



THE CITY OF WINNIPEG

PROJECT MANUAL

TENDER NO. 543-2022B

**CONSTRUCTION OF THE NEW WFPS AMALGAMATED STATION 9 – 1083
AUTUMNWOOD DRIVE**

CITY REPRESENTATIVE	Municipal Accommodations Assets & Project Management	Greg Kucel (204) 794-4790 gucel@winnipeg.ca
ARCHITECT	Cibinel Architecture Ltd 560 Academy Road Winnipeg, MB R3N 0E3 www.cibinel.com	Steff Beernaerts (204) 989 8925 steff@cibinel.com
STRUCTURAL	Crosier Kilgour & Partners 300-275 Carlton Street Winnipeg, MB R3C 5R6 www.ckpeng.com	Steve Bervanakis (204) 943-7501 Steve.bervanakis@ckpeng.com
MECHANICAL AND ELECTRICAL	Epp Siepman Engineering 400-136 Market Avenue Winnipeg, MB R3B 0P4 www.eppsiepman.com	Mechanical: Mitchell Haw mhaw@eppsiepman.com Electrical: Ade Sowunmi asowunmi@eppsiepman.com (204) 453-1080
CIVIL	KGS Group 865 Waverly Street Winnipeg, MB R3T 5P4 www.kgsgroup.ca	John Minkevich (204) 318-2052 jminkevich@kgsgroup.com
LANDSCAPE	HTFC Planning & Design 500-115 Bannatyne Avenue E. Winnipeg, MB R3B 0R3 www.htfc.ca	Omar De Mesa (204) 944-9907 odemesa@htfc.ca

END OF SECTION

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 03	Project Directory	1
00 01 10	Table of Contents.....	6
00 01 07	Seals Page.....	2
00 31 00	Available Project Information	2

DIVISION 01 – GENERAL REQUIREMENTS

01 10 00	Summary of Work	3
01 19 00	Specifications and Documents.....	1
01 31 19	Project Meetings	3
01 32 00	Construction Progress Documentation	3
01 33 00	Submittal Procedures.....	6
01 33 29.03	Sustainable Design Reporting – Green Globes.....	4
01 33 29.07	Prohibited Content – Installer Certification	2
01 35 13	Special Project Procedures.....	2
01 35 26	Environment Protection.....	1
01 35 46	Indoor Air Quality Procedures.....	5
01 35 66.13	Sustainability Certification Project Requirements- Green Globes	7
01 41 00	Regulatory Requirements	1
01 45 00	Quality Control	5
01 51 00	Temporary Utilities	2
01 52 00	Construction Facilities.....	2
01 53 00	Temporary Construction	2
01 55 26	Traffic Control and Procedures.....	2
01 57 13	Temporary Erosion and Sediment Control.....	3
01 61 00	Product Requirements	4
01 61 16	Volatile Organic Compound (VOC) Content Restrictions	4
01 62 00	Product Exchange Procedures	2
	Request for Substitution Form	2
01 70 00	Examination and Preparation	2
01 73 00	Execution	2
01 74 00	Cleaning and Waste Processing.....	3
01 74 19	Construction Waste Management and Disposal.....	5
01 75 16	Start-Up Procedures	3
01 78 10	Closeout Submittals	7
01 79 00	Demonstration and Training.....	3
01 91 13	General Commissioning (CX) Requirements.....	13

DIVISION 02 – EXISTING CONDITIONS

02 41 00	Demolition	5
02 82 00.01	Asbestos Abatement – Minimum Precautions	6
02 82 00.03	Asbestos Abatement – Maximum Precautions	14

DIVISION 03 - CONCRETE

03 10 00	Concrete Forming and Accessories.....	4
03 20 00	Concrete Reinforcing	4
03 30 00	Cast-in-Place Concrete.....	6
03 35 11	Concrete Floor Finishes.....	6
03 41 13	Precast Concrete Hollowcore Planks.....	6

03 53 30	Bonded Concrete Overlays.....	6
----------	-------------------------------	---

DIVISION 04 - MASONRY

04 05 00	Common Work Results for Masonry	5
04 05 12	Masonry Mortar and Grout.....	3
04 05 19	Masonry Anchorage and Reinforcing	3
04 05 23	Masonry Accessories.....	3
04 22 00	Concrete Unit Masonry	6
04 26 16	Adhered Masonry Veneer.....	5

DIVISION 05 - METALS

05 12 23	Structural Steel For Buildings	5
05 21 00	Steel Joist Framing	4
05 31 00	Steel Decking.....	3
05 41 00	Structural Metal Stud Framing	4
05 50 00	Metal Fabrications.....	4
05 51 00	Metal Stairs.....	6
05 52 13	Pipe and Tube Railings.....	4
05 75 00	Decorative Formed Metal.....	6

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

06 10 00	Rough Carpentry.....	4
06 18 00	Glue Laminated and Cross Laminated Construction	6
06 20 00	Finish Carpentry.....	3
06 41 00	Architectural Wood Casework.....	7

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 05 43	Cladding Support Systems	4
07 05 53	Fire and Smoke Assembly Identification.....	1
07 08 00	Commissioning of Thermal and Moisture Protection	10
07 11 13	Bituminous Dampproofing.....	2
07 18 00	Traffic Coatings.....	3
07 21 00	Thermal Insulation	5
07 21 19	Foamed In-Place Insulation	3
07 25 00	Weather Barriers.....	6
07 26 16	Below-Grade Vapour Retarders.....	2
07 42 13.16	Metal Plate Wall Panels	5
07 42 13.23	Metal Composite Material Wall Panels	9
07 52 00	Modified Bituminous Membrane Roofing	9
07 62 00	Sheet Metal Flashing and Trim	5
07 64 13	Standing Seam Metal Wall Cladding	6
07 72 00	Roof Accessories	3
07 81 00	Applied Fireproofing.....	4
07 81 23	Intumescent Fireproofing	6
07 84 00	Firestopping	6
07 92 00	Joint Sealants	6

DIVISION 08 - OPENINGS

08 06 10	Door and Frame Schedule.....	3
08 06 13	Door and Frame Type Schedule.....	2
08 06 71	Door Hardware Schedule.....	18
08 08 00	Commissioning of Openings	7

08 11 13	Hollow Metal Doors and Frames.....	7
08 14 16	Flush Wood Doors	4
08 31 00	Access Doors and Panels.....	2
08 36 27	Folding Bay Doors	6
08 44 13	Glazed Aluminum Curtain Wall.....	12
08 44 35	Protective Framed Glazing Assemblies.....	5
08 56 73	Sound Control Window Assemblies.....	3
08 62 00	Unit Skylights	4
08 71 00	Door Hardware.....	6
08 80 00	Glazing.....	10
08 83 00	Mirrors.....	2

DIVISION 09 - FINISHES

09 06 00	Finish Schedule	2
09 21 16	Gypsum Board Assemblies.....	7
09 22 16	Non-Structural Metal Stud Framing	3
09 30 00	Tiling	5
09 51 00	Acoustical Ceilings.....	4
09 65 13	Resilient Base and Accessories	3
09 65 66	Resilient Athletic Flooring	4
09 67 00	Fluid Applied Flooring	5
09 91 00	Painting.....	6
09 96 00	High Performance Coatings.....	4

DIVISION 10 - SPECIALTIES

10 06 10	Signage Schedule.....	3
10 11 01	Visual Display Boards.....	2
10 14 00	Signage.....	5
10 14 75	Tactile Indicators.....	2
10 26 00	Wall and Door Protection	2
10 28 00	Toilet, Bath, and Laundry Accessories	5
10 44 00	Fire Protection Specialties	3
10 51 13	Metal Lockers.....	3
10 56 13	Metal Storage Shelving.....	2
10 75 00	Flagpoles	3

DIVISION 11 - EQUIPMENT

11 06 40	Equipment Schedule.....	1
11 21 73	Commercial Laundry and Dry Cleaning Equipment.....	3
11 40 00	Foodservice Equipment	4
11 52 13	Projection Screens.....	3
11 81 29	Facility Fall Protection.....	4

DIVISION 12 - FURNITURE

12 24 00	Window Shades	4
12 31 00	Manufactured Metal Casework	7
12 46 33	Waste Receptacles	1
12 48 13	Entrance Floor Mats and Frames	1
12 57 00	Industrial Furniture	2
12 93 13	Bicycle Racks.....	2

DIVISION 21 - COMMON WORK

21 05 00	Common Work for Mechanical.....	19
21 05 00.01	Contractor Training Record.....	2
21 11 00	Fire Protection Piping.....	7
21 13 00	Sprinklers.....	6
21 23 00	Wet-Chemical Fire-Extinguishing.....	7
21 91 00	Commissioning	2

DIVISION 22 - PLUMBING

22 05 81	Disinfection of Water Distribution Piping.....	2
22 10 00	Plumbing Piping.....	16
22 42 01	Plumbing Specialties.....	11
22 42 02	Plumbing Fixtures.....	11
22 47 00	Plumbing Equipment	8

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

23 05 16	Piping Expansion Compensation.....	4
23 05 19	Gauges and Meters	6
23 05 20	Hydronic Specialties	9
23 05 29	Supports and Anchors	11
23 05 48	Vibration Isolation	5
23 05 53	Mechanical Identification.....	4
23 05 93	Testing, Adjusting, and Balancing	10
23 07 13	Duct Insulation	11
23 07 19	Piping Insulation.....	8
23 21 00	Hydronic Piping.....	10
23 21 23	HVAC Pumps.....	3
23 24 00	Geothermal Heat Exchanger	6
23 25 00	Chemical Treatment for Piping	5
23 31 00	Duct Work	7
23 33 00	Duct Work Accessories.....	7
23 34 39	Ceiling Fans.....	2
23 37 00	Air Outlets and Inlets.....	5
23 52 16	Boilers – Condensing Water Tube.....	6
23 55 33	Unit Heaters – Fuel Fired.....	4
23 72 00	Air-to-Air Heat Exchanger.....	5
23 81 40	Air and Water Source Unitary Heat Pumps	6
23 82 16	Air Coils.....	4

DIVISION 25 – INTEGRATED AUTOMATION

25 30 00	Instruments and Control Elements.....	13
25 90 00	Sequence of Operation	15

DIVISION 26 - ELECTRICAL

26 05 00	Common Work Results for Electrical	19
26 05 05	Selective Demolition for Electrical.....	3
26 05 19	Building Wire and Cable	8
26 05 26	Grounding and Bonding.....	4
26 05 29	Electrical Supporting Devices	2
26 05 33	Conduit.....	7
26 05 34	Boxes	5
26 05 53	Electrical Identification	6
26 05 80	Equipment Wiring.....	5

26 12 16	Transformers – Dry-Type.....	3
26 24 13	Distribution Switchboards	7
26 24 16	Panelboards.....	6
26 26 53	Electric Vehicle Supply Equipment	7
26 27 16	Cabinets and Enclosures	3
26 27 26	Wiring Devices	7
26 32 13	Packaged Engine Generators.....	21
26 51 13	Interior Luminaires	8
26 56 29	Site Lighting	4
26 83 00	Heating Cables and Mats.....	3
26 83 33	Electric Space Heating Units	4

DIVISION 27 - COMMUNICATIONS

27 05 26	Grounding & Bonding for Communications Systems.....	2
27 05 28	Pathways for Communications Systems.....	4
27 10 05	Structured Cabling for Communications Systems	6

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 10 00	Access Control.....	12
28 23 00	Video Surveillance	9
28 46 00	Fire Alarm	11

DIVISION 31 - EARTHWORK

31 01 90	Tree Protection	3
31 05 17	Aggregate General.....	4
31 22 00	Site Grading	2
31 23 00	Excavating and Backfilling for Structures.....	5
31 23 33	Excavating Trenching and Backfilling	5
31 32 21	Geotextiles	4
31 37 01	Rock Mulch	2
31 61 13	Pile Foundations, General Requirements	5
31 62 14	Precast Concrete Piles	5

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 11 16.01	Granular Sub-Base	4
32 11 23	Aggregate Base Courses.....	4
32 12 17	Asphalt Paving	3
32 13 13	Concrete Paving	19
32 14 13	Unit Paving.....	2
32 16 00	Curbs, Gutter and Sidewalks	7
32 16 15	Site Concrete	5
32 17 23	Pavement Markings	2
32 31 12	Exterior Metal Fabrication	3
32 32 14	Exterior Site Carpentry.....	3
32 37 00	Site Furnishings	2
32 37 01	Exterior Site Signage	3
32 91 19	Planting Medium & Finish Grading	5
32 93 10	Trees, Shrub & Groundcover Planting	7
32 94 00	Landscape Maintenance.....	3

