsible, coated mineral base fabric or aluminum foil mylar type, mechanically bonded to, and helically supported by, external steel wire.

.2 Performance:

.1 Factory tested to 1000 Pa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.5 NON-METALLIC INSULATED

.1 Type 4: non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Standard of Acceptance: Flexmaster FAB 3T.

2.6 METALLIC ACOUSTIC INSULATED MEDIUM PRESSURE

.1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 25 mm thick flexible glass fibre thermal insulation and sleeved by aluminum foil and mylar laminate vapour barrier.

.2 Performance:

.1 Factory tested to 3 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Duct Diam:	Frequency (Hz)				
mm	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.7 METALLIC ACOUSTIC INSULATED HIGH PRESSURE

.1 Type 6: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation and encased in spiral wound flexible aluminum jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Duct Diam:	Frequency (Hz)				
mm	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.8 NON-METALLIC - ACOUSTIC INSULATED

.1 Type 7: Non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to steel wire with factory applied flexible glass fibre acoustic insulation and encased in aluminum foil and mylar laminate vapour barrier.

.2 Performance:

.1 Factory tested to 3 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

3.0 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with: CAN/ULC-S110,UL-181, ANSI/NFPA 90A, ANSI/NFPA 90B, SMACNA.

.2 Maximum length of flexible duct: 4ft (1.2m)

END OF SECTION 23 33 46

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Waste Management and Disposal.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 177-97, Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-10M-76, Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.

.2 CGSB 51-GP-11M-76, Thermal Insulation, Mineral Fibre, Blanket, for Piping, Ducting, Machinery and Boilers.

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-99, Installation of Air Conditioning and Ventilating Systems.

.2 NFPA 90B-[99], Installation of Warm Air Heating and Air Conditioning Systems.

.4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-95 (Addendum No.1, Nov. 97).

.5 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S102-88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with 01 74 09 - Waste Management and Disposal .

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

2.0 PRODUCTS

2.1 DUCT LINER

.1 General:

.1 Fibrous glass duct liner: air stream side faced with mat facing.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULCS102.

.2 Rigid:

.1 Use on flat surfaces where indicated.

.2 25 mm thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.

.3 Density: 36 kg/cu. m. minimum.

.4 Thermal resistance to be minimum 0.76 m. C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24C mean temperature.

.3 Standard of Acceptance: Duro Dyne 1A-22, Foster 85-60.

2.2 ADHESIVE

.1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29C to plus 93C.

.3 Standard of Acceptance: Duro Dyne 1A-22, Foster 85-60.

2.3 FASTENERS

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

.2 Standard of Acceptance: Duro Dyne PN series with NC or PC-1 series clips.

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

.2 Standard of Acceptance: Duro Dyne FT-2, Foster 42-24.

2.5 SEALER

.1 Meet requirements of ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68C to plus 93C.

.3 Standard of Acceptance: Duro Dyne S-2, Foster 30-35.

3.0 EXECUTION

3.1 GENERAL

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, include 1" [25mm] duct lining where lining is specified.

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

3.3 JOINTS

.1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply 2 coats of sealer over tape.

.2 Replace badly damaged areas of liner at discretion of Departmental Representative.

.3 Protect leading and trailing edges of each duct section with sheet metal nosing having 15 mm overlap and fastened to duct.

END OF SECTION 23 33 53

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 91 13 – General Commissioning (Cx) Requirements

.4 Section 23 05 00 Paragraph 2.3 - Guards

.5 Section 23 05 48 - Vibration Isolation and Seismic Control

.6 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

.1 AMCA 99- 1986, Standards Handbook.

.2 ANSI/AMCA 210- 1985, Laboratory Methods of Testing Fans for Rating.

.3 AMCA 300- 1985, Revised 1987, Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301- 1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.5 ANSI/ASHRAE 51- 1985, Laboratory Methods of Testing Fans for Rating.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Include:

.1 Fan performance curves showing specified point of operation and efficiency.

.2 Sound rating data.

.3 Indicate:

.1 Motors, sheaves, bearings, shaft details

.2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

.2 Extra materials

.3 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

2.0 PRODUCTS

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.3 Sound ratings: comply with AMCA (Air Moving and Conditioning Association) 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.5 Motors:

.1 Open drip proof outside of air stream, TEFC when in air stream, explosion proof as indicated in accordance with NEMA MG1.

.2 For use with variable speed controllers where specified.

.3 Sizes as specified.

.4 Two speed with two windings and speeds of approximately 1200 or 900 r/min low and 1800 r/min high as indicated.

.5 Two speeds with split winding, constant horsepower or constant or variable torque as specified and speeds as indicated.

.6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards, fan inlet outlet safety screens, inlet outlet dampers and vanes and as indicated.

.7 Factory primed before assembly in colour standard to manufacturer.

.8 Scroll casing drains: as indicated.

.9 Factory primed before assembly in colour standard to manufacturer.

.10 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Control for HVAC Piping and Equipment.

.11 Flexible connections: to Section 23 33 00 – Air Duct Accessories.

2.2 CABINET FANS - GENERAL PURPOSE

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheels with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, direct drive or V-belt drive and guard outside casing.

.3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be painted over with corrosion resistant paint to CGSB 1.181. Finish inside and out, over prime coat, with rust resistant enamel to Section 09 91 13 – Exterior Painting. Internally line cabinet with 12-25 mm thick rigid acoustic insulation, pinned and cemented, complete with metal nosings on all exposed edges.

2.3 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive as indicated.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

.3 Acceptable Product: Trane, Sheldons, Barry Blower, Cook, Penn, Woods, Greenheck.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Control for HVAC and Piping Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 – Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 COMMISSIONING

.1 Commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION 23 34 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 – Closeout Submittals

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

1.3 SAMPLES

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

1.4 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.5 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

1.6 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

2.0 PRODUCTS

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board and as specified.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: standard.

.5 Standard of Acceptance: Titus, EH Price, Nailor

2.2 SUPPLY GRILLES AND REGISTERS

.1 Type F: aluminum, double deflection with airfoil shape, long dimension face and short dimension rear bars, with opposed blade dampers. Finish: Standard White.
Model: Titus 272FL-1A-AG35-26, Price 620D-FLA-B12

.2 Type Fs: Extruded Aluminium, Spiral Duct Grille, Double deflection, 3/4" Blade spacing, Front blades parallel to Short dimension, Steel opposed blade damper. White powder coat finish. Model: Price SDGE-A--VCS3-B12,

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Type B: aluminum,fixes louvre 45deg deflection ¾" [19mm] long dimension face and short dimension rear bars. Finish: Standard White.
Model: Titus 350FL-1-26, Price 630-FLA-B12

.2 Type C: aluminum "Egg-crate" 1/2" x 1/2" [12mmx12mm] grid w/flat surface mount white finish frame) Model: Price 80F-B12

.3 Type G: aluminum,fixes louvre 45deg deflection ½" [12] long dimension face and short dimension rear bars. Finish: Standard White.
Model:, Price 635-FLA-B12

2.4 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and gaskets.

.2 Type J: Round Cone Diffuser, Aluminum, Fully Adjustable, White powder coat finish. Model: Price RCDA-B12, .

2.5 DOOR GRILLES

.1 Door Grilles: Aluminium, Flat border both sides, concealed fastening, Aluminium powder coat finish. Model: Price ATG1C-B15

3.0 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

END OF SECTION 23 37 13

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Waste Management and Disposal.

.3 Section 01 78 00 – Closeout Submittals.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA).

.2 ASTM E90-90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Indicate the following for all louvres:

.1 Pressure drop.

.2 Face area.

.3 Free area.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals

.1 Certification of Ratings

.2 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.5 TEST REPORTS

.1 Submit certified data for all louvres from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - 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.

2.0 PRODUCTS

2.1 WALL MOUNT OUTSIDE AIR INTAKES AND RELIEF VENTS

.1 Factory manufactured aluminum.

.1 Complete with integral bird screen of 2.7 mm dia stainless steel wire. Use 12 mm mesh on exhaust 19 mm mesh on intake.

.2 Maximum throat velocity: 3.3 m/s intake.

.3 Maximum loss through unit: 15 Pa exhaust static pressure.

.4 Maximum velocity through damper area: 1.5m/s.

.5 Shape: as indicated.

.2 Standard of Acceptance: Carnes Co. Inc., Greenheck Fan Corp., Jenn Air Corp, Penn Ventilator Canada Ltd., E.H. Price., Ruskin, Airolite Co, Broan.

2.2 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: storm proof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194- SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, stainless steel washer and aluminum body.

.7 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm dia wire aluminum birdscreen on inside face of louvers in formed U-frame.

.8 Finish: prime coated.

.9 Standard of Acceptance: Ruskin, Greenheck, EH Price, Airolite

3.0 EXECUTION

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks as indicated.

.3 Anchor securely into opening. Seal with caulking all around to ensure weather tightness.

.4 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.

.5 Bolt grilles, registers and diffusers, in office in workshop, storage and hangar area.

END OF SECTION 23 37 20

1.0 GENERAL

1.1 RELATED SECTIONS:

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 74 00 – Cleaning and Waste Management

.4 Section 01 74 19 – Waste Management and Disposal.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.1, Gravimetric and Dust Spot for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI Approved).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.14, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.3 CAN/CGSB-115.15, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.

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

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters' Laboratories of Canada (ULC)

.1 ULC-S111, Standard Method of Fire Tests for Air Filter Units.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) 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.

.1 Indicate following:

.1 Pressure drop.

.2 Installation procedures.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

.3 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply one (1) complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals

2.0 PRODUCTS

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 □C.

.2 Number of units, size as recommended by manufacturer and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

.4 Acceptable Product: Farr, Cambridge, American Air Filter.

2.2 ACCESSORIES

.1 Holding frames: permanent "T" section or channel section construction of galvanized steel or same material as casing/hood, 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side and/or from upstream face of filter bank.

2.3 FIBROUS GLASS PANEL FILTERS

.1 Disposable fibrous glass media: to CAN/CGSB-115.10 with adhesive.

.2 Holding frame: 1.2 mm minimum thick galvanized steel with 3 mm diam hinged wire mesh screen.

.3 Performance: minimum average synthetic dust weight arrestance 70 %.

.4 Fire rated: to ULC -S111.

.5 Nominal thickness: 50 mm.

2.4 CARTRIDGE TYPE FILTERS, 80-85 % EFFICIENCY

.1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.

.2 Holding frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

.4 Performance: average atmospheric dust spot efficiency 80-85 % to ASHRAE 52.1.

.5 Fire rated: to ULC -S111.

2.5 CARTRIDGE TYPE FILTERS 95 % EFFICIENCY

.1 Media: disposable, high efficiency, to CAN/CGSB-115.15.

.2 Holding frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

.4 Performance: average atmospheric dust spot efficiency 95 % to ASHRAE 52.1.

.5 Fire rated: to ULC -S111.

2.6 HEPA ABSOLUTE PACKAGE FILTERS 99.97 % EFFICIENCY

.1 Media: water resistant fibrous glass.

.2 Holding frame: cadmium plated steel by unit manufacturer.

.3 Housing and sealing system: manufacturers' standard, suitable for pressure application.

.4 Efficiency: minimum 99.97 % overall on hot DOP test, using 0.003 mm particles.

3.0 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION GENERAL

.1 Install in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

3.3 ACTIVATED CARBON TYPE FILTERS

.1 During testing, adjusting and balancing, install substitute media.

.2 Install permanent media only after all painting is completed.

3.4 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.5 HEPA FILTERS

.1 Use components and devices recommended by manufacturer to ensure complete integrity and to ensure easy removal and replacement, even when dressed in anti-contamination clothing.

.2 Provide proper permanent facilities for challenging integrity with aerosol injector downstream of pre-filters and test sampling manifold downstream of HEPA filter. Location of injector and sampling manifold to be approved by manufacturer.

.3 During TAB, install substitute media having similar pressure drop.

.4 Before acceptance, perform tests to demonstrate integrity of complete installation.

3.6 FILTER GAUGES

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning and Waste Management .

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 44 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 19 – Waste Management and Disposal.

.3 Section 01 74 10 – Cleaning and Waste Management

.4 Section 01 78 00 – Closeout Submittals

.5 Section 01 91 13 – General Commissioning (Cx) Requirements.

.6 Section 23 33 00 – Air Duct Accessories

.7 Section 26 05 01 – Common Work Results – Electrical

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 84-2008, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).

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

.1 Material Safety Data Sheets (MSDS).

1.3 SHOP DRAWINGS AND PRODUCT DATA:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include product characteristics, performance criteria, and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Contract Submittals

1.5 CERTIFICATES:

.1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – 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.

1.8 MAINTENANCE

.1 Furnish list of individual manufacturer's recommended spare parts for equipment include:

.1 Bearings and seals.
.2 Addresses of suppliers.
.3 List of specialized tools necessary for adjusting, repairing or replacing.

2.0 PRODUCTS

2.1 AIR TO AIR HEAT EXCHANGER

.1 The heat exchanger shall be a plate type [polypropylene] cross-flow core. Enthalpy core is optional.

.2 The core shall have cross leakage of less than 2%.

.3 1” pleated filters shall be located in each air stream before the heat exchanger core and must be completely accessible for cleaning or replacement. They shall have a 30%-40% ASHRAE dust spot efficiency.

2.2 MOTORS/BLOWERS

.1 Unit shall be equipped with 2 (two) forward curve, dual inlet impellers using permanently sealed bearings.

.2 Motors of HRV shall operate at a maximum of 1275 RPM and be capable of operating at two speeds.

.3 Low speed shall be field adjustable using the on-board microprocessor to between 40% and 70% of high speed.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

.3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils and dampers.

3.3 COMMISSIONING

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 10 Cleaning and Waste Management.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 72 00

1.0 GENERAL

1.1 SUMMARY

.1 Materials and installation for self-contained multizone and single zone, gas, electric, hot water and refrigeration packaged rooftop HVAC units.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 29 – Health, Safety, and Emergency Response Procedures

.3 Section 01 45 00 – Quality Control

.4 Section 01 74 00 – Cleaning and Waste Management

.5 Section 01 78 00 – Closeout Submittals.

.6 Section 01 91 13 – General Commissioning (Cx) Requirements.

.7 Section 09 91 13 – Exterior Painting

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/Air Conditioning and Refrigeration Institute (ARI)

.1 ANSI/ARI 210/240, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
.2 ARI 270, Sound Rating of Outdoor Unitary Equipment.

.2 ANSI/UL 1995 B, Standard for Heating and Cooling Equipment.

.3 Canadian Standards Association (CSA)

.1 CSA B52, Mechanical Refrigeration Code.
.2 CSA C22.1, Canadian Electrical Code.

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

.1 Material Safety Data Sheets (MSDS)

.5 National Roofing Contractors Association (NRCA)

.6 National Fire Protection Association (NFPA)

.1 NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.7 American Bearing Manufacturer's Association (ABMA)

.1 ANSI/ABMA 9 Load Ratings and Fatigue Life for Ball Bearings
.2 ANSI/ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.

.8 Air Movement and Control Association (AMCA)

.1 AMCA 300 Reverberaut Room Method for Sound Testing of Fans.

.9 National Electrical Manufacturer's Association (NEMA)

.1 NEMA MG1 Motors and Generators

.2 NEMA ICS 7-1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

.10 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for packaged rooftop HVAC units.

.3 Submit WHMIS MSDS in accordance with Section 02 62 00.01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.4 Shop Drawings:

.1 Submit shop drawings to indicate project layout and dimensions; indicate:

.1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.

.2 Piping, valves, fittings shipped loose showing final location in assembly.

.3 Control equipment shipped loose, showing final location in assembly.

.4 Complete internal panel pneumatic tube piping and wiring and external panel pneumatic tube piping and wiring, both as schematics and as actually assembled.

.5 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

.6 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.

.7 Pump and fan performance curves.

.8 Details of vibration isolation.

.9 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.

.10 Type of refrigerant used.

.5 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Instructions: submit manufacturer's installation instructions.

.8 Manufacturer's Field Reports: manufacturer's field reports specified.

.9 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include data as follows:

.1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.

.2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning and Waste Management. Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.3 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan (WMP).

.4 Handle and dispose of hazardous materials in accordance with Canadian Environmental Protection Act (CEPA), Transportation of Dangerous Goods Act (TDGA), Regional and Municipal, regulations.

.5 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

1.7 WARRANTY

.1 Contractor hereby warrants that packaged rooftop HAVC units and refrigeration compressors will function and operate in accordance with GC 31.1, but for 24 months.

2.0 PRODUCTS

2.1 GENERAL

.1 Roof mounted, self-contained single zone unit with electric heating elements and DX refrigeration and bear label of CSA.

.2 Units to consist of cabinet and frame, supply fan, control, air filter, refrigerant cooling coil, compressor, condenser coil and fans, motorized outside air damper, return damper, motorized exhaust damper, economizer and barometric relief damper.

.3 Prefabricated roof curb to conform to requirements of National Roofing Contractors Association (NRCA), minimum height 355 mm (14").

.4 Conform to ANSI/ARI 210/240, rating for unit larger than 40 kW nominal.

2.2 CABINET

.1 Cabinets: weatherproofing tested and soundproofing tested to ARI 270, dbA at 3 m free field.

.2 Framing and supports: 2 mm thick welded steel, galvanized after manufacture, with lifting lugs at top of unit and/or fork lift slots at bottom.

.3 Outer casing: weathertight galvanized steel with baked enamel finish, to Section 09 91 13 - Exterior Painting.

.4 Access: removable gasketted hinged doors or panels with locking door handle type or screwdriver operated flush cam type fasteners.

.5 Insulation: neoprene coated glass fiber on surfaces, 50 mm thick, 32 kg/m^{3}density.

2.3 FANS

.1 Centrifugal, forward curved impellers, backward inclined, or airfoil, statically and dynamically balanced. Multi V-belt drive with adjustable variable pitch motor pulley, rubber spring isolated hinge mounted motor fan, and motor integrally mounted on isolation base, separated from unit casing with flexible connections and spring isolators. Vibration isolators: 95% efficiency.

2.4 AIR FILTERS

.1 50 mm thick, 30 % efficiency, metal framed, replaceable media or throwaway.

.2 To meet NFPA 90A, air filter requirements type Class 1 or type Class 2.

2.5 ELECTRIC HEATERS

.1 Nickel chromium electric resistant type, 64.6 kW/m ^{2} – stage maximum density at 2.5 m/s.

.2 Controls:

.1 Panel board with multi- stage or modulating SCR controller.
.2 Indicating light centre.
.3 Remote thermostats as indicated.
.4 Fuseblocks (one per step unless otherwise specified).
.5 Built-in control transformer.
.6 Thermal cut outs: manual reset disc types, one per circuit, one linear bulb type automatic reset.
.7 Built-in un-fused disconnect switch.
.8 Elements control: accessible with protection against no air flow, short and grounds, and of self checking type.
.9 High limit temperature control: de-energize heating elements to protect against over heating.
.10 Supply fan: start before electric elements are energized and continue operating until temperature reaches minimum setting. Include switch for continuous fan operation.
.11 Conform to Canadian Electrical Code CSA C22.1.

2.6 REFRIGERATION

.1 Conform to CSA B52 and ANSI/UL 465 requirements.

.2 Compressor/condenser section:

.1 Semi-hermetic or hermetic compressors, vibration isolated with flexible suction and discharge connections, oil sight glass, oil pressure switch, crankcase heater, and automatic pump down system with control to liquid line solenoid valve.
.2 Fans: propeller type with single piece spun venturi outlets and zinc plated guards. Motors shall be sequenced for head pressure control.

.3 Electrical system shall have operating controls, oil and refrigerant pressure protection, motor overload protection, weatherproof electrical wiring with weatherproof, rain tight disconnect.

.4 Include refrigerant piping with, sight glass, filter drier and valves.

.5 Condenser: staggered copper tube, aluminum fin coil assembly with sub-cooling rows to provide 6 ^{0}C sub-cooling.

.6 Capacity reduction: cylinder unloading. Provide flooding for head pressure control for low ambient operation down to 0 ^{0}C ambient temperature.