DIVISION 33 - UTILITIES

33 05 13	Manholes and Catchbasin Structures	4
33 11 16	Site Water Utility Distribution Piping	4
33 31 13	Public Sanitary Sewerage Piping	4
33 41 00.01	Storm Utility Drainage Piping	4
33 41 00	Subdrainage.....	2
33 41 17	Landscape Drains	2

DIVISION 41 – MATERIAL PROCESSING AND HANDLING EQUIPMENT

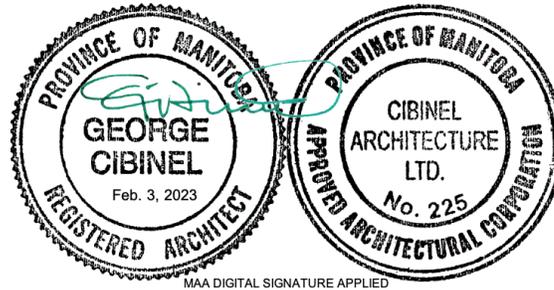
41 22 00	Cranes and Hoists	3
----------	-------------------------	---

END OF TABLE

These specifications (Divisions 1-41) were prepared under the supervision of the following registered coordinating professionals:

ARCHITECTURAL

George Cibinel, MAA FRAIC
Cibinel Architecture Ltd.
560 Academy Road
Winnipeg, MB R3N 0E3



STRUCTURAL

Stylianos Bervanakis, P. Eng.
Crosier Kilgour & Partners
300-275 Carlton Street
Winnipeg, MB R3C 5R6



MECHANICAL

David Siepman, P. Eng.
Epp Siepman Engineering
400-136 Market Avenue,
Winnipeg, Manitoba, R3B 0P4



ELECTRICAL

Ade Sowunmi, P. Eng. Epp
Siepman Engineering 400-136
Market Avenue, Winnipeg,
Manitoba, R3B 0P4



LANDSCAPE

James Hudson, AALA, MALA, CSLA
HTFC Planning & Design
500-115 Bannatyne Avenue E
Winnipeg, Manitoba, R3B 0R3



CIVIL

John Minkevich, P.Eng.
KGS Group
865 Waverly Street
Winnipeg, Manitoba, R3T 5P4



Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part B – Bidding Procedures, Part E - Specifications

1.2 DISCLAIMER

- .1 Following documents are provided solely for Bidder's convenience and does not relieve Bidder of responsibility to make proper site investigations, or to understand full nature of work, or for determining accuracy of information provided.
- .2 Conditions noted and statements made are applicable only to specific locations, and times, at which investigations were made. Bidder to inquire of firm which prepared document, and may arrange with the City or Contract Administrator to make further explorations, to satisfy them self of particular conditions that they may wish to use in preparing their Bid.
- .3 Neither the City, nor Contract Administrator, assumes any responsibility for content of following documents, nor for conclusions that Bidder may use in preparing their proposal
- .4 Data provided and opinions stated in following documents are sole responsibility of firms which prepared documents

1.3 EXISTING CONDITIONS

- .1 Refer to B3 – Site Investigation, for instructions to examine site and to investigate local conditions and related work.
- .2 Compare bid documents with work in place.
- .3 Compensation will not be made because of failure to make proper site investigations or to understand full nature of work.
- .4 Failure to report discrepancies will not relieve Contractor from performing work as intended, and at no cost to the City.

1.4 GEOTECHNICAL INVESTIGATION

- .1 A copy of the following Geotechnical Investigation prepared by Trek Geotechnical is available upon request from the Contract Administrator.
 - .1 “New Winnipeg Fire Paramedic Services (WFPS) Station 9 Geotechnical Investigation Report”, dated November 24th 2022

1.5 ENVIRONMENTAL SITE ASSESSMENT

- .1 A copy of the following Environmental Site Assessment prepared by WSP E&I Canada Limited is available upon request from the Contract Administrator.
 - .1 “Phase II Environmental Site Assessment”, dated December 2022.

1.6 HAZARDOUS MATERIALS REPORT

- .1 A copy of the following Pre-Demolition Asbestos Survey Report prepared by MWI Consultants is available upon request from the Contract Administrator.
 - .1 “Pre-Demolition Asbestos Survey Report, 955 Cottonwood Rd, Winnipeg, MB’ dated November 29th 2022.
 - .2 “Pre-Demolition Asbestos Survey Report, 1083 Autumnwood Dr, Winnipeg, MB’ dated November 29th 2022.

1.7 HYDROGEOLOGICAL STUDY REPORT

- .1 A copy of the following Hydrogeological Study Report prepared by WSP is available upon request from the Contract Administrator.
 - .1 “Hydrogeological/Hydrotechnical Background Assessment – WFPS” dated December 21st 2022.

1.8 EXISTING BUILDING DOCUMENTS

- .1 A copy of the following Existing Building Drawings for the Windsor Park Library located at 955 Cottonwood Road , Fire Station No. 15 located at 1083 Autumnwood Drive, and the Life Station is available upon request from the Contract Administrator:
 - .1 “Fire Station No.04” dated May 28th 1969.
 - .2 “Fire Station 15 Plans” (no date)
 - .3 “Windsor Park Library” dated Sept. 24th 1985.
 - .4 “Windsor Park Lift Station Renovation’ dated December 1975.
 - .5 “Windsor Park Wastewater Pumping Station - Generator Upgrade” dated April 7th 2012.

1.9 TOPOGRAPHIC SURVEY

- .1 A copy of the following Topographic Survey prepared by Barnes and Duncan Surveying Engineering & Geomatics is available upon request from the Contract Administrator.
 - .1 “Plan of Topographic Survey of part of Lot 288 Roman Catholic Mission Property” dated April 1st 2022.

1.10 MANITOBA HYDRO SERVICE UPGRADE

- .1 A copy of the following preliminary Manitoba Hydro Service Upgrade prepared by Manitoba Hydro Distribution Engineering is available upon request from the Contract Administrator.
 - .1 “CSC: St. Boniface Customer Service Project” dated January 11th 2023.

1.11 GREEN GLOBES PROJECT PERFORMANCE AND GREEN DESIGN GOALS

- .1 A copy of the following Green Globes Scorecard prepared by Green Globes Building Certification is available upon request from the Contract Administrator.
 - .1 “Green Globes Building Certification – WFPS Station 9 Printable Questionnaire”

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Contract method.
- .2 Sustainable design certification.
- .3 City-supplied Products.
- .4 Work by others.
- .5 Contract use of the premises
- .6 Documents required.
- .7 Building Permit.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions
- .2 All other Division 01 specification sections.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 32.

1.3 DESCRIPTION OF THE WORK

- .1 Refer to Part D - Supplemental Conditions.

1.4 REFERENCES

- .1 ECD Energy & Environment Canada
 - .1 Green Globes Canada, New Construction 2021, Version 3.0

1.5 SUSTAINABLE DESIGN CERTIFICATION

- .1 Project is targeting Green Globes for New Construction, 2 Globes certification.
- .2 Refer to Section 00 31 00 Available Project Information for Green Globes Performance and Green Design Goals .

1.6 CITY-SUPPLIED PRODUCTS

- .1 Obtain the necessary Shop Drawings from the Contract Administrator and proceed to coordinate details for installation, expedite, receive, unload, install, connect and test the specified equipment, and be responsible for warranty.
- .2 Receive City-supplied Products and equipment F.O.B. and store and process Products and equipment until installation.
- .3 Contract Administrator Responsibilities:
 - .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
 - .2 Deliver supplier's bill of materials to Contractor.
 - .3 Arrange and pay for delivery to the Place of the Work in accordance with Progress Schedule.
 - .4 Inspect deliveries jointly with Contractor.

- .5 Submit claims for transportation damage.
- .6 Arrange for replacement of damaged, defective or missing items.
- .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
- .4 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each Product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Contract Administrator, notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload Products at site.
 - .4 Inspect deliveries jointly with Contract Administrator; record shortages, and damaged or defective items.
 - .5 Handle Products at site, including uncrating and storage.
 - .6 Protect Products from damage, and from exposure to elements.
 - .7 Assemble, install, connect, adjust, and finish Products.
 - .8 Arrange for installation inspections required by public authorities.
 - .9 Repair or replace items damaged by Contractor or Subcontractor on site (under their control).
- .5 Schedule of City-supplied Products.
 - .1 E13: Lockbox (Surface Mount)

1.7 WORK BY OTHERS

- .1 Work executed during Work of this Contract, and which is specifically excluded from this Contract:
 - .1 Supply, installation and maintenance of vehicle exhaust systems for the Apparatus Bays. The City will supply, install, and commission complete vehicle exhaust systems including exhaust fans, exterior louvres/hoods, dampers, exhaust ducting and hoses, capture devices, hangers, and controls. Contractor to integrate/connect vehicle exhaust system controls with Apparatus Bay ventilation controls according to Division 25 specifications and schematics. Work of this Contract must include provisions for coordinating installation of the vehicle exhaust system.
 - .2 Supply and installation of furniture. Work of this Contract must include provisions for coordinating installation of furniture.

1.8 CONTRACTOR USE OF PREMISES

- .1 Contractor has unrestricted use of site until Substantial Performance of the Work.

1.9 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .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 List of outstanding Shop Drawings.
 - .7 Field test records.

- .8 Inspection certificates.
- .9 Manufacturer's certificates.
- .10 Copy of approved Construction Schedule.
- .11 Health and safety plan and other safety related documents.
- .12 Other documents as specified.

1.10 BUILDING PERMIT

- .1 The City shall pay for the building permit. The Contract Administrator shall apply for the building permit on behalf of the City prior to bid closing. Upon award of Contract, the building permit shall be transferred to and become the responsibility of the Contractor.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Complementary documents.
- .2 Specification grammar.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions
- .2 Section 01 10 00 – Summary of Work.
- .3 This section describes requirements applicable to all sections within Divisions 02 to 49.

1.3 COMPLEMENTARY DOCUMENTS

- .1 Drawings, specifications, and schedules are complementary each to the other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents which leave doubt as to the intent or meaning, abide by General Condition C2 Interpretation.
- .2 Generally, drawings indicate graphically, the dimensions and location of components and equipment. Specifications indicate specific components, assemblies, and identify quality.
- .3 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.
- .4 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Notify Contract Administrator of conflicts or additional work required beyond work described.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions

1.2 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the Work.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to Contract Administrator.
- .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 three days after meetings and transmit to meeting participants, to affected parties not in attendance, and Contract Administrator.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRECONSTRUCTION START-UP MEETING

- .1 After award of Contract, but before start of Work, a Start-Up Meeting will be held to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the Contractor, major Subcontractors, field inspectors and supervisors, and Contract Administrator will be in attendance.
- .3 Contract Administrator will establish time and location of meeting and notify parties concerned minimum five Business Days before meeting.
- .4 Contract Administrator will chair Start-Up Meeting, record minutes, and distribute minutes to all attending parties within four Business Days of meeting.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling.
 - .3 Critical work sequencing and long-lead items.
 - .4 Lines of communications.
 - .5 Procedures for RFIs.
 - .6 Submittal procedures.
 - .7 Green Globes Certification requirements, environmental objectives, and waste management objectives.
 - .8 Requirements for temporary facilities, site sign, offices, storage sheds, utilities.
 - .9 Delivery schedule of specified equipment.
 - .10 Safety.
 - .11 Site security.

- .12 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
- .13 City-supplied, Contractor-installed products.
- .14 Record drawings.
- .15 Maintenance manuals.
- .16 Take-over procedures, acceptance, and warranties.
- .17 Monthly progress claims, administrative procedures, photographs, and holdbacks.
- .18 Appointment of inspection and testing agencies or firms.
- .19 Insurances and transcript of policies.

1.4 PROGRESS MEETINGS

- .1 Administrative Requirements:
 - .1 During course of Work, schedule progress meetings at intervals and times agreed to by the Contractor and Contract Administrator. Progress meetings shall occur at least bi-weekly.
 - .2 Provide location for regular Progress Meetings.
 - .3 Prepare agenda for meetings.
 - .4 Notify parties concerned minimum 72 hours in advance of each meeting.
 - .5 Preside at meetings.
 - .6 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three Business Days after meeting. Include significant proceedings and decisions, and identify actions by parties in minutes.
 - .7 Bring one set of As-Built drawings, and project manual to progress meetings.
- .2 Contractor, major Subcontractors involved in Work, and Contract Administrator are to be in attendance.
- .3 Persons attending meetings shall be empowered to act on behalf of organizations whose representatives they are.
- .4 Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - .1 Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - .1 Review schedule for next period.
 - .2 Review present and future needs of each entity present, including the following:
 - .1 Interface requirements.
 - .2 Sequence of operations.
 - .3 Status of submittals.
 - .4 Safety.
 - .5 Deliveries.
 - .6 Off-site fabrication.
 - .7 Access.

- .8 Site utilization.
- .9 Temporary facilities and controls.
- .10 Progress cleaning.
- .11 Quality and work standards.
- .12 Status of correction of deficient items.
- .13 Field observations.
- .14 Status of RFIs.
- .15 Status of proposal requests.
- .16 Pending changes.
- .17 Status of Change Orders.
- .18 Documentation of information for payment requests.
- .3 Problems which impede construction schedule.
- .4 Green Globes Certification requirements, environmental objectives, and waste management objectives.
- .5 Other business.

1.5 PREINSTALLATION MEETINGS

- .1 Conduct a preinstallation meeting at Project site before each construction activity that requires coordination with other construction.
- .2 Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Notify Contract Administrator of scheduled meeting dates five Business Days before meeting.
- .3 Agenda: Review progress of other construction activities and preparations for the particular activity under consideration
- .4 Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- .5 Reporting: Distribute minutes of the meeting to Contract Administrator, each party present, and to other parties requiring information, within four Business Days of meeting.
- .6 Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Schedules, form, content, submission.
- .2 Critical path scheduling.
- .3 Progress photographs.
- .4 Submittals schedules.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions
- .2 Section 01 33 00 - Submittal Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SCHEDULES

- .1 Submit schedules as follows:
 - .1 Construction progress schedule.
 - .2 Schedule of trade costs and monthly cash flow of estimated progress payment claims.
 - .3 Submittal schedule for Shop Drawings and product data.
 - .4 Submittal schedule for samples.
 - .5 Submittal schedule for timeliness of City-furnished Products.
 - .6 Submittal schedule for mock-ups.
 - .7 Product delivery schedule.
 - .8 Cash allowance schedule for acquiring products and installation.
- .2 Schedule Format.
 - .1 Prepare a critical path method (C.P.M.) schedule for the work.
 - .2 Provide a separate bar for each major item of work.
 - .3 Split horizontally for projected and actual performance.
 - .4 Provide horizontal time scale identifying first Business Day of each week.
 - .5 Format for listings: Chronological order of start and finish of each item of work.
 - .6 Identification of listings: By systems description.
 - .7 Schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the work as well as showing those activities/tasks on the critical path.
 - .1 Commencement Date
 - .2 Substantial Performance
 - .3 Total Performance
 - .4 Phasing
- .3 Schedule Submission.
 - .1 Submit one copy of each schedule in electronic format.
 - .2 Contract Administrator will review schedules and return review copy within 10 Business Days after receipt.

- .3 Resubmit finalized schedules within 10 Business Days after return of review copy.
- .4 Distribute copies of revised schedules to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Contract Administrator.
 - .4 Other concerned parties.
- .5 Instruct recipients to report to Contractor within ten days, any problems anticipated by timetable shown in schedules.
- .4 Bring Construction Progress Schedule, and Submittal Schedule for Shop Drawings and Product Data to initial start-up meeting.

1.4 CONSTRUCTION PROGRESS SCHEDULING

- .1 Submit revised schedules with each Application for Payment, identifying changes since previous version.
- .2 Submit computer generated network analysis diagram using the critical path method (CPM).
- .3 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- .4 Indicate estimated percentage of completion for each item of Work at each submission.
- .5 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by the City and required by Allowances.
- .6 Include dates for start and completion of each major element of construction as follows:
 - .1 Permits.
 - .2 Mobilization.
 - .3 Site clearing.
 - .4 Site utilities.
 - .5 Foundation work.
 - .6 Cast-in-place concrete.
 - .7 Structural framing.
 - .8 Cladding and roofing.
 - .9 Doors, windows and glazing.
 - .10 Interior architecture and finishes (walls, floors and ceiling).
 - .11 Millwork.
 - .12 Interior Specialties.
 - .13 Plumbing.
 - .14 Lighting.
 - .15 Power.
 - .16 Environmental controls.
 - .17 Heating, ventilating, and air conditioning.
- .7 Indicate projected percentage of completion of each item as of first day of month.
- .8 Indicate progress of each activity to date of submission schedule.
- .9 Allow for preparation and review of mock-ups in schedule.
- .10 Indicate changes occurring since previous submission of schedule:

- .1 Major changes in scope.
- .2 Activities modified since previous submission.
- .3 Revised projections of progress and completion.
- .4 Other identifiable changes.
- .11 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
- .12 Schedule Updating: Revise Construction Progress Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting

1.5 PROGRESS PHOTOGRAPHS

- .1 Digital Photography:
 - .1 Submit electronic copy of colour digital photography in *.jpg format, minimum 6 megapixel resolution.
 - .2 Identification: Name and number of project and date of exposure indicated.
- .2 Number of Viewpoints: Sufficient views and proximity to clearly indicate stages of completion of all work and services before concealment, including exterior and interior, above ceiling, in-wall, in-floor, and underground conditions.
- .3 Frequency: continually. Submit monthly with progress application.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Shop Drawings and Product Data
- .2 Samples
- .3 Certificates and transcripts
- .4 Requests for Interpretation (RFI)

1.2 RELATED REQUIREMENTS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 78 10 - Closeout Submittals.
- .3 Other sections requesting submittals.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DEFINITIONS

- .1 Submittals for Review: Written and graphic information and physical samples that require Contract Administrator's responsive action. Unless specifically noted otherwise in individual sections, the following shall be considered Submittals for Review:
 - .1 Product Data.
 - .2 Shop Drawings.
 - .3 Samples.
- .2 Submittals for Information: Written and graphic information and physical samples that do not require Contract Administrator's responsive action. Submittals may be rejected for not complying with requirements. Unless noted otherwise in individual sections, the following shall be considered Submittals for Information:
 - .1 Certificates.
 - .2 Maintenance Data.
 - .3 Test and Inspection Reports.
 - .4 Delegated Design Calculations.
 - .5 Closeout Submittals.
 - .6 Sample warranties.
- .3 Request for Interpretation (RFI): Request from Contractor requesting interpretation or clarification of the Contract Documents, that is not easily inferable from the Contract Documents.

1.4 ADMINISTRATIVE

- .1 Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of the construction schedule and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal process 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 manufactured or produced in SI metric units, converted values within the metric measurement tolerances are acceptable.
- .5 Review submittals prior to submission to Contract Administrator. 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.
- .6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .7 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .11 Keep one reviewed copy of each submission on site.

1.5 ELECTRONIC SUBMISSIONS

- .1 Electronic Submittals:
 - .1 Provide in Portable Document Format (*.pdf) with selectable text and graphics that are readable. Merge documents into one bookmarked document up to 20 mb. Use hierarchical bookmarks to form a table of contents and provide hyperlinks to subject topic.
 - .2 Break down information into documents of related materials or systems.
 - .3 Where the Contract Administrator returns the submittal "Reviewed As Noted" and includes mark-ups or comments that change the originally submitted ratings, parameters, specifications, options, etc., correct the documents in the original electronic document before submitting final electronic documents.
 - .4 Highlight specific rating, parameter, specification, option, etc. when original document includes multiple alternatives.
 - .5 PDF drawing size: maximum 279 by 432 mm (11 by 17 inches).

1.6 SHOP DRAWINGS AND PRODUCT DATA

- .1 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .2 Allow 15 Business Days for Contract Administrator's review of each submission. Allow for extra time where Shop Drawings are submitted in bulk or mass to allow proper review and coordination.
- .3 Adjustments made on Shop Drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .4 Make changes in Shop Drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of any revisions other than those requested.
- .5 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.
- .6 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to other parts of the Work.
- .7 After Contract Administrator's review, distribute copies.
- .8 Submit one electronic copy and one hard copy of Shop Drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.
- .9 Submit one electronic copy and one hard copy of product data sheets or brochures for requirements requested in specification sections and as requested by Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product.
 - .1 Delete information not applicable to project.
 - .2 Mark submittal to show which products and options are applicable.
- .10 Supplement standard information to provide details applicable to project.
- .11 Submit electronic searchable pdf format of shop drawings with text at minimum 8 point font size when the drawing is printed on 279mm x 432mm sheet format, for each requirement requested in specification sections and as Contract Administrator may reasonably request. Include details of appropriate portion of Work as applicable:
 - .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 review and approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication details.
 - .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 other parts of the Work.
 - .11 Supplement standard information to provide details applicable to project.
- .12 Submit electronic searchable pdf format of product data sheets or brochures for requirements requested in specification sections and as requested by Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product.
 - .1 Mark submittal to show which products and options are applicable.
- .13 Where the Contract Administrator is required to review Shop Drawings, method samples, mock-ups, premature requests for Substantial Performance or Completion reviews, and completed "corrections" more than once and/ or enter into extended discussions or preparation of additional details or calculations to facilitate the Contractor's work or that of the Sub-Contractor's, the additional consulting time shall be paid for by the Contractor. Similarly, if deficient workmanship or construction requires additional or unscheduled site visits by the Contract Administrator, or other inspectors or reviewers, the additional time and disbursements based on the Contract Administrator hourly rates, etc. shall be paid by the Contractor.

1.7 SAMPLES

- .1 Submit for review samples in as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Contract Administrator's business address.
- .3 Notify Contract Administrator 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 Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.8 CERTIFICATES AND TRANSCRIPTS

- .1 Refer to Part D - Supplemental Conditions.

1.9 REQUESTS FOR INTERPRETATION (RFI)

- .1 General: Immediately on discovery of the need for interpretation of the Contract Documents, prepare and submit a RFI to the as Contract Administrator in the form specified.
 - .1 Contract Administrator will return RFIs submitted to Contract Administrator by entities other than the Contractor and controlled by Contractor with no response.
 - .2 Coordinate and submit RFIs in a prompt manner so as to avoid delays in Work.
 - .3 For RFIs submitted electronically, include project name and RFI number in subject line of email.
- .2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - .1 Project name.
 - .2 Project number.
 - .3 Date.
 - .4 Name of Contractor.
 - .5 Name of Contract Administrator.
 - .6 RFI number, numbered sequentially.
 - .7 RFI subject.
 - .8 Specification Section number and title and related paragraphs, as appropriate.
 - .9 Drawing number and detail references, as appropriate.
 - .10 Field dimensions and conditions, as appropriate.
 - .11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the construction schedule or the Contract Price, state impact in the RFI.
 - .12 Contractor's signature.

- .13 Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - .1 Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- .3 RFI Forms: Contractor generated form including all content indicated in this Section.
 - .1 Form and attachments: electronic files in Adobe Acrobat PDF format.
- .4 Contract Administrator's Action: Contract Administrator will review each RFI, determine action required, and respond. Allow ten Working Days for Contract Administrator's response for each RFI. RFIs received by Contract Administrator after 1:00 p.m. will be considered as received the following Working Day.
 - .1 The following Contractor-generated RFIs will be returned without action:
 - .1 Requests for approval of submittals.
 - .2 Requests for approval of substitutions.
 - .3 Requests for approval of Contractor's means and methods.
 - .4 Requests for approval of corrective actions for deficient work.
 - .5 Requests for coordination information already indicated in the Contract Documents.
 - .6 Requests for adjustments in the schedule or the Contract Price.
 - .7 Requests for interpretation of Contract Administrator's actions on submittals.
 - .8 Incomplete RFIs or inaccurately prepared RFIs.
 - .2 Contract Administrator's action may include a request for additional information, in which case Contract Administrator's time for response will date from time of receipt of additional information.
 - .3 If Contractor believes the RFI response warrants change in the construction schedule or the Contract Price, notify Contract Administrator in writing within ten Business Days of receipt of the RFI response.
- .5 RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log with progress meeting minutes. Include the following:
 - .1 Project name.
 - .2 Name and address of Contractor.
 - .3 Name and address of Contract Administrator.
 - .4 RFI number including RFIs that were returned without action or withdrawn.
 - .5 RFI description.
 - .6 Date the RFI was submitted.
 - .7 Date Contract Administrator's response was received.
- .6 On receipt of Contract Administrator action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Contract Administrator within 10 Business Days if Contractor disagrees with response.