.7 Refrigerant: R 410A.

.3 Evaporator:

.1 Rated to ANSI/ARI 210/240.

.2 Thermostatic expansion valve, with adjustable super heat and external equalizer.

.3 Coil: NPS 1/2 or NPS 5/8 od staggered seamless copper tubes expanded into aluminum fins and insulated condensation pan.

.4 Cooling coil condensate drain pans: designed to avoid standing water, to be easily cleaned or removable for cleaning. Drain connection to have deep seal trap and be complete with trap seal primer.

2.7 CONTROLS

.1 In addition to safety controls, provide smoke sensors in return to NFPA standards, low limit on supply and freeze protection on water coils.

.2 Single Zone Heat-Cool Unit

.1 Low voltage, adjustable room thermostat controls, heater stages in sequence with delay between stages, compressor and supply fan shall maintain room temperature setting.

.2 Thermostat: include system selector switch day-night, heat-cool-auto-off and fan control switch (on-auto).

.3 Mixed air controls: maintain 13 ^{0}C mixed air temperature, lock out compressor below 14^{0}C ambient, restart 17^{0}C.

.3 Night mode: unit cycles as unit heater with 100% recirculation on winter cycles.

.4 Night set-back: 15 ^{o} C.

2.8 REMOTE PANEL

.1 Provide remote readout panel for each unit containing:

.1 Signal lights indicating system status, heating system failure cooling system failure and dirty filters.

.2 Check switches proving signal light operation.

.3 System on-off switch.

.4 Fan on-off switch.

.5 Manual 6hr timer to override night-set back control.

.2 Provide gauges in remote panel indicating outside air, mixed air, return air and discharge air temperatures for each deck before heat exchangers.

2.9 CAPACITY

.1 Capacity: see schedules.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install as per manufacturers' instructions on roof curbs provided by manufacturer.

.2 Manufacturer's representative to certify installation, supervise start-up and commission unit.

.3 Run drain line from cooling coil condensate drain pan to discharge over roof.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Have manufacturer's representative of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 25% and 60% complete.

.3 Upon completion of work, after cleaning is carried out.

.2 Obtain reports within 3 days of review and submit immediately to Owner's Representative.

.3 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.

.4 Verify accessibility, cleanability, drainage of drain pans for coils, humidifiers.

.5 Performance Verification:

.1 Rooftop Air Handling Units:

.1 Set zone mixing dampers for full cooling, except that where diversity factor forms part of design set that % of zone dampers to full heating.

.2 Set outside air and return air dampers for minimum outside air.

.3 Set face and bypass dampers so face dampers are fully open and bypass dampers are fully closed.

.4 Check for smooth, vibrationless correct rotation of supply fan impeller.

.5 Measure supply fan capacity.

.6 Adjust impeller speed as necessary and repeat measurement of fan capacity.

.7 Measure pressure drop for each component of air handling unit.

.8 Set outside air and return air dampers for the % of outside air required by design and repeat measurements of fan capacity.

.9 Reduce differences between fan capacity at minimum and maximum outside air less than 5 %.

.10 Set face and bypass dampers to full bypass and repeat measurement of fan capacity.

.11 Reduce difference between fan capacity with F&BPD fully closed to bypass and fully open to bypass to less than 5 %.

.12 Reduce difference between fan capacity at full cooling and fan capacity at full heating to less than 5 %.

.13 OAD: verify for proper stroking, interlock with RAD.

.14 Measure DBT, WBT of SA, RA, EA.

.15 Measure air cooled condenser discharge DBT.

.16 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.

.17 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.

.18 Use smoke test to verify no short-circuiting of EA, relief air to outside air intake or to condenser intake.

.19 Simulate maximum heating load and:

.1 Verify temperature rise across heat exchanger.

.2 Perform flue gas analysis. Adjust for peak efficiency.

.3 Verify combustion air flow to heat exchanger.

.4 Simulate minimum heating load and repeat measurements.

.20 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.

.21 Verify operating control strategies, including:

.1 Heat exchanger operating and high limit.

.2 Early morning warm-up cycle.

.3 Freeze protection.

.4 Economizer cycle operation, temperature of change-over.

.5 Alarms.

.6 Voltage drop across thermostat wiring.

.7 Operation of remote panel including pilot lights, failure modes.

.22 Set zone mixing dampers for full heating and repeat measurements.

.23 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5 %.

.24 Measure return fan capacity.

.25 Adjust impeller speed as necessary and repeat measurement of return fan capacity.

.26 Check capacity of heating unit.

.27 Measure DX refrigeration system performance as specified Section.

.28 Refer to other sections of these specifications for PV procedures for other components.

.2 Verify accessibility, serviceability of components including motorized dampers, filters, coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.

.3 Verify accessibility, clean ability, drainage of drain pans for coils, humidifiers.

.6 Commissioning Reports:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports supplemented as specified herein. Include:

.1 Report forms as specified Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.

3.4 DEMONSTRATION

.1 Training: in accordance with Section 01 91 13- General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified.

3.5 CLEANING

.1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and in accordance with manufacturer's recommendations.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 74 00

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 78 00 – Closeout Submittals

.3 Section 23 05 48 – Mechanical Sound, Vibration and Seismic Control

1.2 REFERENCES

.1 Air-Conditioning and Refrigeration Institute (ARI)

.1 ARI 210/240, Standard for Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.2 ARI 270 Sound Rating of Outdoor Unitary Equipment

.3 310/380-04 Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)

.4 ARI 340/360 Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

.2 American National Standards Institute (ANSI)

.1 S12.51-02 Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Method for Reverberation Rooms.

.3 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)

.1 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.

.4 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.

.2 90.1-04 Energy Standard for Buildings except Low-Rise Residential Buildings

.3 2004 Handbook HVAC Systems and Equipment

.5 Canadian Standards Association (CSA)

.1 CAN/CSA-C273.3- M91, Performance Standard for Split-System Central Air-Conditioners and Heat Pumps.

.2 CAN/CSA-C656, Performance Standard for Single Package Central Air Conditioners and Heat Pumps.

.6 Environment Canada

.1 EPS 1/RA/2, Code of Practice for the Reduction of Chlorofluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada, Ozone-Depleting Substances Alternatives and Suppliers List.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Sections 01 33 00 – Submittal Procedures.

.2 Indicate:

.1 Capacities.

.2 ARI Ratings.

.3 Sound Power levels.

.4 Installation instructions.

.5 Start-up Instructions.

.6 O&M, Instructions.

1.4 WARRANTY

.1 Base Limited Warranty Period: Coil, Parts – one (1) year.

Base Limited Warranty Period: Compressor – five (5) years.

2.0 PRODUCTS

2.1 GENERAL

.1 Heat pumps to be EPS 1/RA/2, CSA approved and carry ARI or CSA certification seal.

2.2 REFRIGERANTS

.1 Type of Refrigerant. R410A

2.3 DRAIN PANS

.1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 AIR-SOURCE HEAT PUMP

.1 Casing: Unit shall be constructed of zinc coated, 14-gage minimum galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit surfaces shall be tested 500 hours in a salt spray test in compliance with ASTM B117. Cabinet panels shall have lifting handles and shall be water- and air-tight seal. All exposed vertical, top covers and base pan shall be insulated with 13-mm (1/2–inch) matt-faced, fire-resistant, odorless, glass fiber material. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.The base of the unit shall have provisions for forklift and crane lifting.

.2 Filters: 1inch (25mm), throwaway filter shall be standard on all units below 26.4 kW (7-1/2 Tons). Filter rack can be converted to two inch (50mm) capability. Two inch (50mm) filters shall be factory supplied on all units above 26.4 kW (7-1/2 Tons).

.3 Compressors: Compressors shall be direct-drive, hermetic scroll type with centrifugal type oil pumps. Motor shall be suction gas-cooled. Internal overload shall be provided with the scroll compressors. Crankcase heaters shall be utilized with all compressors.

.4 Refrigerant Circuit: A minimum of two circuits is required. Each refrigerant circuit shall have independent fixed orifice or thermostatic expansion devices, service pressure ports, and refrigerant line filter driers factory installed as standard. An area shall be provided for replacement suction line driers.

.5 Evaporator and Condenser Coils: Internally finned, DN 10 (NPS 3/8) copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. The evaporated coil and condenser coil shall be leak tested at the factory to 1378 kPa (200 psig) and pressure tested to 2756 kPa (400 psig). All dual compressor units shall have intermingled evaporator coils. Sloped condensate drain pans are standard.

.6 Outdoor fans: Direct driven, statically and dynamically balanced, draw-through. The fan motors shall be permanently lubricated and shall have built-in thermal overload protection.

.7 Indoor Fan: Motors shall be thermally protected. Oversize motors shall be available for high static application. Motors shall meet the U.S. Energy Policy Act of 2005 (EPACT).

.8 Defrost Controls: A time initiated, temperature terminated defrost system shall ship with a setting of 70-minute cycle, with a choice of 50- or 90-minute cycle. Timed override limits defrost cycle to 10 minutes shall be available on units from 35- to 70-kW (10 to 20 tons). Adaptive demand defrost shall be provided on units below 26.4 kW (7-1/2 Tons).

.9 Controls: Factory wired with controls and contactor pressure lugs or terminal block for power wiring. Micro-processor controls shall be provided for all 24-volt control functions. The resident control algorithms shall make heating, cooling, and ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. Controls shall include an anti-short-cycle timing and time delay between compressors.

.10 Accessories:

.1 Electric Heater: Constructed of heavy-duty nickel chromium elements. Staging shall be achieved through the unit control processor. Each heater shall have automatically reset high limit control. Heaters shall be individually fused from the factory and shall comply with NEC and CEC requirements. Power assemblies shall provide single point connection. Electric heat modules shall be listed and labelled by a national recognized testing laboratory acceptable to authorities having jurisdiction.

.2 Economizer: Down flow factory installed; and shall include fully modulating 0-100 percent motor and dampers, barometric relief, minimum position setting and fixed dry bulb.

.3 Oversized Motors: // Factory installed over sized motor shall be available for high-static application.

2.5 CONTROLS: HEAT PUMP

.1 Master Controller to maintain loop temperature, set points, and monitor pressures and confirm pump flows.

.1 Interlocks provided by Controls Subcontractor

3.0 EXECUTION

3.1 INSTALLATION

.1 Install where indicated and in accordance with manufacturer’s instructions.

.2 Install electrical and control devices furnished by the manufacturer but not specified to be factory mounted. All electrical work shall conform to Electrical Sections.

.3 Install housekeeping pad.

.4 Secure with hold-down bolts.

.5 Where applicable provide Seismic bracing as required under Section Vibration Isolation and Seismic Control Measures.

.6 Make all duct connections through flexible connections.

.7 Level unit with fans running. Align ductwork. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.8 Make all piping connections.

.9 Nothing to obstruct ready access to all components or to prevent removal of components for servicing.

3.2 SEISMIC BRACING:

.1 Comply with requirements in Section 23 05 48, Mechanical Sound, Vibration and Seismic Control.

3.3 DRAIN PANS

.1 Install so that no water can accumulate and arrange so as to be easily accessible for cleaning.

3.4 START-UP AND COMMISSIONING

.1 Manufacturer to certify installation.

.2 Manufacturer to be present during start-up and certify performance.

.3 Manufacturer to provide verbal, and written instructions to operating personnel.

.4 Submit written report to Departmental Representative.

END OF SECTION 23 81 43

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Divisions 26, 27, and 28. This section supplements requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.5 except where specified otherwise.

.3 Building requirements shall meet the requirements of the current edition of the 2015 National Building Code.

1.3 ACRONYMS

.1 DFO: Department of Fisheries and Oceans

1.4 GENERAL REQUIREMENTS

.1 Refer to Section 01 14 00 – Work Restrictions for information on shutdowns and work restrictions.

.2 The contractor shall supply all labour, materials, tools, equipment, transportation required for the complete installation, wiring and testing of the system shown on the drawings and described in the specifications and is responsible for reviewing architectural, mechanical, and structural drawings for discrepancies and report to the Departmental Representative.

.3 The electrical drawings indicate the general location and route. Conduit and/or wiring shall be installed to provide a complete operating system and shall be installed to provide physically to conserve headroom, furring spaces, etc.

.4 The drawings and specifications complement each other and what is called for by one is binding as if called for by both. If there is any doubt as to the meaning of the true intent due to a discrepancy between the drawings and the specifications, obtain ruling from engineer prior to tender closing. Failing this, the specifications take precedence.

.5 Electrical drawings are diagrammatic and do not show all conduit, wire, cable, etc. The contractor shall provide conduit, wire, cable, etc. to form a complete and safe electrical system to meet in all respects the intent of the drawings and specifications. Electrical drawings do not show all architectural, structural, or mechanical details.

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.6 It is the responsibility of the contractor to determine as to which sub-trade provides specific labour and materials. Extras will not be considered based on differences in interpretation as to which trade is to provide certain items.

1.5 MINOR FIELD CHANGES

.1 The location, arrangement, and connection of equipment and material as shown in the Drawings represent a close approximation for the intent and requirements of the contract. The right is reserved by Departmental Representative to make reasonable changes as required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to the owner unless the location, arrangement, or connection is more than 3 meters from that shown or the item in question has already been installed. Confirm final location prior to installation.

1.6 MECHANICAL EQUIPMENT CONTROL

.1 The Contractor shall co-operate/coordinate with the supply and installation of conduit and wiring for the line voltage mechanical controls and equipment interlocking. Low voltage controls form part of the control specifications.

.2 Provide line voltage power supply connections to all mechanical equipment.

.3 Confirm location, ampacity, voltage, and phase of all mechanical equipment before connection. Report any major discrepancies to Departmental Representative.

1.7 EMERGENCY EQUIPMENT

.1 All emergency systems associated with building code requirements such as fire alarms must not be altered without the approval of the Departmental Representative. Such unauthorized changes may result in occupancy permit delays.

1.8 SEISMIC

.1 All electrical equipment is to be secured to the building structure to meet the seismic requirements for the building code. The Contractor shall pay for and obtain a seismic design from a registered structural engineer showing the fastening details of all electrical material and hire the structural engineer to provide EGBC schedules S-B and S-C prior to final inspection.

1.9 FIRE SEPARATIONS

.1 The contractor shall provide fire stopping for all electrical penetrations through fire rated assemblies.

.2 Fire stop systems shall, when subjected to the fire test method in CAN 4-5115-M “Standard method of fire tests of fire stop systems”, have an F or FT rating (as required) not less than the rating of the fire separation.

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.3 The contractor shall provide to Departmental Representative complete listings for all fire stopping installations. Provide specific details regarding type of fire stopping compound, applicable applications, manufacturer, testing, agency, etc.

.4 Contractor shall notify Departmental Representative a minimum of one week prior to concealing of enclosing fire stop assemblies and be available on site for Departmental Representative's field review.

1.10 AS BUILT DRAWINGS

.1 Provide as built drawings in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide a clean set of drawings to Departmental Representative for as built modifications only.

.3 Mark all modifications in red, in a neat, legible manner.

.4 Submit as builts to the Departmental Representative for approval.

1.11 MAINTENANCE AND OPERATION MANUAL

.1 Provide maintenance and operations manual in accordance with Section 01 78 00 – Closeout Submittals.

.2 Manuals to include the following:

.1 Project contact information
.2 Approved shop drawings
.3 Warranties and guarantees
.4 Test results
.5 Load balance results on each panel
.6 As-built drawings
.7 Seismic schedules S-B and S-C
.8 BC Safety Authority Field Safety Representative request for final inspection and inspection report if completed

1.12 CARE, OPERATION AND START-UP

.1 Instruct DFO personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

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1.13 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Fold up metal banding, flatten and place in designated area for recycling.

.6 Place materials defined as hazardous or toxic waste in designated containers.

.7 Ensure emptied lighting containers are sealed and stored safely for disposal away from children.

.8 Dispose of unused batteries at official hazardous material collections site approved by Departmental Representative.

1.14 LOW VOC MATERIALS

.1 All adhesives and sealants used within the weather barrier shall be “Low-VOC” and comply with SCAQMD rule #1168.

.2 All paints and coatings used within the weather barrier shall be “Low-VOC” and comply with GC-11, GC-03, GS-69, and SCAQMD rule #1113.

1.15 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.16 PERMITS, FEES AND INSPECTION

.1 Submit to BC Safety Authority and BC Hydro necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated permit fees.

.3 Departmental Representative will provide drawings and specifications required by BC Safety Authority and BC Hydro at no cost.

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.4 Notify Departmental Representative of changes required by BC Safety Authority prior to making changes.

.5 Furnish Certificates of Acceptance from BC Safety Authority on completion of work to Departmental Representative.

1.17 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from BC Safety Authority.

.3 Factory assemble control panels and component assemblies.

.4 All exterior mounting hardware shall be stainless steel unless noted otherwise.

1.18 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23 and shown on mechanical drawings.

1.19 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.20 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with stainless steel self tapping screws.

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NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English.

.7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.8 Panel boards: indicate panel designation, voltage, phase configuration, and current rating.

.9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.10 Terminal cabinets and pull boxes: indicate system and voltage.

.11 Transformers: indicate capacity, primary and secondary voltages.

1.21 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.22 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

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.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

1.23 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.24 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.25 WARNING SIGNS

.1 As specified and to meet requirements of BC Safety Authority and Departmental Representative.

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

1.26 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Provide single line electrical diagrams under plexiglass as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Electrical power generation and distribution systems: locate in power plant rooms.

.2 Drawings: 600 x 600 mm minimum size.

1.27 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Drawings

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

1.28 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

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.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at heights indicated on Drawings.

1.29 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prior to ordering of any equipment, Contractor shall submit three copies of shop drawings and detail drawings for review by Departmental Representative. Shop drawings shall be submitted for all major equipment.

.3 All shop drawings submitted to Departmental Representative shall bear the Contractor's approval stamp.

.4 All shop drawings shall bear the name of the manufacturer and/or manufacturer's representative.

.5 Submit shop drawings for at least the following items:

.1 All distribution panel boards, disconnect switches, circuit breakers, instrumentation transformers and relays, etc.

.2 Motor control equipment including starters, contactors, overload and heater data, control relays, time delay relays, motor circuit, and control circuit fuses/breakers and applicable pilot lights, control transformers, and selector switches, etc.

.3 Lighting fixtures, dimensions, weights, etc, photometric data, lamp information, and ballast information.

.4 Vacancy sensor switches

.5 Motion sensors

.6 Timeclock

.7 Fire alarm system components including component data sheets, zone schedules, annunciator configuration, wiring diagrams, and testing procedures, etc.

.8 Custom mounting brackets.

.9 Generator, alternator, enclosure, and ATS.

.10 Baseboard and forced flow heaters and related control devices.

.11 Float kiosks and cabinets

1.30 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

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.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.31 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 RPVC, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.32 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.

.3 Conduct and pay for following tests:

- .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems:
  - .1 Fire alarm system verification
  - .2 Data and telephone outlets/cabling.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

□

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.6 Carry out tests in presence of Departmental Representative.

.7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.8 Submit test results for Departmental Representative review.

1.33 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Specifications for marine electrical components

1.2 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.3 REFERENCES

.1 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.2 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Power outlet pedestal

.1 Main Housing:

.1 The housing shall a type 3R enclosure

.2 Constructed of 16 gauge stainless steel and shall be coated with UV-resistant polyester resin powder coating.

.3 Include lamicoid label indicating “Marine Receptacle Kiosk ‘X’” and the circuits that fee the pedestal.

.2 Lighting Assembly / Housing:

.1 Shall be a type 3R enclosure

.2 May be constructed of:

.1 1/8" thick injection molded heavy resin material and shall be coated with a UV-resistant water based acrylic polymer; OR

.2 16 gauge, 316L stainless steel and shall be coated with UV-resistant polyester resin powder coating.

.3 Each pedestal shall be equipped with 3-5W 360 degree LED light, that is controlled by an electromechanical photocell and protected by a decidated single pole

.4 The power pedestal shall be completely pre-wired at the factory to the load side of the compression lug assembly.