1.10 PHOTOGRAPHIC DOCUMENTATION

- .1 Refer to Section 01 32 00 – Construction Progress Documentation

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 General requirements for sustainable design reporting.

1.2 REPORTING REQUIREMENTS

- .1 Free-standing furniture and furnishings are not included in the Contract.
- .2 Contractor must familiarize itself with the relevant reporting requirements and provide the necessary information and instruction to subcontractors and installers.

1.3 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures: General submittal requirements.
- .2 Section 01 35 66.13 - Sustainability Certification Project Procedures - Green Globes.
- .3 Section 01 60 00 - Product Requirements.
- .4 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .5 Section 01 74 19 - Construction Waste Management and Disposal.
- .6 Section 01 91 13 - General Commissioning (Cx) Requirements

1.4 DEFINITIONS

- .1 Definitions in this Article are in addition to sustainable design definitions directly related to products, as listed in Section 01 61 00 - Product Requirements.
- .2 Green Globes Assessor (GGA): Technical expert in the areas of sustainable design, construction, energy, and facility management, and who is certified and contracted by Green Building Initiative organization to perform independent third-party assessments for this prospective Green Globes certified project.
- .3 Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers during construction. Plan must meet or exceed the recommendations of SMACNA (OCC) 'IAQ Guidelines for Occupied Buildings Under Construction'.
- .4 Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.
- .5 Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labour, but excluding site equipment and site labour costs.

1.5 PRODUCT REPORTING SCOPE

- .1 General: Product reporting scope for the purpose of achieving the selected sustainability certification level is limited to those items directly affecting ability to achieve targeted points. See Section 00 31 00 - Available Project Information for Project performance and green design goals.
 - .1 Environmental Product Declarations (EPD): Documentation complying with definition and quality requirements in Section 01 61 00 - Product Requirements.
 - .1 Material Ingredient Reporting: Use, as is appropriate:
 - .1 Manufacturers' inventories of ingredients.

- .2 Provide quantity and cost data for materials and products for which EPDs are available.
- .2 Multi-attribute product certifications: Documentation complying with definition and quality requirements in Section 01 61 00 - Product Requirements.
 - .1 Provide quantity and cost data for materials and products for which multi-attribute product certifications are publicly available, or third party-verified product life cycle assessment based on ISO 14040:2006 and ISO 14044:2006.
- .2 Green Globes product reporting scope: Includes products in the following categories:
 - .1 New Construction - Materials:
 - .1 For products used in construction of core and shell and may include any of the products specified in Divisions 02 through 14.

1.6 REFERENCE STANDARDS

- .1 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.
- .2 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board current edition.
- .3 CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.
- .4 GG (TRM-NC) - Green Globes for New Construction Technical Reference Manual Version 1.0 February 2022.
- .5 ISO 14040 - Environmental management -- Life cycle assessment -- Principles and framework 2006.
- .6 ISO 14044 - Environmental management -- Life cycle assessment -- Requirements and guidelines 2006.
- .7 ISO/IEC 17065 - Conformity assessment — Requirements for bodies certifying products, processes and services 2012.
- .8 SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction 2007.

1.7 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures, for additional submittal procedures requirements.
- .2 Sustainable design documentation: The scope of required documentation is specified in this section and in applicable individual specification sections.
- .3 Green Globes points - Documentation is required for the following items:
 - .1 New product documentation: Use software tools or forms mutually agreed upon by Contract Administrator and project assessor; electronic copies of these to be made available to Contractor at preconstruction meeting. Use for documentation of GG (TRM-NC) Product Life Cycle, Sustainable Materials Attributes, and Volatile Organic Compounds.
 - .1 Product life cycle: Products with third-party verified Type III Environmental Product Declarations (EPD), third-party multiple attribute product certification, or third party-verified product life cycle assessment based on ISO 14040 and ISO 14044 that evaluate cradle-to-gate product life cycle. Refer to GG (TRM-NC) Section 5.2.1.1.

-
- .1 Submit the above documentation separately from required product data.
 - .2 Product life cycle: Products with third-party verified Type III Environmental Product Declarations (EPD), or third party-verified product life cycle assessment based on ISO 14040 and ISO 14044 that evaluate cradle-to-grave product life cycle. Refer to GG (TRM-NC) Section 5.2.1.2.
 - .1 Submit the above documentation separately from required product data.
 - .3 Sustainable materials attributes: Percentage of the total value of building materials that have sustainable materials attributes. Sustainable materials index (SMI) is the sum of the value of these attributes divided by the Total Material Value expressed as a percentage. Submit manufacturer's product data sheets or statement from manufacturer's certifying claims, or third-party certification from an organization that has the program in its ISO/IEC 17065 scope of accreditation. Refer to GG (TRM-NC) Section 5.4.1.1.
 - .4 Volatile Organic Compounds (VOC) emissions, and VOC content: Refer to GG (TRM-NC) Sections 6.2.1.1, 6.2.1.2, and 6.2.1.3. Submit documentation indicating products do not have VOC emissions exceeding compliance with CAL (CDPH SM) or certification by a certification body accredited to ISO/IEC 17065. Submit manufacturer's declarations or certification by a third party testing organization indicating compliance with VOC content requirements. For products containing composite wood, provide products labels, chain-of custody records, or documentation demonstrating compliance with CARB (ATCM) formaldehyde regulation.
 - .1 Submit the above documentation separately from required product data.
 - .2 Reuse of existing structures and materials: Use software tools or forms mutually agreed upon by Contract Administrator and project assessor; electronic copies of these to be made available to Contractor at preconstruction meeting. Use for documentation of calculated percentage of existing structural and non-structural/ interior systems and finishes retained and incorporated in the new design.
 - .1 Structural systems. Refer to GG (TRM-NC) Section 5.5.1.1.
 - .2 Non-structural/interior elements. Refer to GG (TRM-NC) Section 5.5.1.2.
 - .3 Contractor's environmental management during construction: Submit documentation of an environmental management system (EMS) instituted and followed for the Project. Include one or more of the required system components.
 - .1 Contractor's environmental policy, and environmental management plan.
 - .2 Regulatory compliance and training.
 - .3 Project ecological and health risk assessment identifying major risks that could impact general welfare and health of humans, and ecological environment surrounding the immediate area of construction, and local agency requirements.
 - .4 Environmental management roles, responsibilities, and reporting structure, including Contractor's designated compliance manager.
 - .5 Site and work instructions for site personnel outlining environmental procedures during construction.
 - .6 Environmental inspection checklists.
 - .7 Records of compliance with system.

- .8 Construction management policy on smoking.
- .4 Final commissioning report, training syllabus and evidence of completion. See Section 01 91 13 - General Commissioning (Cx) Requirements.
- .5 Contractor's Construction Waste Management Plan. See Section 01 74 19 - Construction Waste Management and Disposal. Include:
 - .1 Preconstruction waste management plan.
 - .2 Final waste management summary report.
- .6 Construction Waste Disposal Management: Periodic reports quantifying diversion of construction and demolition waste away from landfills and incineration facilities.
 - .1 Include information on percentage of diverted material and number of material streams.

Part 2 Products - Not Used

Part 3 Execution

3.1 PROCEDURES

- .1 Submit sustainable design documentation required of Contractor, using procedures defined under Submittals for Information in Section 01 33 00.
- .2 Submit sustainable design documentation to Contract Administrator, unless otherwise indicated.
- .3 Where an item of sustainable design documentation is specified, fill out and submit electronically the appropriate forms, or use appropriate software.
 - .1 Fill out one line for each different brand name product and each different manufacturer of a lot of commodity products.
 - .2 Where required attachments are specified, attach the documentation.
 - .3 Mark each blank with the appropriate information; use "ATT" for items attached; if any item is not relevant use the code "NR"; if any item is not available use the code "NA".
- .4 Each form must be signed by the entity capable of certifying the information.
 - .1 Certification signatures must be made by an officer of the company.
 - .2 For products, certification must be made by the manufacturer not the supplier.
 - .3 For custom fabricated products, certification by the fabricator is acceptable.
- .5 Submit the completed forms in accordance with the requirements of Section 01 33 00, as information submittals.
 - .1 Give each form a unique submittal number.
 - .2 Do not combine sustainable design documentation with product data or shop drawing submittals.

END OF SECTION

1 USE OF THIS FORM

BECAUSE INSTALLERS ARE ALLOWED AND DIRECTED TO CHOOSE ACCESSORY MATERIALS SUITABLE FOR THE APPLICABLE INSTALLATION, THERE IS A POSSIBILITY THAT SUCH ACCESSORY MATERIALS MIGHT CONTAIN VOC CONTENT IN EXCESS OF THAT PERMITTED, ESPECIALLY WHERE SUCH MATERIALS HAVE NOT BEEN EXPLICITLY SPECIFIED.

CONTRACTOR IS REQUIRED TO OBTAIN AND SUBMIT THIS FORM FROM EACH INSTALLER OF WORK ON THIS PROJECT.

FOR EACH PRODUCT CATEGORY LISTED, CIRCLE THE CORRECT WORDS IN BRACKETS: EITHER [HAS] OR [HAS NOT].

IF ANY OF THESE ACCESSORY MATERIALS HAS BEEN USED, ATTACH TO THIS FORM PRODUCT DATA AND MSDS SHEET FOR EACH SUCH PRODUCT.

VOC CONTENT RESTRICTIONS ARE SPECIFIED IN SECTION 01 61 16.

2 PRODUCT CERTIFICATION

I CERTIFY THAT THE INSTALLATION WORK OF MY FIRM ON THIS PROJECT:

[HAS] [HAS NOT] required the use of ADHESIVES.

[HAS] [HAS NOT] required the use of JOINT SEALANTS.

[HAS] [HAS NOT] required the use of PAINTS OR COATINGS.

[HAS] [HAS NOT] required the use of COMPOSITE WOOD or AGRIFIBER PRODUCTS.

LIST OF PRODUCTS OF THESE TYPES THAT WERE USED IS ATTACHED, WITH MANUFACTURER AND BRAND NAME.

PRODUCT DATA AND SDS SHEETS FOR THESE PRODUCTS:

___ Are attached.

___ Were submitted as normal submittals.

___ Were submitted as sustainable design submittals.

3 CERTIFIED BY: (Installer/Manufacturer/Supplier Firm)

FIRM NAME: _____

PRINT NAME: _____

SIGNATURE: _____

TITLE: _____ (OFFICER OF COMPANY)

DATE: _____

END OF FORM

Part 1 General

1.1 SECTION INCLUDES

- .1 Special project procedures.
- .2 Special scheduling requirements.
- .3 Connecting to existing services.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part B – Bidding Procedures, Part C- Part E - Specifications

1.3 GENERAL

- .1 Comply with the requirements of the Manitoba Building Code (latest edition).
- .2 Protect existing work from damage.
- .3 Make good all damage to existing construction.
- .4 Execute the Work with the least possible interference or disturbance to the occupants, the public and the normal use of the premises. Arrange with the City to facilitate the execution of the Work.
- .5 Where building or site security has been reduced by the Work of Contract, provide temporary means to maintain security at no expense to the City.
- .6 Refer to Section 01 11 00 Summary of Work for Contractor construction restrictions that must be implemented during construction.

1.4 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 51 00 – Temporary Utilities.
- .5 Section 01 78 00 - Closeout Submittals.

1.5 ESSENTIAL SERVICES SHUTDOWN PROCEDURES

- .1 Permit procedure as follows:
 - .1 All Permits are to be numbered consecutively.
 - .2 A minimum of 72 hours notice is required before shutdown or disruption of any active services.
 - .3 Requester to identify services affected, location, shutdown time required, and submit to the City.
 - .4 The City to confirm scheduling and check areas affected.
 - .5 The City will review planned shutdowns with the Contract Administrator as required, and notify Contractor accordingly.

- .2 Schedule work so as to keep duration of interruptions to minimum duration. In specific situations Contractor may be required to schedule service interruptions after normal working hours of occupants.

1.6 EXISTING SERVICES

- .1 Where unknown services are encountered, immediately advise Contract Administrator and confirm findings in writing. Establish location and extent of service lines in area of Work before commencing work.
- .2 Where Work involves breaking into or connecting to existing services, carry out work at times directed by the City, with minimum of disturbance to pedestrian and vehicular traffic and ongoing activities in the space or adjacent areas which may be affected.
- .3 Obtain approval from the City for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Remove abandoned service lines within 2 m (6' - 6") of structures. Cap or otherwise seal lines at cut-off points as directed by the Contract Administrator.
- .5 Record locations of maintained, re-routed and abandoned service lines.