.5 All load copper wiring shall be of high stranding and tin plated to resist corrosion.

.6 Distribution

□

.1 Shall include tin plated copper bus bar system to support the overall required ampacity of each pedestal on each phase.

.2 Include dedicated breaker for each receptacle and the integral light

.3 All exposed metallic parts must have an integral ground that is a part of the equipment grounding system.

.7 Receptacles:

.1 All receptacles shall be mounted behind a lockable weatherproof, hinged door that is under tension to ensure proper closing pressure when the receptacle is or is not in use.

.2 All receptacles under shall be of the corrosion resistant type conforming to the configurations shown on the Drawings.

.3 Include lamicoid labels for each receptacle indicating model number and/or NEMA configuration, voltage, ampacity, number of phases and circuit number.

.8 Hose/Cable Bracket:

.1 Fabricated from stainless steel and be strong enough to support a water hose or 50' of 50 Amp, four-conductor boat SOW cord.

.9 Acceptable manufacturers include:

.1 Eaton

.2 Valid Manufacturing

.3 AC Dandy

.2 Power distribution kiosk

.1 Kiosk dimensions are approximate only. Contractor to determine final kiosk dimensions to layout all of proposed equipment.

.2 NEMA 3R

.3 Single or double door unit. Door to be hydraulic activated to hold door open in windy conditions. All door hardware and hinges to be stainless. Doors shall be pad-lockable. Doors shall include gaskets to prevent the ingress of pests.

.4 All power and communications wiring shall be contained in RPVC conduit

.5 All internal control wiring, device installation, and conduit work shall be completed prior to shipping to site.

.6 Fabricated from marine grade aluminum or stainless steel

.7 Continuously welded assembly that includes full floor and aluminum backplane for equipment mounting.

.8 Include 2 x 25mm drainage hole at front of kiosk to allow for drainage of any accumulated water. Include bug screens for holes.

.9 Include top and bottom louvres for passive convection cooling that is sufficient to cool the transformer in ambient temperatures up to 30 deg C. Include bug screens for all louvers.

.10 All electrical equipment included in the kiosk shall be NEMA 3R

.11 Include lamicoid labels for:

.1 Exterior of door that reads “Dock Power Distribution Kiosk”

□

.2 All panels, transformers, and disconnect switches that indicate device name, voltage, size, ampacity, and number of phases.

.12 Approved manufacturers include Valid Manufacturing and West Coast Electric.

.3 Marine supports and hardware

.1 All fastening hardware shall be marine grade 316 stainless steel

.2 All items identified as ‘stainless’ shall be marine grade 316 stainless steel

.3 All items identified as ‘aluminum’ shall be marine grade 6061 aluminum alloy

.4 All items identified as galvanized shall be hot dipped galvanized steel. Any field cuts of scratches shall be treated with 2 coats of Galvacon or other approved high zinc paint.

.4 Wiring:

.1 All wiring shall be:

.1 TECK90 where not subject to tidal or wave movement.

.2 SOW or G-Cable for all areas where tidal or wave movement is present.

Part 3 Execution

3.1 INSTALLATION

.1 Install pedestals and kiosk in accordance with manufacturer’s recommendations.

.1 Include neoprene pads or gaskets to isolate structure from concrete float.

.2 Use 78mm long 13mm diameter stainless Hilti epoxy anchors to secure pedestals, kiosk, and light standards to the concrete floats.

.1 Contractor shall avoid rebar structure of the float for all anchors.

.2 No anchor shall be installed within 500mm of the edge of the float.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18 (R2009), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2No.18.

□

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 GENERAL

.1 All conductors for the project shall be copper and installed in conduit except where noted.

.2 Conductors: 98% conductivity copper, size as indicated, stranded for 10 AWG and larger. Minimum size: 12 AWG. Conductors may be aluminum only where shown on the drawings.

2.2 EXTERIOR WIRES

.1 120/208V: 600 V insulation of chemically cross-linked thermosetting polyethylene material rated.

.2 347/600V: 600 V insulation of chemically cross-linked thermosetting polyethylene material rated.

2.3 INTERIOR WIRES

.1 120/208V conductors:

.1 600V insulation

.2 Chemically cross-linked thermosetting polyethylene material rated RW90 for damp locations. NMD90 cable allowed in wood frame construction.

.2 347/600V conductors:

.1 1000V insulation

.2 Chemically cross-linked thermosetting polyethylene material rated RW90 for damp locations. NMD90 cable allowed in wood frame construction.

□

.3

.4 Provide chemically cross-linked thermosetting polyethylene type insulation for fire alarm system conductors.

2.4 TECK AND ACWU CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90

.1 120/208V conductors: Rated for 600 V.

.2 347/600V conductors: Rated for 1000V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: flat interlocking aluminum.

.5 Overall covering: thermoplastic polyvinyl chloride material.

.6 Fastenings:

.1 One hole galvanized steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.1 Fastenings for marine areas shall be stainless steel.

.2 Channel type supports for two or more cables at 600 mm centers.

.3 Cable trays: Secure to tray every 600mm with UV resistant tie straps.

.4 Threaded rods: 6 mm dia. to support suspended channels.

.1 Stainless steel rod for marine areas

.2 Galvanized for all other outdoor areas.

.3 Electroplated for interior areas.

.7 Connectors:

.1 Watertight, approved for TECK cable.

.8

2.5 ARMOURED CABLES

.1 AC90 (BX) may only be used for lighting drops in T-bar ceiling areas, all other installation areas where solid conduit is not practical shall use flexible conduit with single conductor wiring.

.2 Conductors: insulated, copper, size as indicated.

.3 Type: AC90.

.4 Armour: interlocking type fabricated from aluminum strip.

□

.5 Connectors: as required for the application.

2.6 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TWH polyethylene insulation with shielding of metallized tapes over each pair and over all conductors and overall covering of PVC jackets.

.3 Fire alarm conductors shall have X-link polyethylene type insulation.

Part 3 Execution

3.1 INSTALLATION OF EXTERIOR AND INTERIOR WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34

.2 In underground ducts in accordance with Section 26 05 44.

.3 In trenches in accordance with Section 26 05 44.

.2 Surface wiring allowed in electrical and mechanical rooms only.

.3 Fire detector signal circuits shall not be run in the same conduit with any other signal circuit except when the fire alarm signal circuit is of the same voltage as the fire detector signal voltage.

.4 Low voltage signal wiring shall be mechanically separated from power wiring and run in separate raceways. This includes panel wireways.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Install cable in trenches in accordance with Section 26 05 44.

.3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Support singular armoured cables as required by the CEC.

.3 Install cable in trenches in accordance with Section 26 05 44.

□

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.4 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield(s).

.3 Fire detector signal circuits shall not be run in the same conduit with any other signal circuit except when the fire alarm signal circuit is of the same voltage as the fire detector signal voltage.

.4 Low voltage signal wiring shall be separated from power wiring and run in separate raceways. This includes panel wireways.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

.1 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.

.2 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.3 Plate electrodes: galvanized steel, surface area 0.2 m^2, 1.6 mm thick.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Insulated grounding conductors: green, type RW90.

.6 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

□

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install ground wire in all conduit including metal conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect all proposed building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.13 Ground secondary service pedestals.

3.2 SERVICE GROUND AND TRANSFORMER BASES

.1 Install 2 ground plates and #3/0 bare copper to CEC current edition.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

□

3.4 GROUNDING BUS

.1 Ground proposed items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Steel, u shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

.1 Stainless steel in marine areas

.2 Galvanized steel is all other areas

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole galvanized steel straps to secure surface conduits and cables 50 mm and smaller. Two-hole galvanized steel straps for conduits and cables larger than 50 mm.

.1 Fastenings for marine areas shall be stainless steel.

.2 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.1 Stainless steel rod for marine areas

□

.2 Galvanized for all other outdoor areas.

.3 Electroplated for interior areas.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels spaced as per the CEC for the smallest conduit.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

□

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 BUILDING EXTERIOR JUNCTION BOXES

.1 RPVC NEMA 4X

.2 Sized to suit number of conduits and bending radios of conductors.

.1 Minimum size of 200x200x100mm

2.3 BUILDING INTERIOR JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Communications boxes shall be pad-lockable.

.3 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

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3.2 BUILDING EXTERIOR JUNCTION BOXES

.1 Fasten junction box to building exterior using stainless steel hardware. Ensure that building envelope is not compromised and any penetrations are sealed.

.2 All conduit connections to the JB shall be water tight.

3.3 BUILDING INTERTIOR JUNCTION AND PULL BOXES

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.4 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-09, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

□

2.5 CONDUIT BOXES

.1 Cast FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.
- .3 CSA C22.2 No. 56-1977(R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3-M91(R1999), Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole galvanized steel straps to secure surface conduits 50 mm and smaller. Two hole galvanized steel straps for conduits larger than 50 mm.

- .1 Fastenings for marine areas shall be stainless steel.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits spaced as required by the CEC.

.4 Threaded rods, 6 mm dia., to support suspended channels.

- .1 Stainless steel rod for marine areas
- .2 Galvanized for all other outdoor areas.
- .3 Electroplated for interior areas.

□

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90E bends are required 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Fish cord shall be polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduit concealed in all areas excluding mechanical and electrical rooms, or where specifically noted as being exposed. Run parallel or perpendicular to building lines.

.2 Install a separate bonding conductor in all conduits.

.3 Use PVC conduit for all underground installations as per the CEC latest edition.

.4 Use EMT throughout the building unless otherwise indicated with the following exceptions:

- .1 Flexible conduit may be used for equipment connection or where solid conduit is not practicable.
  - .1 Use liquid tight flexible conduit in exterior and damp locations.
- .2 Flexible conduit shall be used for mechanical motors and other vibrating equipment
  - .1 Use with liquid tight connectors.
  - .2 Minimum conduit size of 17mm.
  - .3 Use sufficient length to prevent transmission of vibration.
- .3 AC90 (BX) may only be used for lighting drops in T-bar ceilings.

.5 Use compression type couplings for EMT. Set screw couplings are not acceptable.

□

.6 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.7 Conceal conduits except in mechanical and electrical service rooms, or where specifically noted as being exposed.

.8 Minimum conduit size for lighting and power circuits: 21 mm.

.9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.10 Mechanically bend steel conduit over 21 mm dia.

.11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.12 Install fish cord in empty conduits.

.13 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.14 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

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.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 31 00 00.01 –Earthwork – Short Form.

.3 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.3 Do not dispose of preservative treated wood through incineration.

.4 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.5 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.

.6 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 DIRECT BURIAL OF DUCTS

.1 After sand bed specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, lay ducts maintaining 75 mm clearance from each side of trench to nearest duct.

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.2 Duct separation: separate ducts as shown in drawing sections

.3 After sand protective cover specified in Section 31 23 10 - Excavating, Trenching and Backfilling, backfill trench with select native backfill as required.

.4 Lay down electrical warning tape as specified depth.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 150 m along duct runs and at changes in direction.

.2 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

□

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

□

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 PHOTOELECTRIC LIGHTING CONTROL

.1 Spec grade

.2 Capable of switching 1000 W of lighting at 120 V.

.3 Voltage variation: plus or minus 10%.

.4 Temperature range: minus 40 degrees C to plus 40 degrees C.

.5 Adjustable illuminance set points

.6 Rated for 5000 operations.

.7 Switching time delay of 30 s.

.8 Colour coded leads: size 12 AWG, 460 mm long.

2.2 TIMECLOCK

.1 Electronic, 1 channel, 7/32 set points, alkaline battery backup.

.2 Accepted manufacturer: Tork

2.3 MOTION SENSOR

.1 Switch lights into the off position when space is unoccupied for 30 minutes or more.

.2 Programmable by push-button and optional remote control.

.3 Capable of switching up to 800W at 120V for all load types.

.4 Dual technology type with passive infrared and ultrasonic sensors for detection.

.5 7.6m range when mounted at 2.74m above finished floor.

.6 Contact closure delay adjustable from 30s to 300s.

.7 Colour: White

□

2.4 ON/OFF SWITCH

.1 Single pole

.2 Totally enclosed case at 15A, 120VAC

.3 Quiet and slow make and slow break design

.4 Toggle handle

.5 Material: Nylon

.6 Colour: White

2.5 DIMMING SWITCH

.1 Single pole

.2 Totally enclosed case at 15A, 120VAC

.3 Capable to adjust lighting output of associated LED luminaire to 1%

.4 On/off switch function

.5 Switch to be approved for use by luminaire manufacturer

.6 Material: Nylon

.7 Colour: White

2.6 VACANCY SWITCH

.1 Single pole

.2 Switch lights into the off position when space is unoccupied for 30 minutes or more.

.3 Programmable by push-button and optional remote control.

.4 Capable of switching up to 800W at 120V for all load types.

.5 Dual technology type with passive infrared and ultrasonic sensors for detection.

.6 On/off switch function

.7 Contact closure delay adjustable from 30s to 300s.

.8 Colour: White

2.7 VACANCY/DIMMER SWITCH

.1 Single pole

□

.2 Switch lights into the off position when space is unoccupied for 30 minutes.

.3 Programmable by push-button and optional remote control.

.4 Capable of switching up to 800W at 120V for all load types.

.5 Dual technology type with passive infrared and ultrasonic sensors for detection.

.6 Capable to adjust lighting output of associated LED luminaire to 1%

.7 On/off switch function

.8 Switch to be approved for use by luminaire manufacturer

.9 Contact closure delay adjustable from 30s to 300s.

.10 Colour: White

Part 3 Execution

3.1 INSTALLATION

.1 Provide an exterior lighting control system for building.

.1 Exterior lights to be controlled by photocell, timeclock, and motion sensors. Include contactors and override switches.

.2 System functionality:

.1 Photocell and timeclock determine “active” night time period for lighting system.

.2 During active period, each motion sensor shall trigger the activation of its affiliated light fixtures. Fixtures and sensor affiliation are shown on the drawings via numeric references.

.3 Non affiliated fixtures shall be activated for entire active period.

.3 Initial motion sensor timer shall be set to 120 seconds.

2. Provide interior lighting controls for each room and area.

1. Interior lights to be controlled by switches and sensors in all finished areas. Refer to electrical drawings for exact placement and delineation of controls.

2. System functionality:

1. Motion sensors, vacancy switches, and vacancy dimmer switches to switch lights into the off position when space is unoccupied for 30 minutes.

3. All interior lighting controls to be one manufacturer throughout project.

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END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Service equipment and installation.

1.2 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 26 05 28 - Grounding - Secondary.

.3 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.4 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.

.5 Section 26 24 17 - Panelboards Breaker Type.

Part 2 Products

2.1 SYSTEM

.1 Provide an underground service as shown. Contractor to coordinate service connection with BC Hydro, ensure all BC Hydro inspection and detail requirements are met.

.2 BC Hydro will provide pilaster cover. Contractor shall arrange with BC Hydro for pick-up and delivery. Contractor to install.

.3 BC Hydro charges will be paid directly by the Owner.

.4 Any changes to the layout to be approved by BC Hydro.

.5 C/T's and meter supplied by BC Hydro, installed by contractor.

.6 Finishes in accordance with Section 26 05 01 - Common Work Results - Electrical.

.7 Details show a general arrangement of components of the main distribution required and are a guide for manufacturers and suppliers only. Rearrangement of components will be considered to suit a particular manufacturer's equipment or physical limitations.

.8 Available fault current related requirements shall be the responsibility of the manufacturer to satisfy.

□

2.2 EQUIPMENT

.1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused as indicated in Drawings.

.2 CT enclosure and metering as per BC Hydro standards.

Part 3 Execution

3.1 INSTALLATION

.1 Water, sewer, and drain pipes including services to be installed prior to BC Hydro underground ducts.

.2 All BC Hydro work to be done in accordance with applicable BC Hydro standards.

.3 Install service equipment.

.4 Connect to incoming service.

.5 Connect to outgoing load circuits.

.6 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.7 Make provision for power supply authority's metering.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V and 600V panelboards with full capacity solid neutral: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or higher as indicated in single line drawing.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

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.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

.10 Acceptable manufacturers:

.1 FPE
.2 Square D
.3 Eaton
.4 Siemens

2.2 BREAKERS

.1 Bolt-on type.

.2 Multi-pole breakers to have single operating handle. Tie-bar breakers are not acceptable.

.3 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.4 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.5 Provide arc-fault circuit breakers for circuits supplying power to receptacles in bedrooms.

.6 Same manufacturer as panel.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results – Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit installed under a protective clear plastic cover.

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Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 For flush mounted panel boards, install spare 3 – 27mm EMT conduits to the ceiling space.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates, heating devices and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, three-way, four-way as indicated switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

.1 White

.2 Quiet, slow make, slow break design, toggle handle, with totally enclosed case rated for 15A 120VAC.

□

.3 Terminal holes approved for No. 10 AWG wire.
.4 Silver alloy contacts.
.5 Urea or melamine moulding for parts subject to carbon tracking.
.6 Suitable for back and side wiring.
.7 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R and 5-20R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 White Decora style.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.
.6 Ground fault interrupting where indicated.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 White nylon plates for wiring devices mounted in flush-mounted outlet box for office and residential areas. Stainless steel for storage, utility, and shop areas.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

2.4 ELECTRIC HEAT

.1 Baseboard heaters:

.1 Ouellet OFM series baseboards or approved alternate.
.2 Voltage and wattage as indicated on the Drawings.

.2 Forced flow heaters

□

.1 Ouellet OAC series force flows or approved alternate.

.2 Voltage and wattage as indicated on the Drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Do not install receptacles back-to-back. Allow a minimum 150mm horizontal clearance and stub between boxes.

.3 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Electric Heat:

.1 Baseboard heaters:

.1 Install heaters as per manufacturer’s recommendations.

.2 Force flow heaters:

.1 Install heaters as per manufacturer’s recommendations.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 26 05 01 - Common Work Results - Electrical.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure as shown, size as indicated, rated for voltage as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.

.5 Heavy duty type, quick-make, quick-break action.

.6 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

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END OF SECTION

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1.0 GENERAL

1.1 Description

This Specification describes the requirements for the materials and services for the installation of sacrificial cathodic protection for new steel structures associated with the Canadian Coastguard – Department of Fisheries and Oceans at Port Hardy, BC. The project includes installation of aluminum anodes as well as structure bond assemblies.

1.2 Related Specifications

.1 This section of the Specifications is not necessarily complete in itself and must be read in conjunction with other sections of the Specifications and Contract Documents.

1.3 References

In the event of conflict between the referenced codes and standards, drawings, specifications, and/or the Purchase Order/Contract, the Contractor shall obtain clarification from theDepartment Representative before proceeding with the Work.

.1 American Petroleum institute

.1 API 5L, Specification for Line Pipe.

.2 American National Standard Institute and American Welding Society

.1 ANSI/AWS D3.6/D3.6M, Specification for Underwater Welding.

.3 ASTM International

.1 ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

.2 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded rod 60 000 PSI Tensile Strength.

.4 CSA International

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.3 CSA W59, Welded Steel Construction (Metal Arc Welding).

.5 Det Norske Veritas

.1 DNV-RP-B401, Cathodic Protection Design.

.6 National Association of Corrosion Engineers

.1 NACE SP0169, Control of External Corrosion on underground or submerged Metallic Piping Systems.

.7 US Military Specification

.1 MIL-A-24779, Anodes Sacrificial Aluminum Alloy

1.4 Submittals

.1 Product Data

.1 Submit manufacturer’s printed product literature, specifications and data sheets for cathodic protection and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Details of material composition of proposed anodes. Acceptance of anode material is subject to approval from the Department Representative.

.3 Cathodic protection system test results indicating that the system is functioning as intended.

.4 Maintenance manual for cathodic protection system which shall include but not be limited to as-built drawings, recommended inspection and testing procedures, and recommended routine maintenance works.

.2 Shop Drawings

.1 Provide shop drawings stamped and signed by a professional engineer registered or licensed in British Columbia, Canada.

.2 Indicate size and locations of anodes.

1.5 Scope

The Contractor's scope of work shall include but not necessarily be limited to the following:

.1 Design, supply, fabrication, installation, test and commissioning of the cathodic protection system.