1.7 SPECIAL WORK SCHEDULE

- .1 Full and uninterrupted use of the lift station and existing buildings on adjacent sites is required during the construction of this project. Any work related to the demolition of existing 400A service to existing lift pump generator building on the property and rerouting of service around new building footprint to be coordinated with the City and representatives from adjacent sites.
- .2 All tie-in's to existing services must be co-ordinated with the City and Manitoba Hydro, and shall only be carried out at times suitable to the City and representatives from adjacent sites.
- .3 Piling, jackhammering and other objectionable noise generating operations shall be carried out during hours as agreed upon and scheduled with the City at the start of construction.
- .4 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.

1.8 SALVAGED MATERIAL

- .1 All material removed and salvageable shall be scheduled with and inspected by the Contract Administrator. Store selected items on site as directed by the Contract Administrator. Dispose of remainder.
- .2 Except for items specifically noted, waste or abandoned materials and equipment are the Contractor's property and must be promptly removed from the site.
- .3 Salvage material may be re-used in the Work only if directed on the drawings or specifications.

1.9 RELICS AND DRAWINGS

- .1 Give immediate notice to the Consultant if evidence of archaeological finds are encountered during construction, and await written instructions before proceeding with the work in this area.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Site fires.
- .2 Site drainage.
- .3 Site clearing and plant protection.
- .4 Pollution control.

1.2 RELATED REQUIREMENTS

- .1 Section 01 35 63 - Sustainability Certification Project Requirements
- .2 Section 01 57 13 - Temporary Erosion and Sediment Control
- .3 Section 01 74 00 - Cleaning and Waste Processing
- .4 Section 31 01 90- Tree Protection
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 FIRES

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

1.4 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.

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Refer to Section 31 01 90- Tree Protection

1.6 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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Construction procedures to promote adequate indoor air quality after construction.
- .2 Total volatile organic compound (VOC) air sampling and analysis after completion of construction.

1.2 PROJECT GOALS

- .1 See Section 00 31 00 - Available Project Information, for overall project goals relating to environment and energy.
- .2 Dust and airborne particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - .1 Cleaning of ductwork is specified in Section 23 31 00.
 - .2 Contractor shall bear the cost of cleaning required due to failure to protect equipment from construction dust.
- .3 Airborne contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - .1 Provide products meeting the specifications.
 - .2 Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.3 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 01 35 66.13 - Sustainability Certification Policy Procedures - Green Globes: Smoking policy.
- .3 Section 21 05 00 - Common Work for Mechanical: Temporary use of equipment, special cleaning
- .4 Section 23 31 00 - Duct Work: Cleaning air ducts.

1.4 REFERENCE STANDARDS

- .1 ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017.
- .2 EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air 1990.
- .3 EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air 1999.
- .4 SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction 2007.

1.5 DEFINITIONS

- .1 Absorptive materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- .2 Contaminants: Gases, vapours, regulated pollutants, airborne mold and mildew, and the like, as specified.
- .3 Particulates: Dust, dirt, and other airborne solid matter.

- .4 Wet work: Concrete, plaster, coatings, and other products that emit water vapour or volatile organic compounds during installation, drying, or curing.

1.6 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Sustainability documentation: Submit all submittals required in this section.
 - .1 For Green Globes certification system projects, submit in accordance with procedures specified in Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
- .3 Construction Indoor Air Quality (IAQ) Management Plan: Describe in detail measures to be taken during construction to promote adequate indoor air quality upon completion; use SMACNA (OCC), including procedures for HVAC protection, as a guide.
 - .1 Submit not more than 30 days after Notice to Proceed, but before construction starts.
 - .2 Identify potential sources of odour and dust.
 - .3 Identify construction activities likely to produce odour or dust.
 - .4 Evaluate potential problems by severity and describe methods of control.
 - .5 Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
 - .6 Describe cleaning and dust control procedures.
 - .7 Describe smoking policy as specified in Section 01 35 66.13.
 - .8 Describe construction procedures for protecting absorptive materials (stored on-site or installed) from moisture damage.
 - .9 Include proposed schedule for submitting photographs of IAQ management measures installed during construction, illustrating all aspects of the IAQ Management Plan.
 - .10 Describe coordination with commissioning procedures.
- .4 Interior finishes installation schedule: Identify each interior finish that either generates odours, moisture, or vapours or is susceptible to adsorption of odours and vapours, and indicate air handling zone, sequence of application, and curing times.
- .5 Test reports: Total volatile organic compounds (TVOC) indoor air sampling and laboratory analysis.
 - .1 Identify:
 - .1 Air sampling and laboratory agency qualifications.
 - .2 Locations and scheduling of air sampling.
 - .3 Test procedures, in detail.
 - .4 Collection media, instruments and apparatus.
 - .5 Sampling methods.
 - .2 Show:
 - .1 Location where each sample was taken, and time.
 - .2 Test values for each air sample; average the values of each set of 3.
 - .3 HVAC operating conditions.
 - .4 Certification of test equipment calibration.
 - .5 Other conditions or discrepancies that might have influenced results.

1.7 QUALITY ASSURANCE

- .1 Air sampling and laboratory agency qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

Part 2 Products

2.1 MATERIALS

- .1 Auxiliary air filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

Part 3 Execution

3.1 CONSTRUCTION PROCEDURES

- .1 Prevent the absorption of moisture and humidity by adsorptive materials by:
 - .1 Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
 - .2 Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
 - .3 Provide sufficient ventilation for drying within reasonable time frame.
- .2 If weather or plumbing leaks result in interior of building becoming wet:
 - .1 Remove standing water as soon as it is observed.
 - .2 Ensure building is properly dried out before installation of additional materials.
 - .3 Inspect installed materials for mould and mildew.
 - .4 Remove and replace absorptive materials that have retained more than 20 percent moisture after 48 hours following moisture exposure.
 - .5 Remove water-damaged materials.
- .3 Regularly inspect conditions on site to ensure that IAQ Management measures are being correctly implemented and maintained:
 - .1 Verify filtration media is intact.
 - .2 Observe materials are adequately protected from exposure to moisture and debris.
 - .3 Ensure spaces and voids to be concealed by construction are free of debris prior to enclosing them.
- .4 HVAC protection: Protect HVAC equipment as follows, but not necessarily limited to:
 - .1 Ventilate project site with temporary exhaust until HVAC system is substantially installed.
 - .2 If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems. Use temporary exhaust to increase amount of outside air in order to dilute construction area airborne pollutants.
 - .3 Replace HVAC filters at frequent intervals throughout construction period, and before occupancy.
 - .4 Shrink wrap ductwork inlets and outlets at both ends when not in use.
 - .5 Keep equipment returns wrapped until final installation of finish grilles.

- .6 Take photographs regularly throughout construction period to document HVAC protection.
- .5 HVAC equipment and supply air ductwork may be used for ventilation during construction, as specified in Section 21 05 00.
- .6 Do not store construction materials or waste in mechanical or electrical rooms.
- .7 Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
 - .1 Inspect duct intakes, return air grilles, and terminal units for dust.
 - .2 Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 - .3 Clean tops of doors and frames.
 - .4 Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 - .5 Clean return plenums of air handling units.
 - .6 Remove intake filters last, after cleaning is complete.
- .8 Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- .9 Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.2 INDOOR AIR SAMPLING

- .1 Perform total volatile organic (TVOC) indoor air sampling and laboratory analysis of collected samples as follows:
 - .1 Take samples using one of the following collection media:
 - .1 Thermal desorption tubes.
 - .2 Canisters.
 - .2 Conduct laboratory analysis in accordance with:
 - .1 VOC range (carbon): C6 - C16.
 - .2 Reference compound: Toluene.
- .2 Perform air contaminant testing before occupancy.
- .3 Do not start air contaminant testing until:
 - .1 All construction is complete, including interior finishes.
 - .2 HVAC systems have been tested, adjusted, and balanced for proper operation.
 - .3 Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
 - .4 New HVAC filtration media have been installed.
- .4 Indoor air samples: Collect from spaces representative of occupied areas:
 - .1 Conduct sampling for TVOCs over a minimum 4-hour period.
 - .2 Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
 - .3 Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 2300 square meters; take samples from areas having the least ventilation and those having the greatest presumed source strength.
 - .4 Collect samples from height from 915 mm to 1830 mm above floor.

- .5 Analyze air samples and submit report.
- .6 Air contaminant concentration test methods:
 - .1 Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.

END OF SECTION

Part 1 General

1.1 PROJECT APPROACH

- .1 This project intends to achieve Two Globes recognition (55 to 69 percent of points achieved out of applicable points) for sustainable design using Green Globes Certification program.
 - .1 A third-party Green Globes Assessor has been assigned to the project. This entity is a key, integral part of the project delivery team. Full cooperation by Contractor with Assessor's work is expected throughout duration of the construction phase of the project, and beyond, until all necessary work and documentation have been completed.
- .2 Contractor is not responsible for the application for sustainability certification, nor for determination of methods of achieving sustainability credits unless specifically so indicated.
- .3 Many sustainability points can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain points relate to the products and procedures used for construction. Therefore, full cooperation of the Contractor and subcontractors is essential to achieving final certification goal, and therefore they must familiarize themselves with the relevant requirements, and provide the necessary information and instructions to product suppliers and installers
- .4 Since Contractor and subcontractors may not be familiar with detailed Green Globes sustainability procedures, this section includes a list of other specifications sections that contain related requirements for products and procedures necessary for achievement of targeted sustainability certification level.
 - .1 Achievement of many points is dependent on proper performance by Contractor and subcontractors, using specific required project management and work execution means and methods.
 - .2 Achievement of other points involves quantifying percentages of installed products by weight and cost; these require careful record keeping and reporting by the Contractor.
 - .3 See GG (TRM-NC) for more information, and Green Globes Project Performance and Green Design Goals in Section 00 31 00 - Available Project Information.

1.2 RELATED REQUIREMENTS

- .1 General and technical sections: Sections that include requirements intended to achieve sustainability points include, but are not limited to, the following:
- .2 DIVISION 01 - GENERAL REQUIREMENTS
 - .1 Section 01 33 29.03 - Sustainable Design Reporting - Green Globes: Requirements and procedures for sustainable design documentation.
 - .2 Section 01 33 29.07 - Prohibited Content Installer Certification: Certification by each installer working on project regardless of product type.
 - .3 Section 01 35 46 - Indoor Air Quality Procedures.
 - .1 Basic construction procedures.
 - .2 Contractor's indoor air quality management plan and construction procedures.
 - .3 Air contaminant testing.

-
- .4 Section 01 57 13 - Temporary Erosion and Sediment Control: Preventive measures and remediation.
 - .5 Section 01 61 00 - Product Requirements.
 - .1 Definitions of:
 - .1 Reused products.
 - .2 Recycled content.
 - .3 Bio-based content.
 - .4 Sustainable forestry certified wood.
 - .5 Source location.
 - .6 Environmental product declarations (EPD).
 - .7 Health product declarations (HPD).
 - .8 Cradle-to-gate.
 - .9 Cradle-to-grave.
 - .10 GreenScreen chemical hazard analysis.
 - .11 Manufacturer's inventory of product content.
 - .6 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: List of indoor-emissions-restricted products and VOC-content-restricted products, requirements, evidence required, and reporting.
 - .7 Section 01 74 19 - Construction Waste Management and Disposal: Requirements for landfill diversion and reporting.
 - .8 Section 01 78 00 - Closeout Submittals: Maintenance and operation manuals for commissioned systems.
 - .1 Include operations and maintenance manual complying with Green Globes certification program requirements.
 - .9 Section 01 79 00 - Demonstration and Training.
 - .1 Demonstration of commissioned systems and equipment.
 - .2 Training of City's personnel.
 - .10 Section 01 91 13 - General Commissioning Requirements.
 - .3 DIVISION 02 - EXISTING CONDITIONS
 - .1 Section 02 41 00 - Demolition.
 - .1 Salvaging of existing materials for re-use.
 - .4 DIVISION 03 - CONCRETE
 - .1 Section 03 20 00 - Concrete Reinforcing: Recycled steel content.
 - .2 Section 03 30 00 - Cast-in-Place Concrete: Replacement of Portland cement, to some extent, with recycled content.
 - .3 Section 03 41 13 - Precast Concrete Hollow Core Planks: Replacement of Portland cement, to some extent, with recycled content.
 - .4 Section 03 35 11 - Concrete Floor Finishes: VOC-content and -emissions-compliant floor finishes.
 - .5 DIVISION 04 - MASONRY
 - .1 Section 04 26 16 - Adhered Masonry Veneer: Recycled clay content in thin brick.