.2 Engaging a NACE certified corrosion specialist to review and validate the proposed cathodic protection system described in this Specification. Validation of items include:

.1 Anode chemical composition.

.2 Anode quantity.

.3 Ensuring the cathodic protection system design and drawings are sealed by a Professional Engineer registered or licensed in British Columbia. The design and sealed drawings shall be submitted to the Department Representative.

2.0 PRODUCTS

2.1 Materials

.1 Anode supporting structure shall confirm to Specification No. 055000 for Metal Fabrications.

.2 Anode support structures shall be to the dimensions indicated in the Drawings and shall confirm to API 5L Grade B or ASTM A106 Grade A or B.

.3 Mounting fittings shall be weldable low carbon steel conforming to CSA G40.20/CSA G40.21, Grade 300W. Mounting brackets shall consist of the following:

.1 Mooring Piles - Cable Anode

.1 100mm x 100mm x 1270mm anode.

.2 9.5mm stainless steel cable, 8m long cast into anode.

.3 2 cable clamps per anode.

.4 100mm x 150mm steel plate for welding to pile, drilled to accommodate 2 cable clamps for each plate to secure anode cables.

.4 Anode quantity:

Location	Elevation	No. of Piles	Anodes per pile	Total
Mooring Piles	-5.00	8	2	16

2.2 Anodes

.1 Sacrificial anodes shall be aluminum alloy composition conforming to US Military Specification MIL-A-24779 (SH) as follows:

Aluminum Alloy Chemical Composition	
Element	**Weight (Percent)**
Indium	0.014 – 0.020
Zinc[1]	4.0 – 6.5
Silicon	0.08 – 0.20
Copper	0.004 maximum
Iron	0.090 maximum
Mercury	0.001 maximum
Tin	0.001 maximum
Others (each)	0.020 maximum (total not to exceed 0.10 percent)
Aluminum[1]	Remainder

[1]Aluminum raw material purity shall be 99.8% by weight (minimum).

.2 Test efficiency of the aluminum alloy in sea water shall not be less than 90% based on 100% efficiency of 2982 ampere-hour per kg. The aluminum alloy shall have a closed circuit potential in seawater of -1.05 V versus silver-silver chloride reference electrode.

.3 Consumption rate in seawater at 26°C shall not exceed 3.45 kg/amp-yr.

2.3 Welding

.1 Welding materials shall conform to CSA W59 and shall be of such quality as to ensure thorough penetration.

.2 Welding electrodes shall conform to CSA W48, class E49XX.

3.0 EXECUTION

3.1 Interfacing and Coordination

.1 Coordinate the Work of this Section with the Work described in other sections of the Specifications and work of other contractors in order to facilitate proper execution.

.2 Report discrepancies and potential problems to the Department Representative for direction before commencing installation. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Department Representative.

.3 The Contractor shall provide a sacrificial anode cathodic protection system for all steel piling in contact with seawater or embedded to the sea bottom. The sacrificial anodes shall be of aluminum alloy.

3.2 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with the manufacturer's written instructions and in such a way as to prevent damage to individual bars.

.2 Deliver materials to site in original factory packaging, labelled with the manufacturer's name and address.

3.3 Fabrication

.1 Materials shall be free of defects, loose scale, slag, discolouration, rust, and other defects which reduce the strength or general stability thereof:

.1 Repairs to minor defects are only permitted with the prior written approval of the Department Representative.

.2 Proposed repair procedures shall be submitted to the SFC Representative and Department Representative for review and acceptance prior to any repairs being carried out.

.3 Any sharp bends or kinked elements shall be rejected. Defected material shall be replaced by the Contractor at no expense to SFC.

.2 Where possible, fit and shop assemble work, ready for installation.

3.4 Wet Welding Procedure

.1 All under water welding of the anode brackets, including tack welds for electrical continuity, shall conform to ANSI/AWS D3.6 Type C Weld.

.2 Welding procedures, welding materials, and welders shall be qualified by testing weldments under actual site conditions and conducted at least one (1) week prior to the project start date.

.3 The Contractor shall supply the necessary equipment and materials for these tests, which include plate fillet welds made in the vertical and horizontal positions by each diver welder. The weld procedures, materials and welder qualifications shall be submitted, along with test results, to the Department Representative for review before any production welding begins. The Department Representative shall be advised when test welding is to take place. Test specimens may be subjected to destructive or non-destructive tests as directed by the Department Representative.

.4 Each diver-welder shall provide two samples of each of the following welds for qualification purposes:

.1 Plate fillet weld: vertical position.

.2 Plate fillet weld: horizontal position.

These welds shall be completed under site conditions while the Department Representative is present.

.5 The qualification of the diver-welders shall occur at the start of the project prior to any underwater welding.

.6 Welding electrodes shall be metallurgically suited to the service involved and shall be specified in the welding procedure proposed by the contractor.

.7 Permanent welds shall be visually inspected by the Department Representative. Defects shall be corrected by the Contractor prior to acceptance of the Work.

3.5 Surface Preparation for Welds

.1 The pipe surface in the vicinity of each weld location shall be cleaned of all marine growth, scale, oxide, paint, or other contaminants. The surface area cleaned shall extend beyond the weld limits at each location. Surface cleaning shall be to a bright metal finish.

.2 Manual tool cleaning is not acceptable. Acceptable cleaning techniques shall include but not be limited to:

.1 High pressure water blasting.

.2 Mechanical power tool cleaning

.3 Weld locations having general surface pitting in excess of 3 mm depth shall not be used. Additional pile surface shall be cleaned until acceptable surface conditions are found. Pitted pile surfaces can be filled with weld metal and ground flat to provide a flush surface for welding.

.4 Pre-cleaning of weld locations up to two days prior to welding is acceptable provided the cleaned areas are thoroughly re-cleaned using a wire brush immediately prior to welding.

3.6 Installation

.1 The Work shall be done in accordance with NACE SP0169.

.2 Surface preparation shall be in accordance to Section 3.5 of this Specification.

.3 The surface area cleaned shall not be less than 200 mm square and shall extend at least 50 mm beyond the welds at each location.

.4 Anode assemblies are to be attached to the locations indicated on the Drawings. Relocation must be approved by the Department Representative.

.5 The structural brackets (channel and plate) shall be fitted into place using a mounting jig or other suitable means as provided by the Contractor and approved by the Department Representative. The brackets must fit level, be equally spaced on both sides and be flush to the pile surfaces with no gaps between the brackets and the pile. Brackets are typical for all pile diameters.

.6 The number of anodes to be installed per steel pipe pile is indicated on the Drawings and shall confirm to the requirements below:

Steel Pipe Pile Diameter (mm)	Number of Anodes
$610 < Ø < 1524$	2
≥ 1524	3

.7 Each weld must be inspected and any defects removed prior to the acceptance of the Work.

.8 The anodes shall be safely lowered and mounted onto the structural bracket making sure the anode plate fits securely onto the bolt. The anode will be tightly secured with lock washers and bolts in accordance with the Drawings.

.9 All extraneous equipment used to assist the installation of the anodes must be removed.

.10 To ensure electrical continuity between anode and steel structure, one 2 mm long tack weld shall be applied along the top of the anode bracket where it fits with the structural bracket. Wet Weld Procedures shall be used for the continuity weld.

4.0 QUALITY ASSURANCE AND CONTROL

4.1 Quality Assurance

.1 All materials shall be subject to visual inspection and testing by the Department Representative and will be approved only if the requirements of the Drawings and this Specification are met. The Contractor shall supply the specimens for testing in accordance with the requests of the Department Representative.

.2 Inspection and testing of materials and workmanship will be carried out by a testing laboratory designated by theDepartment Representative. Test data shall consist of chemical composition, closed circuit potential, and current capacity of the aluminum anodes. Testing procedures shall be in accordance with NACE SP0169 and all testing shall be completed by a NACE certified technologist.

.3 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by theDepartment Representative.

.4 Mill tests and certificates in accordance to CSA W47.1 for fusion welding of steel or CSA W55.3 for resistance welding.

.5 The anode manufacturer shall obtain representative metal samples from each alloy heat and analyze the same to prove compliance with the specified metallurgical composition. Test results are to be documented with reference to the batch numbers and supplied by the vendor complete with a certificate of conformity certifying that the anodes comply in all respects to the Specification.

.6 Each anode shall be marked with its unique heat number and manufacturer’s name. For heat-treated anodes, a heat treatment batch number shall be provided on each number.

4.2 Quality Control

.1 The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Work.

.2 Submit a Quality Control Record detailing the individual anode weights and dimensions and total anode contract weight. The Contractor shall retain an independent inspector to inspect the anodes for surface irregularities and cracks.

.3 Welding

.1 All dry welding may be subject to inspection by Non-Destructive Testing. This inspection shall be carried out in a manner approved of the Department Representative.

.2 The Contractor shall give the Department Representative not less than 24 hours notice of when work will be ready for testing and shall advise theDepartment Representative of the type and quantity of work that will be ready for testing.

.3 Inspection of dry welding in accordance with the inspection procedures described in CSA W59. Results of all weld tests shall be submitted to the Department Representative within one week of the date of testing.

.4 All welds found not acceptable through examination shall be removed and re-welded by the Contractor and subjected to re-examination.

.5 The dive Contractor shall facilitate inspection and testing of the installed works by the Department Representative. The dive Contractor shall provide dive support services for an underwater inspection of the anode assemblies and welds or provide a suitable video feed allowing for a complete visual inspection of the Work.

.4 Anode Surface Irregularities

.1 Shrinkage depressions on the anode surface shall not exceed 10% of the normal height of the anode as measured from the uppermost corner of the bottom depression.

.2 Not more than 1% of the total surface of the anode casting shall be contaminated with non-metallic inclusions visible to the naked eye.

.3 The straightness of the anode shall not deviate more than 2% of the anode nominal length from the longitudinal axis of the anode.

.4 Within the anode section transverse cracks along the length and depth are permitted if width does not exceed 5 mm and there are no more than 10 cracks per anode. Small dense cracks shall be considered one crack and cracks of 0.5mm width shall be ignored. Longitudinal cracks are not permitted in any length.

END OF SECTION 26 42 00

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.3 Section 01 45 00 - Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Departmental Representative.

Part 2 Products

2.1 FIXTURES

.1 As shown on the drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

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.1 Through solid conduit where practicable.

.2 Flexible conduit permitted where solid conduit is not practiseable.

.3 AC90 (BX) is only permitted for T-Bar mounted luminaires.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 SERVICE CABLES

.1 Telephone Service

.1 Termination: BIX Blocks

.2 Service ground: No. 6 AWG TWH green ground wire

Part 3 Execution

3.1 INSTALLATION

.1 Telephone Service

.1 The telephone system includes telephone system raceway as shown in the Drawings. Contractor to coordinate Telus installation and ensure all inspections and detail requirements are met. BIX blocks, service board, unit service boxes and the required conduit are included.

.2 Supply and install BIX block and service ground to Telus demarcation point.

.3 Install duct run from the pilaster to the electrical room.

.4 Telus to install and terminate service cable(s).

.5 Telus charges to be paid directly by the owner.

.6 Any changes to layout to be approved by Telus.

.2 Cablevision Service

.1 The cablevision system includes service raceway, service board, and unit service boxes.

.2 Cablevision company to install and terminate service cable(s).

.3 Cablevision service charges to be paid directly by the owner.

.4 Any changes to layout to be approved by Cablevision company.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.1 CSA-T529-95(R2000), Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.2 CSA-C22.2 No. 214-02, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4-M90(R2001), Plugs, Receptacles, and Connectors for Communication Systems.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA-568-2001, Commercial Building Telecommunications Cabling Standards Set.

1.3 SYSTEM DESCRIPTION

.1 System shall be designed and specified in conformance with the DFO IT Statement of Work, the Drawings, and these Specifications. Where conflicts exist, the more expensive option shall be assumed. Contact the Engineer to clarify any discrepancies.

.2 Data and VOIP System:

.1 Data outlet consists of a double gang box, jacks, and cable.

.2 Provide a home run cable from each outlet to the patch panel located in the IT room.

.3 Provide an EMT conduit system from the data outlet back to the IT room.

.3 Cablevision System:

.1 Cablevision outlet consists of a single gang box, jack, and RJ6 cable.

Part 2 Products

2.1 DATA SYSTEM

.1 Cable: 4 pair, CAT6, No, 24 AWG, FT4.

.2 Data jack: to be RJ45.

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.3 Patch panel

.1 Rack-mount

.2 1x24 port modular patch panels. Provide sufficient modules to account for all data jacks as shown in Drawings plus 20% spare capacity for future.

.3 Include 1x3RU metallic cable management unit with hinged covers below each patch panel.

.4 Data racks

.1 IT Room:

.1 Provide 3 19”x72” pre-drilled metallic equipment rack

.2 Include full height 4”x6” vertical cable management unit on each side of the rack.

2.2 CABLEVISION

.1 All components to be approved by the Cablevision company.

Part 3 Execution

3.1 INSTALLATION

.1 System shall be installed as specified in conformance with the DFO IT Statement of Work.

.2 Install all required raceway, terminations, cable, face plates, electronic components, jack, panel boxes, and miscellaneous components to form a fully functional telephone, data, cablevision, and fibre optic system.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Data installer to be a certified data installer.

.3 Approved CATV contractor shall install coaxial cable and perform all terminations for the Cablevision outlets.

.4 Test UTP cable installations for:

.1 Continuity: including open/short, polarity, and pair transpositions.

.2 DC loop resistance.

.3 Length using TDR.

.4 Noise Attenuation at 250 MHz.

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END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 SYSTEM DESCRIPTION

.1 System shall be designed and specified in conformance with the DFO IT Statement of Work, the Drawings, and these Specifications. Where conflicts exist, the more expensive option shall be assumed. Contact the Engineer to clarify any discrepancies.

.2 Empty telecommunications raceways system consists of outlet boxes, cover plates, distribution cabinets, conduits, cabletroughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

.1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Cable tray as per Drawings

.3 Junction boxes, cabinets: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.4 Fish wire: polypropylene type.

Part 3 Execution

3.1 INSTALLATION

.1 Install empty raceway system, including overhead distribution system, fish wire, terminal cabinets, outlet boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, miscellaneous and positioning material to constitute complete system.

.2 Conduit system shall be concealed were possible and run from each data or tel box back to the IT room. Conduit in the hallway to be tight up against roof.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 Abbreviations:

.1 Electronic Access Control (EAC): control of people through entrances and exits of controlled area. Security utilizing hardware systems and specialized procedures to control and monitor movements within a controlled area.

.2 DRS:. Door Release System.

.3 PIN: Personal Identification Number.

.2 Reference Standards:

.1 Underwriters' Laboratories (UL)

.1 UL 294, Access Control System Units.

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 access controls and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit:

.1 Functional description of equipment.

.2 Technical data for all devices.

.3 Device location plans and cable lists.

.4 Devices mounting location detail drawings.

.5 Typical devices connection detail drawings.

.3 Shop Drawings:

.1 Shop drawings to indicate project layout, including details.

.1 Shop drawings to indicate, mounting heights and locations, wiring diagrams.

.2 Submit zone layout drawing indicating number and location of zones and areas covered.

.3 Submit wiring diagrams.

.4 Submit complete equipment list.

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 access controls and equipment for incorporation into manual.

.1 Include:

.1 System configuration and equipment physical layout.

.2 Functional description of equipment.

.3 Instructions of operation of equipment.

.4 Illustrations and diagrams to supplement procedures.

.5 Operation instructions provided by manufacturer.

.6 Cleaning instructions.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products

2.1 MATERIALS

.1 Design Criteria:

.1 Design access control and security access systems using only ULC/UL listed products.

.2 Design access control systems to meet safety requirements to UL 294.

.3 Design system to provide door manual and automatic control functions from locations indicated to central monitoring system.

.4 Design system to allow for addition of future Door Release System (DRS) controls and activation units by adding appropriate transmission lines and equipment at each location.

.5 Design system to consist of homed run control to activation unit connections.

.6 Each activation unit must have door panel control function/equipment item located as indicated.

.7 Design system to provide ease of operation, servicing, maintenance, testing and expansion of additional services.

.8 Door activation units:

.1 Fully complement and function and match door manufacturer's magnetic controls and hardware.

.2 Fully function with OEM supplied door controls and hardware to activate system in routine and emergency conditions.

.3 Fully function within supplied electrical supervision circuits as specified.

.9 Control Panel:

.1 Fully compatible, compliment and operate door magnets provided by door manufacturer of system or OEM supplied door operating hardware.

.2 Complete with push button or electronic key pad to release and secure each door.

.3 Identify each door control function with lamp electronically identified on panel or associated display unit.

.4 Permanently label (paper labels are not acceptable) or electronically identified each door location on panel or associated display unit.

.5 Fully function within supplied electrical supervision circuits as specified.

.2 Door controls items and panels:

.1 Include standard "off the shelf" equipment items to form a complete and operating DRS system.

.2 Include: equipment cabinets, equipment panels, AC power strips, power line conditioner, system power supply, junction box, door control panels, door activation units, system connectors, system cables.

.3 Provide system cables including coaxial cable, multiconductor control cable, audio and AC power cable required.

.4 Basic System Criteria:

.1 Card readers:

.1 Type: Weigand proximity.

.2 Mullion mount: JCI ioProx P225W26 or approved alternate.

.3 Wall mount: JCI ioProx P325W26 or approved alternate.

.2 Door Controllers:

.1 Kantech KT-400

.2 Controller to include any required auxiliary electronics to provide control of doors.

.3 Kantech PC:

.1 Provide rack-mount PC that is compliant with Kantech’s current recommended specifications

.2 Provide operating system and Kantech EntraPass Corporate software for configuring and administering the system including all required licenses

.3 Provide card reader device for programming proximity cards

.4 Provide KVM drawer for the PC

.5 Approved manufacturers include HP and Dell

.4 Raceways:

.1 Provide ¾” EMT conduit from each door to the IT room.

.5 System Accessories:

.1 Door strike:

.1 24VDC

.2 Coordinate with architectural and door hardware supplier

.2 Door contact: George Risk Industries 199-12WG or approved alternate.

.3 Provide 50 Kantech P10SHL proximity cards for the system for the Owner's use.

Part 3 Execution

3.1 INSTALLATION

.1 Installer to be Kantech certified.

.2 Install components in accordance with manufacturer's written installation instructions.

.3 Install components secure to walls, ceilings or other substrates.

.4 Install required boxes in inconspicuous accessible locations.

.5 Conceal conduit and wiring.

.6 Install KT-400's on the wall in the IT room.

.7 Install the PC in one of the racks I the IT room. Coordinate exact placement with Owner.

.8 Coordinate mounting locations with Architect.

.9 Test and commission system. Provide commissioning report to the Departmental Representative.

.10 Provide certified training to the Owner upon completion of commissioning for the system. Allow for a dedicated trip to site and 4 hours of training.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 NBC-2010, National Building Code of Canada.

.2 Government of Canada

.1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.

.2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-06, Installation of Fire Alarm Systems.
.2 CAN/ULC-S525-07, Audible Signal Appliances.
.3 CAN/ULC-S526-07. Visual Signal Appliances, Fire Alarm.
.4 CAN/ULC-S527-99, Control Units.
.5 CAN/ULC-S528-05, Manual Pull Stations.
.6 CAN/ULC-S529-02, Smoke Detectors.
.7 CAN/ULC-S530-1991(R1999), Heat Actuated Fire Detectors.
.8 CAN/ULC-S531-02, Smoke Alarms.
.9 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems.
.10 CAN/ULC-S537-04, Verification of Fire Alarm Systems.
.11 CAN/ULC-S553-02, Installation of Smoke Alarms.

1.3 DESCRIPTION OF SYSTEM

.1 System includes:

.1 Control and annunciator panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
.2 Trouble signal devices.
.3 Power supply facilities.
.4 Manual alarm stations.
.5 Automatic alarm initiating devices.
.6 Audible signal devices.
.7 End-of-line devices.

□

.8 Annunciators.

.9 Visual alarm signal devices.