-
- .6 DIVISION 05 - METALS
 - .1 Sections 05 12 23 - Structural Steel for Buildings, 05 21 00 - Steel Joist Framing, and Section 05 31 00 - Steel Decking.
 - .1 Recycled steel content.
 - .2 Sections 05 41 00 - Structural Metal Stud Framing, 05 50 00 - Metal Fabrications, 05 51 00 - Metal Stairs, 05 52 13 - Pipe and Tube Railings, 05 75 00 - Decorative Formed Metals.
 - .1 Recycled steel content.
 - .7 DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
 - .1 Note: Definition of sustainable forestry certified wood is in Section 01 61 00.
 - .2 Section 06 10 00 - Rough Carpentry: Requirement to use sustainably harvested wood, certified or labeled, reused wood.
 - .3 Section 06 18 00 - Glued-Laminated Construction: Requirement to use sustainably harvested wood, certified or labeled.
 - .4 Section 06 41 00 - Architectural Wood Casework: Requirement to use sustainably harvested wood, certified or labeled; reused wood.
 - .8 DIVISION 07 - THERMAL AND MOISTURE PROTECTION
 - .1 Section 07 21 00 - Thermal Insulation: For insulation in exterior walls, including recycled content.
 - .2 Sections 07 42 13.16 - Metal Plate Wall Panels, 07 42 13.23 - Metal Composite Material Wall Panels, 07 62 00 - Sheet Metal Flashing and Trim, 07 64 13 - Standing Seam Sheet Metal Wall Cladding.
 - .1 For recycled steel and aluminum content.
 - .3 Section 07 52 00 - Modified Bituminous Membrane Roofing: for unballasted white-coloured roofing with minimum SRI specified.
 - .4 Section 07 81 00 - Applied Fireproofing
 - .1 For VOC-content and -emissions-compliant fireproofing.
 - .5 Section 07 81 23 - Intumescent Fire Protection
 - .1 For VOC-content and -emissions-compliant fireproofing.
 - .6 Section 07 84 00 - Firestopping.
 - .1 For VOC-content and -emissions-compliant firestopping sealants.
 - .7 Section 07 92 00 - Joint Sealants.
 - .1 For VOC-content and -emissions-compliant sealants.
 - .9 DIVISION 08 - OPENINGS
 - .1 Section 08 11 13 - Hollow Metal Doors and Frames: For recycled steel content.
 - .2 Section 08 14 16 - Flush Wood Doors: For sustainable forestry certified wood.
 - .3 Section 08 31 00 - Access Doors and Panels: For recycled steel content.
 - .4 Section 08 336 27 - Folding Bay Doors: For recycled steel content.
 - .5 Section 08 44 13 - Glazed Aluminum Curtain Walls: For daylighting and views, and recycled aluminum content.
 - .6 Section 08 44 35 - Protective Framed Glazing Assemblies: For recycled steel content.
 - .7 Section 08 56 73 - Sound-Control Window Assemblies: For recycled steel content.

-
- .8 Section 08 63 00 - Metal-Framed Skylights: For daylighting.
 - .9 Section 08 80 00 - Glazing: For daylighting and views.
 - .1 For daylighting and views.
 - .2 For VOC-restrictions for glazing sealants.
 - .10 DIVISION 09 - FINISHES
 - .1 Section 09 21 16 - Gypsum Board Assemblies.
 - .1 For emissions-compliant gypsum board, acoustic insulation and sealants.
 - .2 For acoustic insulation, including recycled content.
 - .2 Section 09 22 16 - Non-Structural Metal Framing
 - .1 For recycled steel content.
 - .3 Section 09 51 00 - Acoustical Ceilings.
 - .1 For emissions-compliant acoustic panels.
 - .2 For pre-consumer recycled content, post-consumer recycled content, bio-based content.
 - .4 Section 09 65 13 - Resilient Base and Accessories.
 - .1 For VOC restrictions for adhesives.
 - .2 For product life cycle third-party verification/certification of cradle-to-gate, or cradle-to-grave.
 - .5 Section 09 65 66 - Resilient Athletic Flooring.
 - .1 For VOC-restrictions for flooring and adhesives.
 - .2 For emissions-compliant flooring.
 - .3 For product life cycle third-party verification/certification of cradle-to-gate, or cradle-to-grave.
 - .6 Section 09 67 00 - Fluid-Applied Flooring: For VOC restrictions.
 - .7 Section 09 91 00 - Painting:
 - .1 For VOC-restrictions for interior paints.
 - .2 For emissions-compliant interior opaque paints and coatings.
 - .8 Section 09 96 00 - High-Performance Coatings:
 - .1 For VOC-restrictions for interior high performance coatings.
 - .2 For emissions-compliant interior opaque high performance coatings.
 - .11 DIVISION 10 - SPECIALTIES
 - .1 Section 10 51 13 - Metal Lockers: For recycled steel content.
 - .12 DIVISION 11 - EQUIPMENT
 - .1 Section 11 21 73 - Commercial Laundry and Dry Cleaning Equipment: for ENERGY STAR rated washers and dryers.
 - .2 Section 11 40 00 - Foodservice Equipment: for ENERGY STAR rated appliances.
 - .13 DIVISION 12 - FURNISHINGS
 - .1 Section 12 24 00 - Window Shades: Window shades for glare control.
 - .2 Section 12 31 00 - Manufactured Metal Casework.
 - .1 For requirement to use sustainable forestry certified wood in countertop substrates.

- .2 For system facilitating future deconstruction, demounting, disassembly, and re-configuration.
- .3 For recycled stainless steel content.
- .3 Section 12 48 13 - Entrance Floor Mats and Frames: For walk-off mats at entryways.
- .4 Section 12 93 13 - Bicycle Racks.
- .14 DIVISION 21 - FIRE SUPPRESSION
 - .1 Section 21 05 00 - Common Work for Mechanical

1.3 DEFINITIONS

- .1 Refer to definitions in GG (TRM-NC).

1.4 REFERENCE STANDARDS

- .1 GG (TRM-NC), Green Globes for New Construction Technical Reference Manual, Version 1.0 February 2022

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures, for additional submittal procedures requirements.
- .2 See Section 01 33 29.03 - Sustainable Design Reporting - Green Globes for requirements and procedures for sustainable design documentation.

Part 2 Products (Not Used)

Part 3 Execution

3.1 PROCEDURES

- .1 General: Conduct project management and construction operations in a manner consistent with, and in support of successful achievement of City's targeted certification level.
 - .1 Collect the cost information for materials and products.
 - .1 Collect cost information for building materials and products with appropriate sustainability documentation, to establish the Sustainable Materials Index (SMI). Refer to GG (TRM-NC) Section 5.4.1.1.
 - .2 Construction waste management and disposal: Implement approved waste management plan during the entire duration of the Contract.
 - .3 Commissioning authority activities: Cooperate with Commissioning Authority to coordinate construction and closeout activities scheduling. See Section 01 91 13, and Sections 07 08 00 and 08 08 00.
 - .4 Sustainable design reporting: Comply with requirements of Section 01 33 29.03.
 - .5 Green Globes assessor: Coordinate construction and closeout activities with Assessor's on-site assessment responsibilities.

- .1 Verification of complying construction: Where elements of construction are required to be incorporated in the work in a particular manner required for designed in-service performance, keep records of installation details and procedures.
 - .1 For elements of construction that become concealed from view prior to being visually inspected, or become unable to be tested without disturbing in-place construction, document as-built conditions using digital photographs and/or digital video. Make digital record available to the Assessor.

3.2 MEETINGS

- .1 Pre-mobilization meeting: Before mobilization on-site, the Contractor and the Green Globes Champion shall hold a kick-off meeting with the Contract Administrator to review the Green Globes requirements. This meeting shall include a review of:
 - .1 Green Globes certification and performance objectives.
 - .2 Green Globes requirements and procedures.
 - .3 Green Globes documentation and submittals.
- .2 Pre-construction coordination meeting: Before start of construction, the Contractor and the Green Globes Champion shall hold a coordination meeting with the construction team to explain the Green Globes requirements to the Sub-Contractors. This meeting shall include a review of:
 - .1 Green Globes certification and performance objectives.
 - .2 Green Globes requirements and procedures.
 - .3 Green Globes documentation and submittals.
- .3 Contractor shall ensure appropriate Sub-Contractors attend pre-construction coordination meeting. If Sub-Contractors are unable to attend pre-construction coordination meeting, the Contractor shall make arrangements to host additional Green Globes coordination meetings to suit.

3.3 SMOKING POLICY

- .1 General: Smoking policy on the project site is implemented for the following reasons:
 - .1 Protection and promotion of health of all persons on the project site.
 - .2 Prevention of fire.
 - .3 Prevention of exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke, resulting in build-up on hard surfaces, and absorption of smoke by textiles and fabrics.
 - .4 Promotion of successful results of Indoor Air Quality testing.
- .2 Smoking is permitted only in designated outdoor areas, located more than 7.62 m from any building entrances, exits, operable windows, or ventilation system fresh-air intakes.
- .3 Include explanation of smoking policy as part of orientation and safety training for every worker on the site.
 - .1 Require every worker to sign a consent form stating s/he understands the policy and will comply with it.
 - .2 Reinforce the policy at regular Health and Safety, and other regular employee or labor-management meetings.
- .4 Enforcement: Institute smoking policy enforcement measures.

3.4 CONSTRUCTION WASTE MANAGEMENT

- .1 Comply with applicable requirements of Section 01 74 19 - Construction Waste Management and Disposal.

3.5 TEMPORARY ENVIRONMENTAL CONTROLS

- .1 Comply with applicable requirements of Section 01 35 46 - Indoor Air Quality Procedures.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 References and codes
- .2 Laws, notices, permits and fees

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES AND CODES

- .1 Do Work in accordance with:
 - .1 National Building Code of Canada (NBC 2010), and Manitoba amendments, The Buildings and Mobile Homes Act (C.C.S.M. C. B93)
 - .2 Province of Manitoba: The Workplace Safety and Health Act, C.C.S.M c. W210.
 - .3 City of Winnipeg Accessibility Design Standard 2016
- .2 Meet or exceed requirements of:
 - .1 Contract Documents.
 - .2 Specified standards, codes and referenced documents.

1.4 LAWS, NOTICES, PERMITS AND FEES

- .1 If the Contractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Contractor shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations or codes.
- .2 Determine detailed requirements of authorities having jurisdiction.

1.5 SMOKING

- .1 No smoking is permitted during execution of the Work within or outside the premises.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Definitions.
- .2 Review by Contract Administrator.
- .3 Independent Inspection Agencies.
- .4 Access to work.
- .5 Procedures.
- .6 Rejected work.
- .7 Reports, tests and mix designs.
- .8 Mock-ups.
- .9 Test and inspection logs.
- .10 Mill tests.
- .11 Equipment and systems.

1.2 RELATED REQUIREMENTS

- .1 Section 01 21 00 - Allowances.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DEFINITIONS

- .1 Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- .2 Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Contract Administrator.
- .3 Mock-ups: Full-size physical assemblies that are constructed on-site. Mock-ups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mock-ups are not Samples. Unless otherwise indicated, approved mock-ups establish the standard by which the Work will be judged.
 - .1 Integrated Exterior Mock-ups: Mock-ups of the exterior envelope, consisting of multiple products, assemblies, and subassemblies.
- .4 Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- .5 Product Testing: Tests and inspections that are performed by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- .6 Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

- .7 Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- .8 Independent Inspection and Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 REVIEW BY CONTRACT ADMINISTRATOR

- .1 Contract Administrator may order any part of Work to be examined if Work is suspected to not be in accordance with Contract Documents. If, upon examination, such Work is found not in accordance with Contract Documents, correct such Work and pay full cost of correction and re-examination by Contract Administrator review.
- .2 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.