.10 Ancilliary devices.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to Fire Commissioner of Canada (FC) approval.

.3 Subject to FC inspection for final acceptance.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include:

.1 System component datasheets

.2 Layout of equipment.

.3 Zoning.

.4 Complete wiring diagram, including schematics of modules.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

.4 List of recommended spare parts for system.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 4 spare glass rods for manual pull box stations if applicable.

1.8 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

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Part 2 Products

2.1 MATERIALS

.1 Acceptable system manufacturers: Edwards, Mircom, Notifier, and Simplex-Grinnell.

.2 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.3 Power supply: to CAN/ULC-S524.

.4 Audible signal devices: to ULC-S525.

.5 Visual signal devices: to CAN/ULC-S526.

.6 Control unit: to CAN/ULC-S527.

.7 Manual pull stations: to CAN/ULC-S528.

.8 Thermal detectors: to CAN/ULC-S530.

.9 Smoke detectors: to CAN/ULC-S529.

.10 Smoke alarms: to CAN/ULC-S531.

2.2 SYSTEM OPERATION

.1 Single stage, addressable operation. Operation of any alarm initiating device to:

- .1 Cause audible signal devices to sound throughout building.
- .2 Transmit signal to fire department via monitoring station.
- .3 Cause zone of alarm device to be indicated on control panel.
- .4 Cause air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
- .5 Cause fire doors and smoke control doors if normally held open, to close automatically.

.2 Capability to program smoke detector status change confirmation on any or all zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Supervised, single stage, addressable coded, zoned and closed circuit 24VDC system.

.2 20% spare capacity for addressable loops.

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2.4 POWER SUPPLY

.1 The system shall incorporate sufficient battery back-up to self power the system as per the applicable codes despite the fact that there is a back-up generator at the site.

.2 Review battery system and increase battery bank size if required to suit proposed equipment.

2.5 MANUAL ALARM STATIONS

.1 Manual alarm stations: pull lever, wall mounted surface type, single action and single stage bilingual English and French signage.

2.6 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors, fixed temperature, rated 57 degrees C.

.2 Thermal fire detectors, combination fixed temperature and rate of rise, self-restoring rate of rise, fixed temperature 57 degrees C, rate of rise 8.3 degrees C per minute.

.3 Smoke detector: photo-electric type.

.1 Twist lock type with fixed base.

.2 Wire-in base assembly with integral red alarm LED.

2.7 AUDIBLE SIGNAL DEVICES

.1 Horns: surface mounted, temporal audible pattern with and average of 94dBA sound level at 3,048mm as per CAN/ULC S525.

2.8 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits signalling circuits (as required), sized to ensure correct supervisory current for each circuit. Open, short, or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.9 REMOTE ANNUNCIATOR PANEL

.1 Shall have an LCD display for events and LED display as per fire alarm schedule.

.2 Shall be equipped with a weather proof back box, vandal resistant cover, and thermostat controlled electric heater for outdoor use.

.3 LED test push button.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524.

.2 Locate and install manual alarm stations and connect to alarm circuit wiring.

.3 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.4 Connect alarm circuits to main control panel.

.5 Locate and install signal horns and connect to signalling circuits.

.6 Connect signalling circuits to main control panel.

.7 Install end-of-line devices at end of alarm and signalling circuits s required.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

3.2 FIELD QUALITY CONTROL

.1 Perform tests and verification in accordance with Section 26 05 01 - Common Work Results - Electrical and CAN/ULC-S537.

.2 Provide certification and verification prior to final acceptance. Verification report to be type written and included in the maintenance manuals.

.3 Coordinate signal to fire department with Departmental Representative.

.4 Fire alarm system:

- .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, sprinkler system, transmit alarm to control panel and actuate general alarm.
- .2 Check annunciator panels to ensure zones are shown correctly.
- .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
- .4 Class A circuits.
  - .1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
  - .2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point

of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits.

.1 Test each conductor on all circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

3.3 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

.1 All work shown on the Civil Engineering Drawings C01 – C05, is to conform to the Port Hardy Subdivision & Development Control Bylaw 17-99 and supplemented by the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2.

Port Hardy Subdivision & Development Control Bylaw 17-99 is available for download at:

https://porthardy.ca/wp-content/uploads/2017/01/9ad2933d-964e-4d63-b192-56b8f0974e7asubdivision_byl17-99.pdf

.2 Connection to, or alteration of, existing district-owned utilities, requires authorization by the District engineer.

.3 A "permit to install works within streets, lanes and district property areas" will be required where construction is to be undertaken in district of port hardy right-of-ways and/or district of Port Hardy-owned utilities or properties.

.4 Upon approval of the permit, the district of Port Hardy's Department of Public Works shall be notified 48 hours prior to commencement of work.

.5 The engineer shall be notified 48 hours prior to commencement of work.

.6 Contractor to comply with all applicable Ministry of Environment and Department of Fisheries & Oceans Canada requirements at all times during construction.

.7 Contractor to confirm location of existing utilities at all crossings and connections and report any discrepancies to the engineer prior to construction.

.8 Contractor to confirm that elevation, location and gradient of asphalt match existing prior to placement of asphalt or concrete.

.9 All trees not being removed in the construction area shall be protected.

.10 Adjust all manholes, water valves, hydro vaults, etc. to match new construction.

PART 2 - PRODUCTS

1.2 APPROVED PRODUCTS

.1 Materials and products are to conform to the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2 and the Port Hardy Subdivision & Development Control Bylaw 17-99 using products as identified in

SECTION 01011S – List of Approved Materials and Products available for download from the above link

PART 3 - EXECUTION

1.3 INSTALLATION

.1 All Construction to be as described in the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2.

END OF SECTION

PART 1 - GENERAL

1.1 Description

This Specification describes the requirements for the furnishing of all materials, equipment, labour and services for installation of steel pilings for the Canadian Coast Guard – Department of Fisheries and Oceans at Ocean Protection Plan Depot, Port Hardy. This specification also details the materials and workmanship necessary to provide the minimum quality acceptable.

1.2 Related Specifications

.1 This section of the Specifications is not necessarily complete in itself and must be read in conjunction with other sections of the Specifications and Contract Documents.

1.3 References

In the event of conflict between the referenced codes and standards, drawings, specifications, and/or the Purchase Order/Contract, the Contractor shall obtain clarification from the Departmental Representative before proceeding with the Work.

.1 American Petroleum Institute
- .1 API 5L, Specification for Line Pipe.
- .2 API RP2A, Recommended Practice for Planning, Design and Constructing Fixed Offshore Platforms.

.2 ASTM International
- .1 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot–Dipped, Zinc Coated, Welded and Seamless.
- .2 ASTM A252, Standard Specification for Welded and Seamless Steel Pipe Piles.
- .3 CSA International
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Construction.
  - .2 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .3 CSA S6, Canadian Highway Bridge Design Code.
  - .4 CSA S16.1, Limit States Design of Steel Structures.
  - .5 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
  - .6 CSA W48, Filler Metals and Allied Materials for Arc Welding.
  - .7 CSA W59, Welded Steel Construction (Metal Arc Welding).
  - .8 CSA Z245.1, Steel Line Pipe.

1.4 Submittals

.1 Submit a post-delivery inspection report on piling prior to installation.

.2 Submit installation work method and pile driving sequence.

.3 Submit drivability analysis to the Departmental Representative for approval of hammers.
- .1 Submit prior to pile installation a list and details of equipment for use in installation of piles.

.2 Impact hammers to manufacturer's written data.
.3 Vibratory hammer characteristics to evaluate performance.

.4 Submit certificates signed by the manufacturer certifying that materials used in the Work comply with specified performance characteristics and physical properties. Submit test results for concrete.

.5 Maintain field driving records for each shell including elevation of bedrock, driven depth of pile and rock socket depth, cut-off elevation of shell and protruding core.

.6 Submit detailed method statement and procedures for controlling and monitoring verticality and alignment of piles prior to commencing pile installation.

1.5 Services

.1 The Contractor's scope of work shall include but not necessarily be limited to the following:
.1 Supply of electricity and water for the performance of work, necessary for pile installation and associated works in accordance with this specification and the Drawings.
.2 Supply and transportation of piles to Project site.
.3 Offloading of piles as agreed with the Departmental Representative.
.4 Testing and inspection of field splices.
.5 Supply, delivery, and installation of concrete reinforcement and cast-in-place concrete necessary for steel piles and rock sockets.

PART 2 – PRODUCTS

2.1 Pipe

.1 Pipe piles shall be supplied by the Contractor. The details of size, number, and length of pile sections are indicated on the Drawings. The characteristics and performance are indicated in Specification 350551 - Marine General Sitework.

.2 Steel pipe for piling shall be seamless. Longitudinally welded or helically welded pipe conforming to project specifications. Minimum yield strength of 300MPa.

.3 High carbon steel pile shoe to ASTM A53, welded to the bottom of the pipe shell.

.4 Mill reports shall be in accordance with CSA S6.

.5 Piles shall be spliced to the required lengths and fabricated in a workshop, fabrication yard or equivalent to ensure high quality welds.

2.2 Cast-in-Place Concrete

.1 Cast-in-place concrete shall be supplied by the Contractor. The quantity, type, characteristics, and performance are indicated in Specification No. 033000 for Cast-in-Place Concrete.

2.3 Concrete Reinforcement

.1 Concrete Reinforcement shall be supplied by the Contractor. The quantity, type, characteristics, and performance are indicated in Specification No. 032000 for Concrete Reinforcing.

.2 Concrete tests shall be in accordance with CSA A23.1/A23.2

2.4 Hammer

.1 For impact hammers, provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.

.2 For non-impact hammers, provide installation method whether augering, jacking, vibratory hammer or other means and include full details of characteristics necessary to evaluate performance.

.3 Hammers to be selected on basis of driveability analysis using wave equation analysis, performed to show that piles can be driven to bedrock

.4 Drivability analysis shall include hammer, cushion, cap block details, static soil parameters, seismic and damping factors, total soil resistance, blow count, pile stresses and energy.

.5 When penetration to bedrock cannot be achieved with the proposed hammer, use a larger hammer and take other measures as required.

.6 Contractor shall submit piling equipment and hammer before start of project for review and approval. By approving the use of selected equipment and hammer, client does not take any responsibility of failure of the selected hammer or equipment for intended purpose. It is the responsibility of the contractor to successfully complete and deliver the finished product within agreed schedule and quality, without the claim of selection of equipment and hammer of improper size and capacity.

2.5 Drills

.1 Rotary hydraulic drilling rigs equipped with hydraulic motors to execute drill depths specified on the drawings. Drilling equipment shall consist of the following:

.1 Casing clamp.
.2 Working platforms
.3 Rotary head.
.4 Mast.
.5 Hydraulic Motor.
.6 Suction pipe.

.7 Drill rod.
.8 Stabilisers for drill rod.
.9 Down-the-hole hammer.

PART 3 – EXECUTION

3.1 Interfacing and Coordination

.1 Coordinate the Work of this Section with the Work described in other sections of the Specifications and work of other contractors in order to facilitate proper execution.

.2 Report discrepancies and potentials problems to the Departmental Representative for direction before commencing installation. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Departmental Representative.

3.2 Delivery, Storage and Handling

.1 All pile delivery, storage, and handling shall be in accordance with Specification No. 350551 and this specification for Pile Installation.

3.3 Splice Welding

.1 If field splicing (splicing in leads) becomes necessary, Details of proposed pile field splicing shall be provided to the engineer ar least 2 weeks prior to commencing work, splices shall be made by full penetration butt welds with backing plate procedures conforming to CSA W59 Clause 12. Root size and bevel angle shall be selected by the Contractor for his economy.

.2 Details of splice welding are covered in this specification.

.3 Field splicing shall be first approved by the Departmental Representative.

.4 Butt end joints shall be inspected by non-destructive radiographic or ultrasonic tests in accordance with CSA W59. Joints shall be tested for 100% of their welded length until the Department Representative is satisfied that sound, complete welds are obtainable. The Department Representative may then elect to test welds for 10% of their lengths by spot radiographic or ultrasonic tests disturbed around the joint.

.5 All welds found not acceptable through examination shall be removed and re-welded by the Contractor and subjected to re-examination.

.5 Pipe sections shorter than 3 meters in length shall not be used for fabrication into piles unless approved by the Department

Representative.

3.4 Coating of Piles .1 No coating shall be applied to piles.

3.5 Driving Pipe Piles .1 Pile Installation

.1 Installation of each pile shall be approved by the Departmental Representative prior to relocating the pile driving rig.

.2 Steel piles shall be firmly supported at the correct location prior to and during driving, by means of an approved template or other suitable means.

.3 Unless noted otherwise, the provisions of API-RP2A, API 5L and CSA Z245.1 shall be followed where applicable.

.4 Clearly mark each pile with its number and its overall length. Prior to driving, clearly mark each pile at intervals of 300 mm along its full length.

.5 Contractor to provide a hammer of suitable size and energy to install the piles to bedrock level without damage to the piles.

.6 Contractor shall select equipment and make the necessary provisions to facilitate driving through the anticipated materials to achieve the required pile penetration.

.7 The piles shall be driven to bedrock to facilitate installation of pile socket. If pile refusal is met at lower penetration, the Contractor shall follow the direction of the Departmental Representative.

.8 Remedial action due to failure of the Contractor's equipment to drive the piles as specified will be at the Contractor's expense. Such remedial action may consist of, but need not be limited to, adjustment or replacement of the hammer.

.9 Care shall be taken not to damage the pile tip by overdriving. Should the pile meet with excessive penetration resistance above the bedrock elevation the driving shall be stopped. Methods shall be used to remove soils and the pile shall be re-driven. This re-driving and clearing shall continue until bedrock elevation is reached.

.10 If impact driving, the Contractor shall provide leads that will enable the hammer to deliver impact concentrically and in alignment with the pipe longitudinal axis without inducing rocking movement or bending moments in pile. Leads shall be fixed, held in position at or near the top and at or near the bottom except where swinging leads are authorized by the Departmental Representative. Leads shall be parallel and not bent beyond a 15 mm deviation from a straight line over any 5 m length (0.3%). The suitability of the leads will be subject to

assessment by the Departmental Representative. Any remedial action required will be at the Contractor's expense.

.11 Ensure that the driving equipment does not exert lateral forces on the piles during driving. No adjustment of possible misalignment will be permitted during driving, except at the initial stage.

.12 Use of vibratory hammers permitted with approval from the Departmental Representative.

.13 After driving is complete (for abutment piles only), clean out the inside of pile and inspect for intrusion of material. Inspection shall be completed by using a video camera placed inside the pile. Ensure loose material is removed.

.14 Pile locations provided on the drawings are to cut-off elevations

.15 Maintain accurate records of the blow counts for each 300mm of penetration for the entire length of the pile and for each 25mm for the final 150mm of penetration.

.2 Driving Tolerances

.1 Prior to driving, the piles shall be located with proper allowances for their movement during driving operations to achieve the position indicated on the drawings.

.2 The driven piles shall have a maximum tolerance of +1% from intended batter or verticality and its location at the cut-off elevation within 75 mm of the true position as shown on the Drawings. Variation of pile cut-off elevation shall not be more than +12 mm.

.3 If the pile location is not within the above specified limits, the Contractor shall be liable for corrective measures required by the Departmental Representative. The Contractor may be required to remove such a pile and install a new pile to the specified tolerances at his own expense.

.4 Piles that do not meet all the requirements of this Specification, including those piles that are damaged, broken, misplaced, out of alignment, have material defects, or have inadequate capacity due to improper driving, shall be rejected. Installation of each pile shall be approved by the Departmental Representative.

.3 Ground Vibrations

.1 Carry out ground vibration and air overpressure measurements during pile driving.

.2 Ground vibrations from pile driving shall not exceed a peak particle velocity (PPV) of 12.5 mm/s in any structures (including new construction).

3.6 Reinforcing Steel

.1 Make reinforcement into cages sufficiently rigid enough to resist damage or displacement during handling.

.1 When reinforcement is made up from more than one segment, include sufficient bar length required to lap splice.

3.7 Concrete Placement

.1 Concrete and placement methods shall be in accordance with CSA A23.1/A23.2 and Specification No. 033000 for Cast-in-Place Concrete.

.2 Place 1 m of concrete into bottom of rock socket, secure anchor core in position and allow concrete to set.

.3 Complete placement of concrete to the required elevation within shell as approved by the Representative.

.4 Clean off concrete laitance accrued at top of shell.

.5 Cut-off top of shell neatly and square at elevations indicated.

.6 Protect steel reinforcement core projecting above concrete in caisson.

.7 When tremie concrete is used, with approval of the Departmental Representative and Representative, proceed as follows:

.1 Clean out rock socket.
.2 Equalize water level inside and outside of caisson.
.3 Place reinforcement.
.4 Lower sealed tremie pipe to bottom of socket. Fill tremie pipe and hopper with concrete.
.5 Withdraw tremie pipe, allow concrete to set, pump excess water out, clean up al laitance, and complete concrete in the dry.
.6 In case of losing concrete charge during tremie operations, withdraw pipe and reinforcement, remove concrete, and start again.

3.8 Rock Socket Installation

.1 After the pile is driven to bedrock, remove overburden down to tip of pile. Clean out material adhering to inside surface of pile.

.2 When pile shell reaches bedrock, churn drill 100 mm minimum into bedrock. Remove churn drill and drive shell into bedrock to form seal. Alternatives to churn drilling shall be approved by the Departmental Representative.

.3 Secure equipment in position during drilling. Drill sockets to minimum

depth into bedrock as indicated on the Drawings.

.4 After drilling is complete, clean out socket. Allow for socket to stand for 24 hours and inspect again for intrusion of material. Inspection shall be completed by using a video camera placed inside the pile and drilled socket.

.1 Ensure loose material is removed, caisson is free from foreign matter and there are no faults in bedrock or bearing strata directly below caisson.

.5 Make reinforcement into cages sufficiently rigid enough to resist damage or displacement during handling.

.6 Place concrete reinforcement for rock sockets in accordance to Specification No. 032000 for Concrete Reinforcing. Use locating devices to center reinforcement cage in pile and rock sockets.

.7 Place concrete for rock sockets in accordance to Specification No. 033000 for Concrete Reinforcing.

.8 Rock sockets must allow for intimate contact between outside of casing and rock surface. Contractor to provide proposed drilling and installation methodology in plan requested in Section 1.4. Where intimate contact is not achievable/possible the annulus between pile and rock will require grouting.

3.9 Obstructions

.1 Because the piles are specified to be advanced by drilling methods, any visible surface obstructions are assumed to be the responsibility of the Contractor.

.2 Contractor to allow for a pre-pile dive survey at all pile locations in order to remove any visible obstructions before pile installation begins. The Departmental Representative is to be advised as to timing for the dive survey, so he may attend.

.3 Sub-surface obstructions may be present in the overburden. These sub-surface obstructions fall into two categories: a) rocks and buried wood debris; and b) buried metal debris or buried reinforced concrete debris.

.1 Rocks and wood debris are Contractor responsibility and no claims for such obstructions will be entertained.

.2 Buried metal debris including reinforced concrete will be claimable as an extra to the Contract, as long as the Departmental Representative agrees as to the nature of the

debris encountered.

All instruction in this matter will be through the Departmental Representative and will require clear direction and written communication on both sides. As part of a claim under this section the Contractor will be required to prove that he has actually incurred additional costs as a result of said obstruction.

3.10 Cleaning

.1 Remove cut-off lengths from site on completion of work. Keep the work area clean at end of each day.

.2 Upon completion remove surplus materials, rubbish, tool and equipment. Separate and recycle waste materials.

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 Pile Cap

.1 All piles to have a 9mm pile cap welded all around

.2 Floating mooring pile shall have PVC cone pile cap fixed on top

PART 4 – QUALITY ASSURANCE AND CONTROL

4.1 General

.1 Personnel, supplied by the Contractor, experienced in pile driving inspection shall be on site full time during piling installation. Such personnel shall take all pile driving records and be responsible for completion of all relevant testing. Test results to be submitted within one week to the Departmental Representative after completion of testing.

.2 Piles driven before completion of satisfactory confirmation test on test piles will be at the Contractor's risk.

.3 Provide method and equipment for inspection of each pile to ensure that pile and rock sockets are properly cleaned out. Submit records of pile inspection prior to installing concrete infill for rock socket.

.4 The Contractor shall supply to the Departmental Representative a record for each pile, kept up to date as the works proceed. Each record shall be made on special forms made up for the project and approved by the Departmental Representative and include but not be limited to the following:

.1 Pile number, size, splice lengths, total length, coated length, location and other related information.

.2 Hammer type, make, model number, weight and rated energy.

.3 Penetration of pile under its own weight, own weight plus weight of hammer, depth of seabed prior to driving and at termination of driving.

.4 Details of driving and installation sequence, including dates, times and equipment used, interruption of driving shall be measured from last blow to first resumed blow.

.5 Installation details such as change of pile and hammer cushion, servicing or fuelling of hammer, breakdowns.

.6 If impact driving, the number of blows per 300 mm of driving for entire pile and number of blows per 10 mm for last 100 mm of driving approaching bedrock.

.7 The rate of penetration per 300 mm of driving and the associated vibratory hammer energy, including the rate for the last 100 mm of driving approaching bedrock.

.8 Measurement of sea/seabed level outside of pile and water/soil level inside of pile.

.9 Toe elevation upon termination of driving pile.

.10 Record driving difficulties and where applicable, pile damage.

.11 Record elevation of adjacent driven piles prior to and after driving of the pile.

.5 The integrity of the piles during construction shall remain at all times the responsibility of the contractor.

.6 Contractor is responsible for the inspection documentation and approval of all shop and field welds.

END OF SECTION 31 61 13

1.0 GENERAL

1.1 DOCUMENTS

.1 This section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SECTION INCLUDES

.1 Furnish all labour, materials, equipment and service necessary for the complete installation of fencing as indicated on the drawings and as hereinafter specified.

.2 The work of this section shall include the supply and installation of the following:

.1 Galvanized chain link steel fencing, posts and gates.

.2 Concrete footings for fencing line posts and terminal posts.

.3 Work of this section also includes supply and installation of welded wire fencing and post & wire fencing as specified herein complete with concrete footings at support posts, gates, and other accessories as required.

.4 Supply and installation of a manual sliding access gate at the vehicle driveway and swing man gate.

.5 Note that fence types and heights are designated on the drawings:

.1 Chain link fencing (security/perimeter fence)

.2 All fencing to be 1830 mm (6-feet) in height.

1.3 SUBMITTALS

.1 Provide shop drawings of fencing a minimum of two weeks prior to installation to the Consultant for approval.

.2 Drawings shall show the general arrangement with proper details of all components necessary to complete installation.

.3 Provide samples of all proposed fence types prior to installation.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Store packaged material in original containers with manufacturer's seals and labels intact.

.2 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

2.0 PRODUCTS

2.1 MATERIALS

.1 All pipe, tie wires, tension wires and bands, connectors, fittings, throw-bolts and hardware shall be hot dipped galvanized.

.2 Pipe: to CAN2-138.2 MBO, Table 1 Medium Duty. Schedule 40 (wall thicknesses as shown below), standard continuous weld, modulus of elasticity 30,000.

Pipe Diameter		Schedule 40 Wall Thickness	
41.3 mm	(1-5/8")	0.140"	(9/64")
47.6 mm	(1-7/8")	0.145"	(19/128")

60.3 mm	(2-3/8")	0.154"	(5/32")
73.0 mm	(2-7/8")	0.203"	(13/64")
88.9 mm	(3-1/2")	0.226"	(7/32")
114.3 mm	(4-1/2")	0.237"	(15/64")

.3 Tension Bar: 16 x 5 mm (5/8" x 3/16"), length to match entire height of fencing.

.4 Tie Wire: 3.55 mm (9 gauge) galvanized.

.5 Bottom Tension Wire (where applicable) 4.88 mm (6ga.) fixed to fencing by hog rings.

.6 Woven fabric: to CAN2-138.1.M80. See 2.1.8. for gauge and mesh size. Top and bottom selvedges to have knuckled finish. Wire diameters shall be as follows for the specified wire gauges:

Specified Gauge	Minimum Core Wire Diameter	
6 gauge	3.60 mm	(0.142")
9 gauge	2.64 mm	(0.104")
11 gauge	1.98 mm	(0.078")

.7 Concrete Footings: compressive strength 18 MPa at 28 days.

.8 Table One: Component Size and Description for each Location

Fence Component	Sizes (outside diameter)	
Bottom Rail	41 mm	(1-5/8")
Mid Rail	41 mm	(1-5/8")
Top Rail	41 mm	(1-5/8")
Line Posts	60 mm	(2-3/8")
End Posts	89 mm	(3-1/2")
Gate Posts	89 mm	(3-1/2")
Mid Brace	41 mm	(1-5/8")
Chain Link	50 mm	(2")
Fabric	galvanized mesh, 6 gauge	
Tie Wire, Hog Rings	300 mm. (12") on centre at all tension bands and frame members.	

.9 Touch-up paint: Zinc rich organic ready-mixed coating to CGSB-1-GP-18M.

.10 Gate Hardware: Galvanized pin-type hinge. Latch for exterior gate, other than that specified under Section 08 71 00, to be designed to receive padlock. All sized to suit the gate they are installed on.

2.2 VEHICLE ACCESS GATE

.1 Supply and install a chain link sliding driveway gate complete with all accessories, as indicated on civil drawings.

3.0 EXECUTION

3.1 POST SPACING

.1 Maximum post spacing 3000 mm on centre. Set end posts of straight runs and adjust on centre spacing of line posts equally between.

3.2 FOOTINGS

.1 All footings shall be set relative to finished surfaces as detailed.

.2 Minimum footing dimensions, except where detailed otherwise: footing depth 1200 mm, footing diameter 150 mm larger than outside post diameter, post depth 75 mm from bottom of footing.

.3 All posts shall be installed in footings for each section of fence before welding in the rails for that section.

3.3 FENCE CONSTRUCTION

.1 All fences shall be all welded construction. Weld all ends continuously to adjoining member. Grind all welds smooth.

.1 Cope all posts to accept top rail

.2 Cope all mid braces and bottom rails to fit posts

.3 Cut angle iron to fit backstop posts

.2 Cope all Connections. NO crimping or flattening will be permitted. Any connection not meeting this specification will be rejected and replaced with specified construction at the contractor's expense.

.3 Mid braces shall be installed at all end sections and all sections adjacent to gates and comers, for all fences. All fences 2.4m high or higher shall have horizontal mid rails installed continuous in all sections.

3.4 TACK WELDING

.1 Tack weld ALL 6 gauge galv. wire mesh in lieu of tie wires as described in item Table One above. Spacing for tack welds shall match specified tie wire spacing and as detailed.

3.5 TENSION BANDS

.1 Install tension bands where fabric terminates at all terminal, comer and gate posts.

3.6 FINISH

.1 Clean all welds and other breaks in the galvanized surface. Touch up with zinc rich paint. All link fence and posts to be galvanized finish.

3.7 CLEANUP

.1 Clean up all excess and waste material and remove from the site.

END OF SECTION 32 31 13

PART 1 - GENERAL

1.1 SUMMARY

.1 All work shown on the Civil Engineering Drawings C01 – C05, is to conform to the Port Hardy Subdivision & Development Control Bylaw 17-99 and supplemented by the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2.

Port Hardy Subdivision & Development Control Bylaw 17-99 is available for download at:

https://porthardy.ca/wp-content/uploads/2017/01/9ad2933d-964e-4d63-b192-56b8f0974e7asubdivision_byl17-99.pdf

PART 2 - PRODUCTS

1.2 APPROVED PRODUCTS

.1 All watermains to be PVC C900 DR18 (Rated to 235 psi) with integrally thickened bell.

.2 Materials and products are to conform to the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2 and the Port Hardy Subdivision & Development Control Bylaw 17-99 using products as identified in SECTION 01011S – List of Approved Materials and Products available for download from the above link

PART 3 - EXECUTION

1.3 INSTALLATION

.1 Installation to be in accordance with Ministry of Health guidelines

.2 A full length section of watermain pipe is to be installed directly adjacent to all fittings where applicable.

.3 All watermain fittings to have both joint restraints and thrust blocks.

.4 All Construction to be as described in the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 All work and materials are to be as described in the Project Specifications, the District of Port Hardy Subdivision and Development Control Bylaw 17-99 & Master Municipal Construction Documents (MMCD) 2009 or as otherwise approved by the district engineer

.2 Contractor not to commence backfill operation until the excavation and works have been approved by the engineer

.3 If a conflict between the specifications arises, the most stringent specification shall apply

.4 Expose all existing services at connection and crossing points 48 hours prior to starting construction of specified services contractor to verify location and depth of existing works, notify engineering immediately of any discrepancies

.5 Contact the District of Port Hardy and MoT Engineering Department 24 hours prior to blasting on site

.6 All construction and materials shall conform to standard practice specifications and drawings unless otherwise noted on this drawing

.7 Repair and/or replace all infrastructure/private property damaged or removed during construction, to better than, or equal to pre-construction condition

.8 Ensure the current municipal OH&S ground disturbance practice and procedures are followed contact BCONE at 1-800-474-6886 for external utility locations at least 72 hours prior to the start of construction

.9 Confirm location and elevation of existing utilities at all crossings and connections prior to construction

.10 Tanks to be installed and backfilled in accordance with dan's precast septic tank installation guide.

.11 The field and treatment works are to be constructed in general conformance with the Standard Practice Manual Version 3 and applicable equipment supplier installation requirements the finished distribution area must be graded so that rain and groundwater can drain away from the site

.12 Provision shall be made by means of proper sealing and venting of all components of the treatment plant system so as to minimize odours

.13 An authorized installer is to ensure that all electrical works are in accordance with applicable electrical codes

1.2 SECTION INCLUDES

.1 Materials and installation for precast concrete septic tanks.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 31 05 00 – Common Work Results For Civil Construction

.4 Section 33 36 33 - Utility Drainage Fields

1.4 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 ~~CAN/C~~CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association, (CSA International)

.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CAN/CSA-A23.4/A251, Precast Concrete-Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.

.3 CAN/CSA-B66, Prefabricated Septic Tanks and Sewage Holding Tanks.

.4 CSA B1800, Plastic Non-pressure Pipe Compendium – B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

1.5 DESIGN REQUIREMENTS

.1 Design precast concrete septic tank in accordance with CAN/CSA-B66, and to carry handling stresses and indicated service loads.

.2 Tank to have minimum total working capacity as indicated.

1.6 SUBMITTALS

.1 Shop drawings to indicate:

.1 Design calculations for items designed by manufacturer.
.2 Tables and bending diagrams of reinforcing steel.
.3 Camber.
.4 Formwork.
.5 Finishing schedules.
.6 Methods of handling and erection.
.7 Storage facilities.
.8 Openings, sleeves, inserts and related reinforcement.

1.7 QUALIFICATIONS

.1 Manufacturers and erectors of precast concrete elements shall be certified by CSA as meeting requirements of CAN/CSA-A23.4/A251, for Category SC and SP products.

PART 2 PRODUCTS

2.1 CONCRETE MIXES AND MATERIALS

.1 Concrete mixes and materials: to CAN/CSA-B66 and CAN/CSA-A23.1/A23.2.

.2 Use type 10 cement.

2.2 MANUFACTURE

.1 Manufacture units in accordance with CAN/CSA-A23.4/A251, except where specified otherwise. Piping as indicated on drawings.

2.3 FINISHES

.1 Finish tanks to commercial grade to CAN/CSA-A23.4/A251.

2.4 SIPHON CHAMBER

.1 Siphon chamber to meet design requirements specified for septic tanks.

.2 Provide siphon chamber vents.

2.5 ACCESS

.1 Provide access holes to surface to facilitate cleaning inspection.

2.6 TANK BEDDING AND SURROUND MATERIAL

.1 Granular material to Section 31 05 00 – Common Work Results For Civil Construction and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

Sieve Designation	% Passing
200 mm	-
75 mm	-
50 mm	-
37.5 mm	-
25 mm	-
19 mm	-
12.5 mm	100
9.5 mm	-
4.75 mm	80-100
2.00 mm	50- 90
0.425 mm	10- 50
0.180 mm	-
0.075 mm	0- 10

2.7 BACKFILL MATERIAL

.1 As indicated.

.2 Type 3, in accordance with Section 31 05 00 – Common Work Results For Civil Construction.

2.8 MODULAR WALL SEALS

.1 Provide modular wall seals.

2.9 EFFLUENT FILTER

.1 Consists of primary and secondary filter to permit removal of primary filter for servicing. Filter material to be non-corrosive PVC, ABS and polyethylene.

.2 Filter container complete with primary and secondary pull rods, inlet and outlet, leg bosses to accept either NPS 32 mm or 38 mm SCH 40 PVC pipe and septic tank riser with cover.

.3 Capacity: filter area, slot diameter and flow rate as indicated.

.4 Filters manifold together as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Place bedding and surround material in unfrozen condition.

.2 Do excavation in accordance with Section 31 05 00 – Common Work Results For Civil Construction.

.3 Place tank bedding material in accordance with details as indicated. Compact to 95% maximum dry density to ASTM D698.

.4 Make inlet and outlet joints of septic tank watertight, using modular wall seals.

.5 Conduct leakage test on septic tank in presence of Owner's Representative, before backfilling. Fill tank to level of effluent pipe, and allow to stand for 24 hours. Allowable leakage is zero.

.6 Do backfilling in accordance with Section 31 05 00 – Common Work Results For Civil Construction.

.1 Compact to 90% maximum dry density to ASTM D698.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for trench type septic tank disposal fields.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 31 05 00 – Common Work Results For Civil Construction

.4 Section 33 36 00 - Wastewater Utility Storage Tanks.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422, Standard Method for Particle-Size Analysis of Soils.
- .4 ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

- .1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
  - .1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

1.4 SUBMITTALS

.1 Submit to Owner’s Representative 20 kg samples of granular materials at least 4 weeks prior to beginning Work.

.2 Submit to Owner’s Representative copy of certification or licence of approved installers.

1.5 QUALITY ASSURANCE

.1 Use certified, licenced installers who comply with local authority having jurisdiction.

PART 2 PRODUCTS

2.1 GRANULAR MATERIALS

.1 Granular material to Section 31 05 00 – Common Work Results For Civil Construction and following requirements:

.1 Pit run crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

Sieve	% Passing Designation	
	Sand	Stone
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	-	80-100
19 mm	-	0-5
12.5 mm	100	-
9.5 mm	-	-
4.75 mm	80-100	-
2.00 mm	50-90	-
0.425 mm	10-50	-
0.180 mm	-	-
0.075 mm	0-5	-

2.2 IMPORTED FILTER MATERIAL

.1 Washed stone conforming to requirements of local authority having jurisdiction.

2.3 PIPE FOR DISPOSAL FIELDS

.1 Straight PVC pipe and fittings to CAN/CSA-B182.2. Perforated or unperforated as indicated.

2.4 DISTRIBUTION BOX

.1 Concrete: as indicated and to Section 33 36 00 - Wastewater Utility Storage Tanks.

2.5 SOURCE QUALITY CONTROL

.1 If requested, provide Owner's Representative with 3 certified copies of factory tests of pipe material.

PART 3 EXECUTION

3.1 TRENCH TYPE DISPOSAL FIELD INSTALLATION

.1 Excavate to lines and depths as indicated and in accordance with Section 31 05 00 – Common Work Results For Civil Construction.

.2 Scarify trench base and walls under dry conditions.

.3 Obtain Owner's Representative approval to operate construction equipment across disposal field.

.4 Place minimum 150 mm of stone material in bottom of trench.

.5 Install distribution box between septic tank and absorption trenches. Installation to be water-tight construction.

.6 Distribution box: set level as indicated. Provide access with removable cover for inspection of distribution box.

.7 Connect lengths and place distribution pipe on stone material as indicated and cover with minimum 50 mm of stone material.

.8 Connect each distribution pipe individually to distribution box.

.9 Cap or plug free ends of distribution lines.

.10 Maintain pipe elevations within 5 mm of inverts indicated.

.11 Do not backfill trenches until pipe grade and alignment have been approved by Owner's Representative and authority having jurisdiction.

.12 Backfill trenching with material as indicated. Material to be approved by Owner's Representative. Do not compact. Overfill to allow for settlement.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 All work shown on the Civil Engineering Drawings C01 – C05, is to conform to the Port Hardy Subdivision & Development Control Bylaw 17-99 and supplemented by the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2.

Port Hardy Subdivision & Development Control Bylaw 17-99 is available for download at:

https://porthardy.ca/wp-content/uploads/2017/01/9ad2933d-964e-4d63-b192-56b8f0974e7asubdivision_byl17-99.pdf

PART 2 - PRODUCTS

1.2 APPROVED PRODUCTS

.1 All catch basin leads to be 200mm dia. PVC SDR35.

.2 All catch basins to be complete with traffic rated lids. Shop drawings required prior to construction.

.3 All duckbill check valves to consist of materials suitable for a marine environment. Shop drawings required prior to construction

.4 Pre-cast concrete headwall to be suitable for marine environment. Shop drawings required prior to construction.

.5 Materials and products are to conform to the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2 and the Port Hardy Subdivision & Development Control Bylaw 17-99 using products as identified in SECTION 01011S – List of Approved Materials and Products available for download from the above link.

PART 3 - EXECUTION

1.3 INSTALLATION

.1 All Construction to be as described in the Master Municipal Construction Documents (MMCD) Platinum Edition (2009) Volume 2.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM):
- .1 ASTM A123/A123M-13, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A252-10, Specification for Welded and Seamless Steel Pipe Piles.
- .3 ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.2 Canadian Coast Guard (CCG):
- .1 MA 2080, General Specifications for Moorings for Aids to Navigation, Issue C (September 1999).

.3 Canadian Institute of Treated Wood/Western Wood Preservers Institute (CITW/WWPI):
- .1 Best Management Practices for the Use of Treated Wood in Aquatic and Westland Environments (BMP), November 2011.

.4 Canadian Standards Association (CSA):
- .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .2 CSA G40.21-13, Structural Quality Steels.
- .3 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 CAN/CSA-S16-14, Limit States Design of Steel Structures.
- .5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
- .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.5 National Lumber Grades Authority (NLGA):
- .1 Standard Grading Rules for Canadian Lumber, 2014 edition.

1.2 Inspection and Acceptance

.1 At his discretion, the Departmental Representative may inspect materials and products at any stage of manufacture, transportation and assembly. Satisfactory inspection at any stage does not preclude future rejection if the materials or products are subsequently found to lack uniformity or fail to conform to the specified requirements.

.2 The Contract work will not be accepted until the materials or products are satisfactorily installed in the completed structure as specified.

.3 Additional costs incurred by PSPC that result from unsatisfactory materials or workmanship will be charged to the Contractor.

1.3 Mobilization and Demobilization

.1 Mobilization and demobilization will include all work required to supply the material, plant and labour to the site of the work, unless specified otherwise.

1.4 Method of Measurement

.1 The method of measurement for the classes of labour, plant or material constituting the work will be as follows:

.1 Item No. 1.1, Mobilization and Demobilization

.1 Unit: a single lump sum for all mobilization and demobilization work.

.2 Item No. 2.1, Receive, Tow and Install Concrete Float
- .1 Unit: Lump sum will include acceptance of a complete float supplied by the Owner at specified location, towing, delivery and installation at site as specified.
- .2 Delivery will be required to adhere to the towing instructions included in the contract documents.

.3 Item No. 2.2, Supply, fabricate, and deliver steel pipe piles (1067 diameter x 25 thick)
- .1 Unit: each lineal meter of steel pipe pile supplied, fabricated, delivered to site and remaining an integral part of the completed work as specified, measured from cut-off to ground line plus actual penetration into the ground.
- .2 Penetration in excess of specified penetration will not be measured for payment unless the Departmental Representative is satisfied that such penetration is necessary and has so notified the Contractor in writing

.4 Item No. 2.3, Install Mooring Steel Piles
- .1 Unit: each pile installed, secured and remaining an integral part of the completed work as specified.
- .2 This includes rock sockets, handling, pile appurtenances, cutting shoes, splices and necessary works, in order to achieve the required design as specified

.5 Item No. 2,4, Supply and Install Fendering System
- .1 Unit: Lump sum will include fendering system supplied and installed and remaining an integral part of the completed work as specified, including connection hardware.