1.5 INDEPENDENT INSPECTION AGENCIES

- .1 Engage independent inspection and testing agencies for purpose of inspecting and testing portions of the Work.
- .2 Costs:
 - .1 Quality Control Testing: borne by the Contractor.
 - .2 Quality Assurance Testing: Specific quality assurance testing and inspections specified in technical specification sections, unless explicitly assigned to the City, are paid for by cash allowance. Refer to Section 01 21 00 - Allowances.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.
- .6 The Contractor is responsible to advise the City, Contract Administrator and testing agency a minimum of 5 Business Days prior to inspection or testing services date, and to arrange for testing agency attendance.
- .7 If defects are revealed during inspection or testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no additional cost to the Work. Pay costs for retesting and re-inspection.
- .8 Indicate all independent inspection and testing dates on the Construction Progress Schedule – Refer to Section 01 32 00. Coordinate all inspections and tests with the work progress and reschedule as required. Contractor is responsible to communicate with City, Contract Administrator and independent testing and inspection agencies in a timely manner regarding any schedule changes including retesting or re-inspection.

1.6 ACCESS TO WORK

- .1 Provide equipment and reasonable facilities for such access as required for executing review, inspection and testing of the Work. Fully cooperate with appointed agencies and testing agencies and Contract Administrator during testing.
- .2 If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

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

1.7 PROCEDURES

- .1 Notify appropriate agency and Contract Administrator in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- .4 Provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
- .5 Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - .1 Submit a certified written report, in duplicate, of each quality-control service.
- .6 Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- .7 Provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- .8 Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

1.8 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Correct defect and irregularities as advised by Contract Administrator or inspection/testing agencies at no cost to City. Pay costs for re-testing and re-inspection resulting from failure to meet Contract Document standard. Costs will include all testing and inspection agency costs including disbursements, and Contract Administrator coordination time, as applicable.
- .3 If in opinion of Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, City may deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Contract Administrator.
- .4 Make good other Contractor's work damaged by such removals or replacements promptly.

1.9 REPORTS, TESTS AND MIX DESIGNS

- .1 Submit electronic copy of signed inspection and test reports to Contract Administrator.
- .2 Provide electronic copy of signed inspection and test reports to manufacturer or fabricator of material being inspected or tested, and Subcontractor of work being inspected or tested.
- .3 Furnish test results and mix designs as may be requested. Provide copies to Subcontractor of work being inspected or tested or to manufacturer or fabricator of material being inspected or tested.
- .4 Submit mill test certificates as required of specification Sections.

- .5 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Contract Administrator and may be authorized as recoverable.
- .6 Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - .1 Date of issue.
 - .2 Project title and number.
 - .3 Name, address, and telephone number of testing agency.
 - .4 Dates and locations of samples and tests or inspections.
 - .5 Names of individuals making tests and inspections.
 - .6 Description of the Work and test and inspection method.
 - .7 Identification of product and Specification Section.
 - .8 Complete test or inspection data.
 - .9 Test and inspection results and an interpretation of test results.
 - .10 Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - .11 Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - .12 Name and signature of laboratory inspector.
 - .13 Recommendations on retesting and reinspecting.
- .7 Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - .1 Name, address, and telephone number of technical representative making report.
 - .2 Statement on condition of substrates and their acceptability for installation of product.
 - .3 Statement that products at Project site comply with requirements.
 - .4 Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - .5 Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - .6 Statement whether conditions, products, and installation will affect warranty.
 - .7 Other required items indicated in individual Specification Sections.
- .8 Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - .1 Name, address, and telephone number of factory-authorized service representative making report.
 - .2 Statement that equipment complies with requirements.
 - .3 Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - .4 Statement whether conditions, products, and installation will affect warranty.
 - .5 Other required items indicated in individual Specification Sections.

1.10 MOCK-UPS

- .1 Mock-ups: Before installing portions of the Work requiring mock-ups, build mock-ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - .1 Build mock-ups in location and of size indicated or, if not indicated, as directed by Contract Administrator.
 - .2 Notify Contract Administrator five Business Days in advance of dates and times when mock-ups will be constructed.
 - .3 Employ supervisory personnel who will oversee mock-up construction. Employ workers that will be employed during the construction at Project.
 - .4 Demonstrate the proposed range of aesthetic effects and workmanship.
 - .5 Obtain Contract Administrator's approval of mock-ups before starting work, fabrication, or construction.
 - .1 Allow five Business Days for initial review and each re-review of each mock-up.
 - .6 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
 - .7 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.
 - .8 Failure to prepare and complete mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

1.11 TEST AND INSPECTION LOG

- .1 Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - .1 Date test or inspection was conducted.
 - .2 Description of the Work tested or inspected.
 - .3 Date test or inspection results were transmitted to Contract Administrator.
 - .4 Identification of testing agency or special inspector conducting test or inspection.
- .2 Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Contract Administrator's reference during normal working hours.

1.12 MILL TESTS

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

1.13 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, and electrical systems.
- .2 Refer to Mechanical and Electrical Divisions for definitive requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Temporary utilities.

1.2 RELATED REQUIREMENTS

- .1 Section 01 35 63 - Sustainability Certification Project Requirements
- .2 Section 01 52 00 - Construction Facilities.
- .3 Section 01 53 00 - Temporary Construction.
- .4 Section 23 05 01 - Use of HVAC Systems During Construction.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.4 DEWATERING

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

1.5 WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.

1.6 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 may be permitted as specified in Section 23 05 01 – Use of HVAC Systems During Construction.
- .7 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Contract Administrator.
- .8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .3 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination is not less than that required by legislation. Use high-efficiency lighting for the construction site if possible.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Contract Administrator provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three months.

1.8 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary high speed internet, telephone and data hook up, lines and equipment necessary for own use and use of Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Parking.
- .4 Sanitary facilities.
- .5 Construction signs.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions
- .2 Section 01 35 63 - Sustainability Certification Project Requirements
- .3 Section 01 51 00 - Temporary Utilities.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.
- .3 Select an ecologically appropriate staging area, for storing construction equipment and materials.
- .4 Locate temporary buildings, parking and vehicle access ways away from sensitive areas to avoid damage to vegetation and topsoil.

1.4 SCAFFOLDING

- .1 Provide and maintain stairs, ladders, ramps, platforms, and scaffolding.

1.5 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists shall be operated by qualified operator.

1.6 USE OF THE WORK

- .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 a weight or force that will endanger the Work.

1.7 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 Maintain existing roads used for access to project site for duration of Contract and make good damage resulting from Contractors' use of roads.

1.8 SECURITY

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

1.9 OFFICES

- .1 Provide office heated to 22 degrees C; lighted and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.11 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities.
- .3 Except where connected to municipal sewer system, periodically remove wastes from Site.
- .4 New permanent facilities may not be used.
- .5 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

1.12 CONSTRUCTION SIGNS

- .1 Safety Signs:
 - .1 Format, location, and quantity of signs and notices to be approved by Contract Administrator.
 - .2 Signs and notices for safety or instruction to be in English language, or commonly understood graphic symbols.
- .2 Maintain signs and notices for duration of project. Remove and dispose of signs off site when directed by Contract Administrator.
- .3 Do not advertise or promote systems, construction or assembly methods, tools or equipment used or incorporated without written approval of Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Site enclosure.
- .2 Guardrails and barriers.
- .3 Weather enclosures.
- .4 Dust tight barriers.
- .5 Protection for off-site and public property.
- .6 Protection of applied finishes.
- .7 Protection of surrounding Work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 35 63 - Sustainability Certification Project Requirements
- .2 Section 01 51 00 - Temporary Utilities.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

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

1.4 SITE ENCLOSURE

- .1 Before construction operations begin, provide site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - .1 Type of fence at Contractor's discretion. Minimum 2.0 m high and anchored securely to ground to withstand wind pressure, with adjacent panels securely fastened together to resist vandalism.
 - .2 Provide one lockable truck gate.
 - .3 Maintain enclosure in good repair.

1.5 GUARD RAILS AND BARRIERS

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

1.6 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.

1.7 DUST TIGHT BARRIERS

- .1 Provide dust tight barriers and screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work.
- .2 Maintain and relocate protection until such work is complete.

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.9 PROTECTION OF APPLIED FINISHES

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

1.10 PROTECTION OF SURROUNDING WORK

- .1 Provide protection for finished and partially finished Work from damage.
- .2 Provide necessary cover and protection.
- .3 Be responsible for damage incurred due to lack of or improper or inappropriate protection.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Informational and warning devices.
- .2 Protection and control of public traffic.
- .3 Informational and warning devices.
- .4 Fire routes.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part C – General Conditions for Construction; Part D – Supplemental Conditions; Part E - Specifications
- .2 Section 01 53 00 - Temporary Construction. Roadway and pedestrian access to the site.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Municipal guidelines and regulations enforceable in the Place of the Work.

1.4 ACCESS TO SITE

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

1.5 PUBLIC TRAFFIC FLOW

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

1.6 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of City of Winnipeg traffic signage guidelines, regulations, and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on or near a travelled way:
 - .1 Place equipment in position to present minimum of interference and hazard to traveling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Do not close any lanes of road without approval of Contract Administrator. Before re-routing traffic erect suitable signs and devices in accordance authority having jurisdiction.
- .4 Keep travelled way free of pot holes and of sufficient width for required number of lanes of traffic.
- .5 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Contract Administrator.

1.7 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights, and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in municipal guidelines.
- .3 Place signs and other devices in locations recommended in municipal guidelines.
- .4 Meet with Contract Administrator before start of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Contract Administrator.
- .5 Continually maintain traffic control devices in use by:
 - .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Removing or covering signs which do not apply to conditions existing from day to day.

1.8 FIRE ROUTES

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Requirements for an erosion and sediment control plan.
- .2 Prevent loss of soil during construction by storm water runoff and wind erosion.
- .3 Protect stockpiled topsoil.
- .4 Prevent sedimentation of storm water and receiving streams.
- .5 Prevent pollution of the air with dust and particulate matter.

1.2 RELATED REQUIREMENTS

- .1 Division 31 – Earthwork

1.3 REFERENCES

- .1 EPA 832/R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, September 1992.
- .2 Local erosion and sediment control guidelines.

1.4 DEFINITIONS

- .1 Erosion: Deterioration, displacement, or transportation of land surface by wind or water, intensified by land-clearing practices related to construction activities.
- .2 Rain or Rain Storm: An event defined causing the pooling of water on road or other impervious surfaces.
- .3 Sediment: Particulate matter transported and deposited as a layer of solid particles within a body of water.
- .4 Snow Melt: An event in snow conditions when the temperature is above 0 degrees C or when environmental conditions causing snow on the ground to melt.

1.5 SUBMITTALS

- .1 Provide requested information specified in Section 01 33 00.
- .2 Provide erosion and sediment control plan within 14 Business Days of date established for start the Work, and before start of the Work on site.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Provide and implement erosion and sediment control plan to meet following objectives:
 - .1 Prevent loss of soil during construction by storm water runoff and wind erosion, including protecting topsoil.
 - .2 Prevent sedimentation of the storm sewer and receiving streams.
 - .3 Prevent polluting air with dust and particulate matter.
- .2 Erosion and Sediment Control Plan will describe how each of the following has been implemented for the project. If any of the items are not applicable to the site, the Plan must explain why it is not applicable:

- .1 Preserve vegetation and mark clearing limits
- .2 Establish and delineate construction access
- .3 Control flow rates
- .4 Install sediment controls
- .5 Stabilize soils
- .6 Protect drain inlets
- .7 Stabilize channels and outlets
- .8 Control pollutants
- .9 Control dewatering
- .10 Maintain the erosion control measures
- .11 Maintain and report on the Erosion and Sediment Control Plan

Part 3 Execution

3.1 INSTALLATION AND REMOVAL

- .1 Provide erosion and sedimentation control measures before Work is started on site. Do not remove erosion and sedimentation control measures until work is complete and vegetation has been adequately established.
- .2 Remove all such work after use. Restore and stabilize areas disturbed during removal.

3.2 GENERAL

- .1 Prevent cleared topsoil and excavated earth stockpiled on site from being eroded by rain storm, snow melt or wind.
- .2 Minimize amount of disturbed soil.
 - .1 Site disturbance shall only occur where necessary for project completion and must be conducted in a timely manner.
 - .2 Stockpile disturbed soil in one location, until removal, to a maximum height of 2 metres.
 - .3 Cover stockpiled materials at the end of each work day to prevent soil erosion. Extend covering material below stockpiled materials.
 - .4 Correct disturbed soils using erosion control mats, or mulch and seed within 90 days of disturbance.
 - .1 Where snow cover precludes re-vegetation, complete re-vegetation as soon as practical.
- .3 Remove sediment from onsite runoff before it leaves the site.
 - .1 Install straw wattles or other sediment filtering devices around storm sewer inlets to prevent sedimentation of the storm sewer.
- .4 Slow down runoff flowing across the site.
 - .1 Maintain existing drainage patterns that flow into sod areas and ditches in order to filter water through sod or other vegetation.
 - .2 Filter water pumped from excavations, foundations and other areas as part of dewatering before discharging to storm sewer.
 - .3 Place rip-rap around storm sewer outlets. Remove silt and debris after each 24-hour rainfall of 5 mm or more.
- .5 Prevent polluting air with dust and particulate matter.