.6 Item No. 2.5, Supply and Install Pile Wells
- .1 Unit: each pile well supplied, fabricated, installed and remaining an integral part of the completed work as specified.

.7 Item No. 2.6, Supply and Install Cathodic Protection
- .1 Unit: Lump sum will include cathodic protection system designed, supplied and installed and remaining an integral part of the completed work as specified, including connection hardware.

.8 Item No. 3.1, Receive, Transport and Install Steel Vehicle Ramp
- .1 Unit: Lump sum will include acceptance of a complete ramp supplied by the Owner at specified location, delivery and installation at site as specified.
- .2 This includes installation of grating, aprons and associated components as specified.

.9 Item No. 3.2, Supply, fabricate, and deliver steel pipe piles (508

diameter x 17.5 thick)

.1 Unit: each lineal meter of steel pipe pile supplied, fabricated, delivered to site and remaining an integral part of the completed work as specified, measured from cut-off to ground line plus actual penetration into the ground.

.2 Penetration in excess of specified penetration will not be measured for payment unless the Departmental Representative is satisfied that such penetration is necessary and has so notified the Contractor in writing.

.10 Item No. 3.3, Install Vertical Steel Piles

.1 Unit: each pile installed, secured and remaining an integral part of the completed work as specified.

.2 This includes rock sockets, reinforced concrete fill, handling, pile appurtenances, cutting shoes, splices and necessary works, in order to achieve the required design as specified.

.11 Item No. 3.4, Install Batter Steel Piles

.1 Unit: each pile installed, secured and remaining an integral part of the completed work as specified.

.2 This includes rock sockets, reinforced concrete fill, handling, pile appurtenances, cutting shoes, splices, connections and necessary works in order to achieve the required design as specified.

.12 Item No. 3.5, Supply and Install Abutment Structure

.1 Unit: each cubic metre of reinforced concrete supplied and installed and remaining an integral part of the completed work as specified, measured in place.

.2 This includes anchor bolts, guardrail, slide plates and necessary works in order to achieve the required design as specified.

.13 Item No. 3.6, Supply and Install Revetment Filter Rock

.1 Unit: each cubic meter of filter rock supplied and installed and remaining an integral part of the completed work as specified.

.2 This includes delivery and placement of filter rock and necessary works in order to achieve the required design as specified.

.13 Item No. 3.6, Supply and Install Revetment Armour Rock

.1 Unit: each cubic meter of armour rock supplied and installed and remaining an integral part of the completed work as specified.

.2 This includes delivery and placement of armour rock and necessary works in order to achieve the required design as specified.

PART 2 - PRODUCTS

2.1 General

.1 Use only new materials except where specified otherwise.

.2 Use products of one manufacturer for material and equipment of the same type or classification unless otherwise specified.

.3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.5 Provide metal fastenings and accessories in the same texture colour and finish as base metal in which they occur.
- .1 Prevent electrolytic action between dissimilar metals.
- .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

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

.7 Use heavy hexagon heads, semi-finished unless otherwise specified.

.8 Bolts may not project more than 1 diameter beyond nuts.

.9 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.

.10 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.

.11 Store products in accordance with suppliers' instructions.

2.2 Steel

.1 Small fastenings: to CSA B111.

.2 Items manufactured or fabricated from scrap steel of unknown chemical composition or physical properties are not acceptable.

.3 Bolts: all bolts are to be machine bolts unless specified otherwise.
- .1 See Drawings for bolt, nut and washer grades

.4 Steel plate washers:
- .1 Shape: round, unless specified to be square.
- .2 Size: select from table below, unless specified otherwise:

WASHER DIMENSIONS

Bolt Size	Thickness	Round Plate Outside Diameter	Square Plate Side Size
12.7 mm	5 mm	62 mm	62 mm
15.9 mm	6 mm	69 mm	69 mm
19.1 mm	6 mm	75 mm	75 mm
22.2 mm	8 mm	81 mm	81 mm
25.4 mm	9 mm	87 mm	87 mm
31.8 mm	11 mm	100 mm	100 mm
38.1 mm	11 mm	112 mm	112 mm

.5 Bolt holes:
- .1 Machine bolts: bore holes to provide a driving fit.
- .2 Drift bolts: bore holes 1.5 mm less than bolt diameter.

.6 Welding:
- .1 Unless specified otherwise, welding is to be in accordance with CSA W59.
- .2 Provide evidence that welding companies are certified to CSA W47.1.

.7 Steel Grades:
- .1 Channels and Angles: 350W
- .2 Miscellaneous Plate: 350W

.8 Finish:
- .1 All fabricated steel profiles, angles and plates are to be hot dip galvanized unless otherwise noted.

2.3 Hardware

.1 Bolts (drift, machine, carriage, lag, etc.), nuts and washers: hot dip galvanized to CAN/CSA-G164.

.2 Spikes and nails: hot dip galvanized to CAN/CSA-G164 unless otherwise specified.

.3 All other hardware specified to be galvanized: hot dip galvanized to CAN/CSA-G164 unless specified otherwise.

.4 Stainless steel screws to ASTM F593-02

2.4 Chains and Shackles

.1 Chains:
- .1 To CCG MA 2080 C.
- .2 Black carbon steel, 19.1mm, long-link mooring chains, galvanized.

.2 Shackles:
- .1 Crosby load-rated shackles galvanized or alternate approved by addendum during tendering.
- .2 Secure pin against rotation after fastening with No. 12 gauge (2.052 mm) insulated copper wire.

2.5 Piling

.1 Steel piling:

.1 Steel pipes shall be as indicated on the drawings.
  .1 Steel Grade: 300 W.
  .2 Seamless, longitudinally welded or helically welded.
  .3 In in accordance with CSA Z245.1, API 5L, ASTM A252 or approved equivalent.

.2 Prior to fabrication of piles, contractor to verify dimensions and submit the following for approval:
  .1 Shop Drawings.
  .2 Details of pile installation method and equipment.
  .3 Mill certificates and certificates of conformance to the applicable standards.

.3 See specification 31 61 13 for further details on pile installation.

2.6 Rock Rip-Rap

.1 Hard, durable, irregular shaped, angular rock with minimum density of 2,640 kg/m^3 solid measure, meeting the following grading limits:
  .1 Provide specification and gradation to Department Representative for approval prior to installation.

.2 The maximum dimension of each piece shall not exceed 3 times the least dimension.

.3 Refer to Revetment specifications for details on material and placement.

2.7 Fendering

.1 Fender shall have the following features:
  .1 Meet energy requirements shown on the drawings.
  .2 Reinforced polyurethane skin.
  .3 Corrosion resistant fasteners as recommended by the manufacturer.
  .4 Non-marking even against white hulls.
  .5 The tolerance on specified rated Energy and Reaction shall be within +/- 10%.

.2 See drawings for size and number of fenders.

.3 Provide fender details and specifications to be submitted to the Department Representative for review prior to procurement.

.4 Provide fender details and specifications to Department Representative for approval prior to installation.

.5 The Contractor is required to verify the location and dimensions of the bull rail supports on the concrete float prior to procurement and adjust fender lengths and numbers accordingly.

PART 3 – EXECUTION

3.1 Handling of Treated

.1 Treated materials will be rejected if damaged in any manner during

Materials

handling, including damage from strapping and slings.

3.2 Field Preservative Treatment

.1 Treated materials:

.1 Do not make field cuts in treated material unless permitted by the Departmental Representative. When specified or approved, field treat cuts with field treatment preservative.

.2 Pile tops, pile bolt holes, pile bracing bolt holes, and cap-to-pile bolt holes may be field cut. Treat as specified.

.3 Before treatment all braces are to be bored on one end for the bolt to pile connection. This bored end is to be installed in the structure at the lowest end of the brace.

.4 Where field treatment is required, treat with 3 coats of preservative (for specific preservatives refer to CSA-O80 Series-08, Wood Preservation).

3.5 Material Disposal

.1 General:

.1 Debris specified to be removed and disposed of becomes the property of the Contractor. Disposal of the debris shall be performed in an environmentally sensitive manner at upland site (s) approved by the Ministry of Water, Land and Air Protection under the B.C. Waste Management Act, and by other agencies having jurisdiction, including municipal authorities.

.2 All disposal sites must be operating with up-to-date permits and licences.

.3 The Contractor shall submit proof of approval(s), copies of current permits and licences to the Departmental Representative 10 days before the initial disposal of debris.

.2 Certificates of Disposal:

.1 Provide the Departmental Representative with certificates of disposal from the disposal site, noting the dates, quantities, weights and general description of the debris received and proof of payment of all disposal fees.

.2 Provide certificates within 5 days of disposal.

.3 The Contract work will not be accepted until all certificates have been received by the Departmental Representative.

END OF SECTION 35 05 51

PART 1 - GENERAL

1.1 Description

.1 This Specification details the material and workmanship necessary to provide the minimum quality acceptable for the rock material for the revetment protection (armour and filter rock layers), and the transition to the pavement sub-grade. It should be referenced and interpreted simultaneously with all other specifications pertinent to the works described herein.

1.2 Related Specifications

.1 This Specification is not necessarily complete in itself and must be read in conjunction with the latest revision of other technical specifications and Drawings pertinent to the works described herein.

35 31 19 - Revetment Construction Specification

.2 Below is a list of the Design Drawings related to these works, and herein referred to collectively as the Drawings:

201- Revetment Plan
202- Revetment Sections Sheet 1
203- Revetment Sections Sheet 2

.3 Should a conflict arise between this Specification and other technical specifications, this Specification shall apply.

1.3 References

.1 All materials shall be in accordance with the standards referred to in this specification. Where no specific requirement is stated, the minimum shall meet or exceed the requirements set forth in the American Society for Testing and Materials International (ASTM) standards:

i. ASTM C127-[04], Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.

ii. ASTM C535-[03e1], Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

$$D\ (mm) = 1000 * \left(\frac{M\ (kg)}{2{,}650\ \left(\frac{kg}{m^3}\right)} \right)^{\frac{1}{3}}$$

iii. ASTM C136-[05], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

iv. ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/f3 (600kN-m/m3)).

1.4 Submittals

.1 At least 14 calendar days prior to commencing the work, inform the Engineer of proposed source of Products and provide results of grading analysis for each material proposed for use.

.2 Submit test results for each rock sample to the Engineer for review.

PART 2 – PRODUCTS

2.1 Rock Materials, General

.1 Rock materials referenced in this document pertain to the armour rock, filter, and transition to pavement sub-grade rock to be placed on the revetment.

.2 All rock materials from the quarry shall be rough angular quarried stone of a dense, hard, durable character, free of organic material, in-filled joints, seams or other defects, resistant to breakdown by handling, frost action or weather, and not subject to deterioration in sea water. As a minimum, rock shall meet the following test requirements:

Test	Requirement
Absorption (ASTM C127)	Not more than 2.0 percent
Abrasion, 500 Revolutions (ASTM C535)	Not more than 30.0 percent loss
Magnesium Sulphate Soundness, Fraction Loss at 5 Cycles (ASTM C88)	Not more than 15.0 percent loss
Petrographic Examination	Absence of weakness or materials that could result in significant stone alteration and reduction in durability
Degradation (ASTM D3744)	No index less than 35

.3 The rock shall have a unit mass not less than 2,600 kg/m³; i.e., a specific gravity (saturated surface dry) not less than 2.60.

.4 For armour rock and filter rock, mass governs the gradation and the Nominal Size is defined as:

where W is the mass in kilograms and D is the nominal size in millimetres (mm).

.5 Each type of rock shall be graded between the limits specified, with the longest dimension of any piece not greater than 2.5 times its least dimension.

.6 Production of rock materials shall implement measures to accommodate the difference between the Nominal Size and the actual shape or dimensions of the rock materials.

.7 The quality of rock material used for the transition to pavement sub-grade must be sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps,

organics, or other substances that would act in a deleterious manner.

2.2 Armour Rock

.1 Gradation of Armour Rock shall be within the gradation limits shown in Table 1 and Figure 1. Material shall be reasonably well graded, within the prescribed limits.

Finer by Mass (%)	Mass (kg)	Nominal Size (mm)
95 – 100	4600	1200
80 – 100	4000	1150
50 – 90	3200	1070
20 – 50	2000	910
0 – 20	1100	750
< 5	600	610

Note: M50 shall be greater than 1300 kg and less than 3200 kg.

2.3 Filter Gradation

.1 Gradation of Filter Rock shall be within the gradation limits shown in Table 2. Material shall be reasonably well graded, within the prescribed limits.

Table 1: Filter Rock Gradation

Finer by Mass (%)	Mass (kg)	Nominal Size (mm)
95 – 100	80	310
80 – 100	55	275
50 – 90	30	225
20 – 50	16	180
0 – 20	9	150
< 5	5	120

END OF SECTION 35 31 19

1.0 GENERAL

1.1 Purpose

.1 This Specification details the material and workmanship necessary to provide the minimum quality acceptable for the removal of debris, shoreline materials, and vegetation and the placement of armour, filter and transition rock material.

1.2 Specification for Related Works

.1 This Specification is not necessarily complete in itself and must be read in conjunction with the latest revision of other technical specifications and Drawings pertinent to the works described herein. The other technical specification and report listed below contain information related to work covered by this specification:

35 31 19 - Revetment Material Specification

Lewkowich Engineering Associates Ltd., 2019. Geotechnical Evaluation-Waterside Jensen Cover Road, Port Hardy, BC

.2 Below is a list of the Design Drawings related to these works, and herein referred to collectively as the Drawings:

.1 201 - Revetment Plan

.2 202 - Revetment Sections Sheet 1

.3 213 – Revetment Sections Sheet 2

.3 Should a conflict arise between this Specification and other technical specifications, this Specification shall apply.

1.3 Reference Standards and Guidelines

.1 Standards:

BS 6349-7 1991 Guide to the Design and Construction of Breakwaters (amended January 2010).

.2 Guidelines:

CIRIA; CUR; CETMEF. The Rock Manual. The Use of Rock in Hydraulic Engineering (2nd Edition) (2007).

1.4 Submittals

.1 Work Plan as described in Section 1.5 - Health and Safety.

.2 Traffic Management Plan as described in Section 1.5 – Health and Safety.

.3 Transportation method as described in Section 3.2 – Transportation.

.4 The Contractor shall submit all necessary information to adequately evaluate progress claims:

.1 For each load of material delivered onto or removed from site, scale delivery slips stating type of material, gross mass, net mass, mass of delivery equipment, time and date of delivery, must be provided to the Engineer. Materials shall not be placed without provision of a scale delivery slip. Delivery slips for placed material or material removed from site shall be included in the daily report.

.2 Submit all survey and cross-section records to the Engineer within 2 business days after data collection.

.3 Submit all removed material volumes to the Engineer within 2 business days after data collection.

1.5 **Health and Safety**

.1 The Contractor shall prepare and submit a Work Plan, at least one week in advance of the work, to the Owner. The work plan shall include:

.1 Timeframe of construction, including start date, duration, and hours of operation. The Contractor shall indicate if night time works are anticipated and provide the anticipated methodology.

.2 Mode(s) of transportation and equipment, including a description of all machinery to be used during the work.

.3 Copies of operator certificates and licenses for the individual equipment operators.

.4 Number of expected loads of material / trips.

.5 The Contractor shall meet with BC Ferries representative as needed to coordinate staging areas and vehicle / pedestrian traffic. The Work Plan shall include details of the Contractor's approach to coordination.

.6 Emergency response plan in the event of workplace incident or injury. The response plan shall be prepared in consultation with the Engineer and BC Ferries representative to ensure compliance with existing on-site procedures.

.7 Emergency contact phone numbers.

.8 Map showing route to nearest medical facility.

.9 Site specific risk assessment to identify risks and mitigations measures. The mitigation measures shall describe work site access controls and describe any required personal protective equipment (PPE). The mitigation measures shall include extra care taken when removing existing vegetation due to steep slopes.

.2 The Contractor shall undertake a toolbox meeting to review site safety at the start of each working day at the project site.

.3 The Contractor shall prepare and submit a Traffic Management Plan at least one week in advance of the work to Owner. The traffic management plan shall include:

.1 Details of signage, flagging, or other traffic control measures. Note that the work area shall be set up to avoid any interference with adjacent operations, and be staged to minimize interference with ongoing Langdale Terminal operations. The Contractor shall ensure that the work area is actively controlled to ensure no pedestrian or vehicle traffic can enter the work area without warning.

.4 The Contractor must supply and install materials for alleviation or prevention of dust nuisance caused by construction activities.

1.6 Facilities

.1 Temporary restroom facilities at the Site shall be the provided by the Contractor during the construction period for personnel working at the Site.

.2 The Contractor is responsible for providing temporary construction power, as required. Temporary power may be available upon request at the Site; however, this should not be relied on.

2.0 PRODUCTS

2.1 Materials

.1 Rock Materials:

.1 Rock materials referenced in this document pertain to the armour rock and filter rock to be placed as fill and on the face of the slope.

.2 Shall be of a quality as specified in the Material Specification Section 35 31 19

.3 Rock material shall be tested according to the requirements defined in the Material Specification Material Specification Section 35 31 19

.4 Each truck load delivered on site must meet the required gradation for the specific rock type.

.2 Outfall and Headwall:

.1 There are three storm outfalls within the revetment footprint. The approximate location and size of the storm outfalls are shown in the civil and mechanical documents.

.2 It is the responsibility of the contractor to ensure that the selected headwall product meets the requirements listed in Contract Documents.

2.2 Inspection

.1 Rock Materials:

.1 Prior to loading rock materials the Contractor shall inspect the materials to ensure that individual pieces do not contain weaknesses such as bedding planes, joint cracks, or other rock quality factors. Stones found to contain weakness planes or not satisfying rock quality criteria shall not be used.

.2 Prior to loading rock materials onto the barge or truck, the Contractor will set up a meeting at the quarry with the Engineer, to inspect the rock size and confirm that it meets the required gradation of the specific rock type. If, during the inspection, a batch of material is found to be made up of pieces that do not meet the specific gradation, the batch must be replaced and approved.

.3 Rock materials loaded onto the barge or truck and delivered on site must meet the required gradation for the specific rock type.

.4 The Contractor shall inspect the materials on-site to ensure that individual pieces do not contain weaknesses such as bedding planes, joint cracks, etc. Stones found to contain weakness planes or not satisfying rock quality criteria shall not be used.

.5 The Engineer or Owner's Representative reserves the right to inspect and approve or reject rock materials at any time prior to and during placement of the revetment.

.6 At no additional cost to the Client, any barge or truckload of rock material that arrives on site may be checked randomly, at the discretion of the Engineer, to confirm that it meets the gradation of the specific rock type.

.7 In addition to the daily checks, if, at the discretion of the Engineer, any barge or truckload appearing to have a gradation that does not meet the specific rock type, construction will be stopped, and the load checked. These checks will be at the expense of the Contractor.

$$W(kg) = Volume\ (m^3) \times (1 - Bulk\ Porosity) \times \rho\left(\frac{g}{m^3}\right)$$

.8 The Contractor shall provide, at no additional cost to the Client, the means of weighing armour rock at the Quarry or source and on site. Note that a bucket loader equipped with a scale and slings is acceptable for weighing individual rocks.

.9 If, during the inspection of rock materials, a particular load is found to be made up of pieces that do not meet the specific gradation, the Contractor shall be responsible to replace the deficient size. Note: There is limited room on site to stockpile rock material for later use, and any additional transportation and handling charges incurred from the delivery of rock material that does not meet gradation shall be covered by the Contractor at no cost to the Owner. It is strongly recommended that the Contractor setup good QA/QC procedures at the quarry where materials are loaded for transport to the site.

.2 Existing armour:

.1 The Contractor shall inspect the materials to ensure that materials are suitable for incorporation into the revetment. The existing armour surface must be clear of sharp protuberances and/or local pockets of similar rock sizes.

.2 Any large material unstable / unsuitable must be removed or replaced.

.3 The Engineer must inspect and approve the existing armour conditions prior to filter placement. See also Section 3.4 - Removals

2.3 Measurement and Payment

.1 The baseline of the revetment is identified by sections connected to Work Points at the Revetment Crest as shown in the Design Drawings.

.2 The measurement of payment shall be as below:

.1 Supply and place filter rock: by mass (weight slips) and by volume (survey);

.2 Supply and place armour rock: by mass (weight slips) and by volume (survey);

.3 The pre-construction survey shall be completed after the removal of vegetation, unsuitable material and garbage from the shoreline, to allow for accurate measurement.

.4 Material graded or removed beyond the design line and grade shown on the Design Drawings will not be paid for unless these changes were requested by the Engineer.

.5 Rock materials that have been determined from survey to be placed outside of tolerance will not be paid for, and the estimated mass of this material will be deducted from the weigh slip totals.

.6 The calculation for the mass of excess rock materials shall be based upon the volume of material (as determined by survey data), the assumed porosity of the placed material, and the rock density.

Where W is the mass (kg), ρ is the rock density (kg/m3), and Bulk Porosity is the result of void spaces between individual rocks.

.7 The design in-place bulk porosity, for the theoretical volumes of the filter, transition and armour rock material layers is:

.1 Placed Filter Rock: 30 percent

.2 Transition Rock to Granular Sub-Base: 30 percent

.3 Placed Armour Rock: 35 percent

.8 If the Contractor disputes the assumed bulk layer porosity given in this document, they may, at their own cost, setup a test section on site and place material to the satisfaction of the Engineer within the test section. The bulk layer porosity shall then be determined from a survey of the volume of the test section along with the total weight of material placed into the test volume. The test volume shall be sufficiently large to be representative of a section of placed material.

.9 Before placement of any overlying material of different type to the underlying material, the underlying material shall be surveyed and survey results approved by the Engineer.

.10 Cross-sections of the completed work shall be surveyed perpendicular to the control line of the revetment at no more than five (5) m intervals (along the baseline). Measurements shall be taken at no greater than 1.5 m intervals along each individual cross-section. Coordinates shall be in UTM Zone 10, NAD83, as per drawing standards. Vertical datum is Geodetic Datum CGVD2013.

.11 The Contractor shall provide all surveying necessary to lay out the work, proceed with placement, provide quality control, and measurement for payment.

.12 Site clean-up will be to the satisfaction of the Engineer, and will entail the removal of all equipment (machinery, support equipment, construction debris, silt-fencing and flagging, etc) from the project site. The intent is that the Site will be returned to a pre-construction condition in all areas outside of the completed works.

3.0 EXECUTION

3.1 General

.1 The Site is subject to natural water level fluctuations due to tides, waves and currents. Storm events may cause water levels to exceed normal ranges. The contractor shall familiarize themselves with these conditions prior to undertaking the work.

.2 The Contractor is advised that tidal and storm conditions may impact construction operations and they shall be prepared to work around these conditions.

.3 Any loose or unconsolidated areas of the slope following excavation shall be compacted to the satisfaction of the Owner's Representative prior to placement of rock material.

.4 Recovery or replacement of any materials displaced by storm events or vessel wake shall be at the Contractor's expense and at no cost to the client

3.2 Transportation

.1 Rock materials shall be handled and transported to the appropriate location of placement so that each type retains its qualification as the specified gradation and materials and in such manner to prevent segregation or breakage. Note: As there is limited space on site to store or sort rocks, it is important that each delivery of material to the Site meets the gradation specification.

.2 The contractor is free to propose the method of transportation and it shall be submitted in writing to the Engineer at least one week in advance. The Engineer shall observe the method of transportation to monitor breakage or abrasion occurring in transport.

.3 Once approved, the proposed method shall not be changed without prior written authorization from the Client.

.4 Transportation can be stopped at any time by the Engineer if he considers the method does not maintain the required gradation for the required material. Any time lost of this shall be at the Contractor's expense.

3.3 Site Preparation

.1 A pre-construction survey must be conducted prior to commencement of work on site (see also Section 2.3 – Measurement and Payment).

.2 Prepare and grade slopes as shown on the Design Drawings and as directed by the Engineer. Slope must be cleared of debris or sharp objects and unsuitable / unstable material, smoothed, made uniform, and ensured that it is clear of sharp protuberances and/or local pockets.

.3 The Contractor shall plan their excavation and rock placement work to minimize the time in which excavated sections are left uncovered by rock armour. It is brought to the Contractor's attention that a wind event occurring at high tide conditions could damage the project site, and it is for this reason that the work must be planned and executed to ensure excavated slopes are covered in the design rock sections quickly. The Contractor shall monitor weather forecasts and not proceed with excavation work when adverse weather is forecast in the near future. It is recommended to only excavate an area for one day's worth of work during low tide, including placement of Filter Rock. This is important to ensure there is no need to de-water previously excavated areas, as excavations will flood during high tides.

.4 Excavated material must be placed back after Armour Rock placement (on top and around armour).

3.4 **Removals**

.1 Broken concrete blocks, asphalt slabs, broken fencing, out of service drainage pipes, and other non-natural materials shall be removed and cleared from the beach area.

.2 Existing vegetation within 2m of the existing slope shall be removed and grubbed from the slope and upland area.

.3 Materials not suitable for incorporation into the revetment include, but are not limited to: large woody debris, metal debris, plastic, broken asphalt, and concrete slabs.

.4 All materials removed shall be disposed of in appropriate disposal facilities in accordance with all local laws and regulations.

3.5 Placement of Filter Rock

.1 Filter Rock shall be handled and placed in such a manner as to prevent segregation and to provide a stable and well-graded in-place mass. The handling and placement procedures shall avoid mixing of different types of rock and avoid contamination of the placed mass of filter rock. Any undersized or contaminated sections of materials are to be removed and repaired at the Contractor's expense.

.2 Filter Rock must be placed with a layer thickness as shown on the Design Drawings.

.3 Filter Rock shall be placed beginning from the toe of the slope, working up the slope. The finished surface shall be densely placed, well keyed, and uniform. Fill voids, rework rocks not properly embedded, and remove protuberances to the satisfaction of the Engineer.

.4 Filter Rock may be placed in bulk and subsequently trimmed to the elevations, thicknesses, slopes, and lines shown on the Design Drawings. Use methods to ensure that the finer one-third of the gradation is evenly distributed throughout the layer and over the surface being covered.

.5 Remove and replace the portion of any layer in which material becomes segregated during spreading.

.6 Settlement is possible during construction. The Contractor shall use their available equipment (such as the bucket head) to tap down placed filter material to check for compaction. In the event of compaction or settlement, additional material, of the same type, shall be placed to ensure the required design elevations are achieved. This material shall be added prior to the placement of the Armour Rock. If settlement continues to occur, additional material shall be added at the direction of the Owner's Representative to maintain final design elevation (as required) until the end of the construction period.

.7 All material shall provide a stable, interlocked, and well-graded in-place mass.

3.6 Placement of Armour Rock

.1 Armour rock shall be handled and placed in such a manner as to prevent segregation and to provide a stable, interlocked, and well-graded in-place mass. The handling and placement procedures shall minimize breakage of the stone, avoid mixing of different types and avoid contamination of the placed mass of rock material. Any undersized stones or contaminated materials are to be removed at the Contractor's expense.

.2 Care must be taken when placing Armour Rock to avoid disturbing the filter layer. Armour Rock shall not be dropped onto the filter layer from heights higher than 0.8 m above the filter layer or already placed Armour Rock.

.3 Place Armour Rock in the locations and to the elevations, thickness and details indicated on the Design Drawings and as directed by the Engineer. Use methods to ensure that the finer one-third of the gradation is evenly distributed throughout the layer and over the surface being covered.

.4 Begin placement of Armour Rock at the toe of the slope and continue placement working up the slope. Place the rock in at least two layers in such a manner as to create firm bedding and interlocking of individual pieces to obtain a tightly packed structure. The finished surface shall be densely placed, well-keyed, and uniform. Individual rocks shall have at least three (3) points of contact to adjacent rocks. Fill voids, and rework or replace rocks not properly embedded, and remove protuberances, to the satisfaction of the Engineer. Remove and replace that portion of any layer in which material becomes segregated during spreading.

.5 Settlement is possible during construction. As a consequence, additional material, of the same type, shall be placed to ensure the required design elevations are achieved. If settlement continues to occur, additional material shall be added at the direction of the Engineer to maintain final design elevation (as required) until the end of the construction period.

.6 Remove and replace any portion in which material becomes segregated during placement to avoid any large areas of small armour rock.

.7 All material shall provide a stable, interlocked, and well-graded in-place mass.

3.7 Tolerances

.1 The tolerances given below are the technically accepted tolerances.

.2 All dimensions, thicknesses, and profiles of the slope protection as shown on the Design Drawings are minimum dimensions/profiles. Locally acceptable lesser thicknesses are defined below.

.3 All rock materials shall be placed to the lines, grades, and elevations indicated on the Design Drawings.

.4 The horizontal location of the edge of crest or the toe of slope for any material along the revetment face shall not deviate from the design location by more than 0.2 m.

.5 The maximum permissible variation in the finished thickness of Filter Rock or Armour Rock layers, when measured as the perpendicular dimension between the top and bottom surface planes, shall be within -10 to +15 percent of the layer thickness indicated on the Design Drawings. For the purpose of measuring layer thickness, the surface planes shall be considered to pass through the average location of the crests of the individual rocks on the surface.

.6 Excavation slopes shall not deviate from the design elevations by more than 180mm.

.7 Finished slope angles of filter rock or armour rock layers shall not be steeper than the design slopes shown on the Design Drawings. Slopes may be milder, to within 2 degrees of the angle corresponding to the slope specified on the Design Drawings.

3.8 Outfall and Headwall

.1 The Contractor shall be responsible for confirming the existence, size, and location of any outfall that may be affected by the work.

.2 The Contractor shall be responsible for notifying the Engineer of conflicts or potential conflicts between the proposed work and existing conditions, and shall be responsible for damage that occurs due to contractor's negligence.

.3 The Contractor shall be responsible for extending the storm outfall, as necessary to install a headwall with grills as specified in the Civil and Mechanical Contract Documents.

3.9 Restoration

.1 Upon completion of work, remove and dispose of surplus materials and debris off Site.

.2 Clean and reinstate areas affected by work as directed by the Engineer.

4.0 QUALITY CONTROL

4.1 Quality Assurance

Quality Assurance refers here to administrative and procedural activities that will be implemented by the Contractor within their quality system to ensure that the rock materials as placed on-site meet the requirements of this specification.

The Contractor shall be responsible for monitoring and reporting on quality. The Contractor shall identify a person on their team who is responsible for Quality Assurance and who will develop the specific procedures (Quality Controls) to be used by the Contractor in the execution of their work.

4.2 **Quality Controls at Quarry**

The Contractor shall, at a minimum, develop the following quality control procedures for the work at the quarry:

.1 A quality control procedure at the quarry to ensure proper rock gradation is produced. A written plan of the steps to be taken at the quarry to ensure proper delivery of rock materials to the project site shall be prepared and submitted to the Owner's Representative for approval. At a minimum the plan shall include:

.1 Monitoring of intrinsic rock properties for: geological variability, changes in petrography, density, porosity, and discontinuities in the rocks. The plan shall identify who at the quarry will monitor intrinsic properties.

.2 Mass distribution controls: A weighing device or load cell is required to weight individual rocks and obtain gradation curves from stockpiles (See Section 5.0). The plan shall identify the equipment and list the frequency with which gradations will be checked.

.3 To assist quarry operators who must sort rock, a set of reference stones with their mass painted on them shall be setup near to the work area in the quarry. The reference stones should represent the upper and lower bounds for the median rock weight, along with upper and lower size rocks for the overall gradation.

.4 Controls to remove rocks from the stockpiles for which the longest dimension of any piece is greater than 2.5 times its least dimension.

Row	C1 Rock Mass kg (sorted from smallest)	C2 Cumulative Mass (kg)	C3 Cumulative % mass less than
1	650	650	1.1%
2	710	1360	2.3%
3	740	2100	3.5%
4	810	2910	5.0%
5	1140	4150	6.9%
6	1270	5420	9.0%
7	1340	6760	11.2%
8	1390	8150	13.5%
9	1470	9620	16.0%
10	1590	11210	18.6%
11	1630	12840	21.3%
12	1670	14510	24.1%
13	1730	16240	26.9%
14	1890	18130	30.0%
15	1890	19950	33.1%
16	1990	21940	36.4%
17	2050	23990	39.8%
18	2090	26050	43.2%
19	2190	28240	46.9%
20	2260	30500	50.6%
21	2330	32830	54.5%
22	2430	35260	58.5%
23	2500	37870	62.8%
24	2640	40510	67.2%
25	2740	43250	71.8%
26	2790	46040	76.4%
27	3020	49060	81.4%
28	3250	52310	86.8%
29	3420	55730	92.5%
30	4530	60260	100.0%

.2 A test shall be arranged to weigh rocks at the quarry(s) from the stockpile(s) of material prepared for the project prior to shipment to confirm the gradation by mass. This test shall be separate to the mass distribution controls used at the quarry to prepare the stockpiles and shall be witnessed by the Owner's Representative.

It is emphasized that most of the quality control should be performed at the quarry to minimise the risk of transportation of unsuitable materials.

4.3 Quality Control during Delivery and Construction

The Contractor shall develop a quality control plan for the work site that ensures the proper gradation of rock material is achieved in the finished works. A written quality plan shall be developed that:

.1 Identifies the Contractor employee on-site responsible to ensure rock quality is achieved.

.2 Provides a plan for testing rock gradations on site. This could include a combination of estimating mass by dimensional measurement of the rock, along with limited weighing of rocks. Particular control will be required if local stockpiles are used in which materials obtained locally from excavation are to be worked into material obtained off-site.

.3 Establishes protocol for the visual control of the shape of the rocks.

.4 Ensures inspections are undertaken for breakage from each delivery. Excessive breakage can result in a change of the gradation.

.5 Include a plan that specifies the equipment and procedures to be used to ensure that rock placement is as per the locations, dimensions, slopes and thicknesses as indicated on the Design Drawings.

5.0 CALCULATION OF GRADATION

This section provides guidance on the methods that the Owner's Engineer will use to determine gradation. It is recommended that the Contractor adopt similar methods for their own Quality Controls. It is expected that the Contractor will undertake gradation checks and provide results for all classes of rock as part of their quality control.

5.1 Gradation from Weights

The following is an example of how to calculate the mass distribution curve for a selected sample of 30 rocks. In the example, 30 individual rocks are selected from a stockpile and weighed. It is important that all rocks within an area of the stockpile selected for inspection are included (i.e. smallest rocks are not ignored). If by visual inspection one area of the stockpile has notably larger (or smaller) rocks than another area, then the Contractor should re-sort the stockpile using equipment to ensure there is no segregation of rocks sizes.

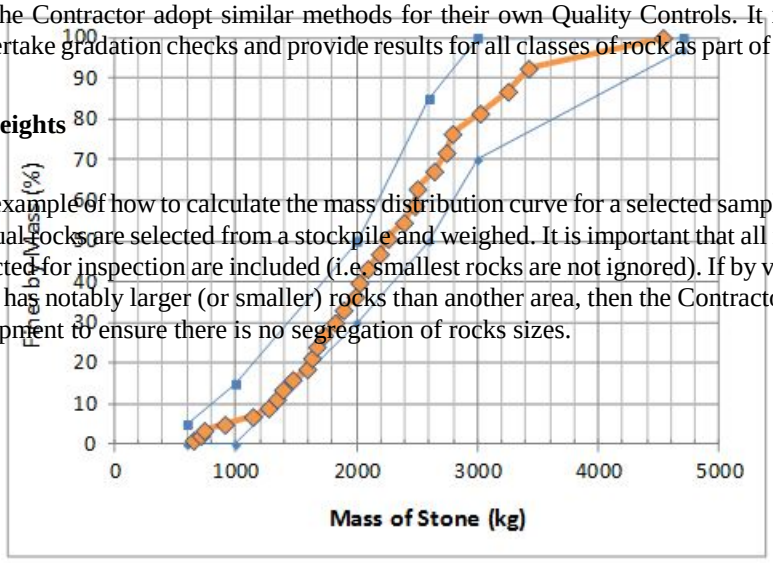

Figure 1: Table of Measured Gradation

Individual Rock mass shall be listed in a table, and sorted from smallest to largest. (See column C1 in Figure 1 as an example). From this the cumulative mass is determined (Column C2) and the cumulative % mass (Column C3).

The results should be plotted on a curve with the gradation limits shown in order to ascertain if the test sample meets the specification (see example on Figure 2).

Figure 2: Plot of Measured Gradation (example)

The weighing of individual rocks is not a common operation at a quarry, and it is recommended that specific safety protocols be developed for the procedure. Figure 3 and Figure 4 show examples of rocks being weighed individually.

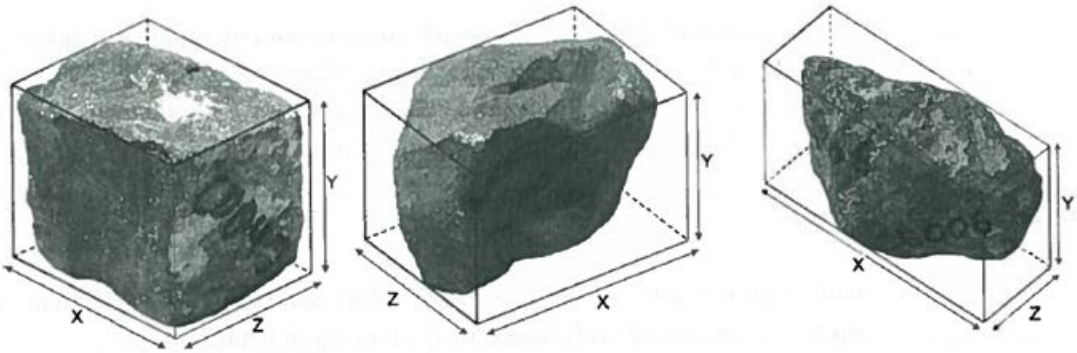

Figure 3: Individual rock weighing at quarry using a floor scale on beams
(Ref: CIRIA C683)

Figure 4: Individual rock weighing using load cell and slings

5.2 Gradation from Dimensional Measurement

A supplemental method to direct weighing of individual rocks is to estimate the rock mass from three dimensions. This can be done relatively quickly at site to check the consistence of rocks being worked from a stockpile, and only requires a tape measure and a field notebook.

The method is subjective, and requires some eye 'calibration' by the team in the field making the estimates. The person making the measurements must estimate the 'blockiness' value (BL) of the rock (see Figure 5).

Figure 5: Rock Blockiness Examples, Left to Right, BL = 80%, 60%, 40% (CIRIA C683)

The mass of an individual rock is estimated by taking three mutually perpendicular measurements of the rock (x,y,z) as best as possible in the field or at the quarry. A BL value is then estimated, and the mass of the rock determined as follows:

Mass = X Y Z (BL) (ρ)

Example: A person measures a rock 1.35m by 0.85m by 0.7m, and estimates the BL coefficient as 60%. The rock material has a density of 2650 kg/m3. The mass is thus determined as:

Mass = (1.35m) x (0.85m) x (0.7m) x (0.6) x (2650kg/m3) = 1280kg

The methodology outlined above is based on estimating and adjusting the outer inscribed equivalent block based on the larger mutually perpendicular dimensions of the rock. A methodology based on estimation of a smaller inscribed solid block is also acceptable.

These methods of estimating mass should "calibrated" by weighing a sub-sample of measured rocks to verify the estimates of BL being used by personnel and help to "calibrate" the field staff who are evaluating rock onsite as per Section 4.3.

Once a number of rocks have been measured and the mass estimated, the gradation can be determined in the same manner as given in Section 5.1.

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