- .1 Minimize period of soil exposure, through temporary ground covers, mulches, or acceptable environmentally-safe soil stabilizers and dust control agents.
- .2 Provide silt fencing to prevent wind erosion from carrying sediment off the site or into storm sewers.
- .3 Provide gravel pads at site entries. Maintain and clean pads during construction period.
- .4 During dry days, control dust by wetting soil each day for 15 to 30 minutes before construction activities begin, and again after construction activities cease for the day.
- .6 Meet or exceed local sediment and erosion control requirements.
 - .1 Coordinate erosion and sedimentation control provisions with the municipal and provincial requirements where applicable.
- .7 Complete visual inspection of erosion and sedimentation control measures daily. Repair damage immediately.
- .8 Inspect erosion control measures on periodic basis, minimum once/month.
 - .1 Provide formal documentation of the inspection, including photographs, and completion of a log, checklist, or inspection log with a description of any corrective actions taken.
- .9 Maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .10 Where erosion and sedimentation control measures must be removed temporarily to accommodate construction operations, reinstate affected barriers as soon as practical.
- .11 Clean sediment control devices of accumulated silt and debris on a monthly basis, and after all rain events, or more often as necessary.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, and coordination.
- .4 Concealment, and remedial work.
- .5 Location of fixtures.
- .6 Fastenings.
- .7 Protection of work in progress.

1.2 RELATED REQUIREMENTS

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TERMINOLOGY

- .1 New: Produced from new materials.
- .2 Defective: A condition determined exclusively by the Contract Administrator.

1.4 PRODUCT QUALITY

- .1 Products, materials, equipment, parts or assemblies (referred to as "Products" in the specifications, and "Materials" in the General Conditions) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.
- .2 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Contract Administrator.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

- .1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 If delays in supply of Products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .3 In event of failure to notify Contract Administrator at start of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to

substitute more readily available Products of similar character, at no increase in Contract Price or affect to the construction schedule.

1.6 STORAGE AND PROTECTION

- .1 Store and protect Products in accordance with manufacturers' written instructions.
- .2 Store with seals and labels intact and legible.
- .3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.
- .4 For exterior storage of fabricated Products, place on sloped supports above ground.
- .5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.
- .6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- .7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.7 TRANSPORTATION AND HANDLING

- .1 Transport and handle Products in accordance with manufacturer's written instructions.
- .2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- .3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.8 MANUFACTURER'S WRITTEN INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or affect to construction schedule.

1.9 QUALITY OF WORK

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

1.10 COORDINATION

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

1.11 CONCEALMENT

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

1.12 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

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

1.14 FASTENINGS

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

1.15 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of any part of the Project.
- .2 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Requirements for indoor-emissions-restricted products.
- .2 Requirements for VOC-content-restricted products.
- .3 Requirement for installer certification that they did not use any non-compliant products.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 33 29.03 - Sustainable Design Reporting - Green Globes: Procedures for reporting emissions and VOC content data.
- .3 Section 01 33 29.07 - Prohibited Content Installer Certification: Form for certifying that no non-compliant products were used.
- .4 Section 01 61 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- .5 Section 07 92 00 - Joint Sealants: Emissions-compliant sealants.

1.3 DEFINITIONS

- .1 Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- .2 Emissions-restricted products: All products in the following product categories, whether specified or not:
 - .1 Paints and coatings applied on site within, or are a part of the building's continuous plane of air tightness.
 - .2 Adhesives and sealants applied on site.
 - .3 Interior floors/floor coverings.
 - .4 Interior ceiling systems.
 - .5 Interior acoustical and thermal insulation.
 - .6 Interior wall systems including wall coverings, gypsum board and window shading devices.
 - .7 Composite wood.
- .3 Inherently non-emitting materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - .1 Stone.
 - .2 Concrete.
 - .3 Concrete masonry and clay brick.
 - .4 Glass.
 - .5 Ceramics.
- .4 Interior of building: Anywhere inside the exterior weather barrier.
- .5 Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

- .6 VOC-content-restricted products: All products in the following product categories, whether specified or not:
 - .1 Paints and coatings applied on site within, or are a part of the building's continuous plane of air tightness.
 - .2 Adhesives and sealants applied on site, within, or are a part of the building's continuous plane of air tightness.

1.4 REFERENCE STANDARDS

- .1 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.
- .2 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board current edition.
- .3 CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.
- .4 CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- .5 GG (TRM-NC) - Green Globes for New Construction Technical Reference Manual Version 1.0 February 2022.
- .6 ISO/IEC 17065 - Conformity assessment — Requirements for bodies certifying products, processes and services 2012.
- .7 SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
- .8 SCS (CPD) - SCS Certified Products Current Edition.
- .9 UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: For each VOC-restricted product used in the project, submit evidence of compliance.
- .3 Sustainable design reporting: Submit evidence of compliance.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
- .4 Installer certifications regarding prohibited content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifibre products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.
 - .1 Refer to Section 01 33 29.07 - Prohibited Content Installer Certification.

1.6 QUALITY ASSURANCE

- .1 Indoor emissions standard and test method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - .1 Wet-applied products: State amount applied in mass per surface area.
 - .2 Paints and coatings: Test tinted products, not just tinting bases.
 - .3 Evidence of compliance: Acceptable types of evidence are the following;
 - .1 Current UL (GGG) certification.

- .2 Current SCS (CPD) Floorscore certification.
- .3 Current SCS (CPD) Indoor Advantage Gold certification.
- .4 Current CRI (GLP) certification.
- .5 Test report showing compliance and stating exposure scenario used.
- .4 Product data submittal showing VOC content is NOT acceptable evidence.
- .5 Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- .2 Composite wood emissions standard: CARB (ATCM).
 - .1 Evidence of compliance: Acceptable types of evidence are:
 - .1 Current SCS "No Added Formaldehyde (NAF)" certification; www.scs-certified.com.
 - .2 Report of laboratory testing performed in accordance with requirements.
 - .3 Published product data showing compliance with requirements.
 - .4 Certification by manufacturer that product complies with requirements.
 - .3 Testing agency qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section, accredited to ISO/IEC 17065.

Part 2 Products

2.1 MATERIALS

- .1 All Products: Comply with the most stringent of federal, provincial, and local requirements, or these specifications.
- .2 Indoor-emissions-restricted products: Comply with Standard Method for Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources, except for:
 - .1 Composite wood, wood fibre, and wood chip products: Comply with CARB (ATCM).
 - .2 Inherently non-emitting materials.
 - .1 Refer to Table 11.2.1.3: Interior Product VOC Emissions in GG (TRM-NC).
- .3 VOC-content-restricted products: VOC content not greater than required by the following:
 - .1 Adhesives, including flooring adhesives: SCAQMD 1168 Rule.
 - .2 Joint sealants: SCAQMD 1168 Rule.
 - .3 Paints and coatings: CARB (SCM).
 - .4 Refer to Table 11.2.1.1: Adhesives and Sealants VOC Content Criteria in GG (TRM-NC).

Part 3 Execution

3.1 SITE QUALITY CONTROL

- .1 City reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to City.

- .2 Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Substitutions during construction.

1.2 RELATED REQUIREMENTS

- .1 Tender No. 543-2022B; Part B- Bidding Procedures, Part C – General Conditions for Construction; Part D – Supplemental Conditions

1.3 DEFINITIONS

- .1 Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - .1 Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - .2 Substitutions for Convenience: Changes proposed by Contractor that are not required in order to meet other Project requirements but may offer advantage to Contractor.

1.4 SUBSTITUTIONS DURING BID PERIOD

- .1 Substitutions During the Bid Period: Part B Bidding Procedures specify time restrictions for submitting requests for Substitutions during the bidding period.

1.5 SUBSTITUTIONS DURING CONSTRUCTION

- .1 Contract Administrator may consider requests for Substitutions for Cause only within 15 days after date of Contract Award.
- .2 Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.
- .3 Substitutions for Convenience will not be considered.
- .4 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .5 A request constitutes a representation that the Contractor:
 - .1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - .2 Will provide the same warranty for the Substitution as for the specified Product.
 - .3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Contract.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
- .6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

- .7 Substitution Submittal Procedure:
 - .1 Limit each substitution request to one proposed Substitution.
 - .2 Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
 - .3 Contract Administrator will notify Contractor in writing of decision to accept or reject request.

END OF SECTION

REQUEST FOR SUBSTITUTION

This form must be completely filled in with all relevant data by the Subcontractor and submitted to the Consultant for consideration before any request to change the Drawing or Specification requirements will be considered.

REFERENCE DATA

Project Name:	Date of Request:		
Location:	Consultant Project No.:		
Request by (company):			
Address:			
Contact:	Ph:	Fx:	E:
Subcontract Works:	Package No.:		

SUBSTITUTION REQUEST DATA

Substitution is request for:	Reason for Request:
<input type="checkbox"/> Named Product	
<input type="checkbox"/> Product type, material, finish or formulation	
<input type="checkbox"/> Fabrication or installation methods	

PRODUCT/ MATERIAL/ METHOD FOR WHIICH SUBSTITUTION IS REQUESTED IS SHOWN ON THE FOLLOWING DOCUMENTS:

Specification:	Section No:	Page(s):	Clause No.(s):
Drawings (list of Drawings as affected):			

COST/ BENEFIT ANALYSIS

Describe in detail any alteration to any other part of the Work not required by use of the requested substitution.

Total net cost to any such other required alterations, including overhead and profit:	\$
Cost of Contractor's Administration (to be filled in by Contractor):	\$
Total cost of such other alterations (to be filled in by Contractor):	\$
Total cost savings achieved (from page 2, to be filled in by Contractor):	\$
Total cost/ benefit to Owner (to be filled in by Contractor):	\$
Benefits to Owner other than financial:	

ADDITIONAL INFORMATION REQUIRED

Complete the page 2 as applicable. Attach the following information:

1. Manufacturer's technical data sheets on proposed products.
2. Manufacturer's standard form of warranty.
3. Letter on manufacturer's letterhead stating that manufacturer will warrant products as specified in specification.

REQUEST FOR SUBSTITUTION

COMPARISON OF OPTIONS

Fill in the following blanks as are applicable to the product, material or method type. As a guide, if the item is mentioned in the Specification as a performance or materials replacement, then information about the proposed substitution is required by the Consultant to evaluate the proposed substitution. Requests lacking relevant information will be returned without action.

SPECIFIED PRODUCT, MATERIAL OR METHOD	PROPOSED SUBSTITUTION
Description:	Description:
Product Name:	Product Name:
Type:	Type:
Model No.:	Model No.:
Fire Rating (hrs):	Fire Rating (hrs):
Thickness:	Thickness:
Country of manufacture:	Country of manufacture:
Substrate preparation required:	Substrate preparation required:
Length of warranty (yrs):	Length of warranty (yrs):
Sound transfer coefficient (STC):	Sound transfer coefficient (STC):
Exposure class:	Exposure class:
Resistance to chemicals (list):	Resistance to chemicals (list):
Other specified criteria (list):	Other specified criteria (list):

UNIT COST OF PRODUCT/ MATERIAL (must be completed):	UNIT COST OF PRODUCT/ MATERIAL (must be completed)
\$ _____ What:	\$ _____ What:
Units required: _____ Total value: \$ _____	Units required: _____ Total value: \$ _____

CONTRACTOR'S REVIEW

I certify that I have review the above documentation for the proposed Request for Substitution and warrant it to be substantially complete and accurate.

Signed by: _____
Date: _____

CONSULTANT'S ACTION

- | | |
|--|---|
| <input type="checkbox"/> Request approved. | <input type="checkbox"/> Request approved subject to qualifications per attached documentation. |
| <input type="checkbox"/> Request denied. | <input type="checkbox"/> Refer Variation Order No.: _____ |

Approved by: _____
Date: _____

Comments: _____

Part 1 General

1.1 SECTION INCLUDES

- .1 Field engineering survey services to measure and stake site.
- .2 Recording of subsurface conditions found.
- .3 Survey services to determine measurement inverts for the Work.

1.2 RELATED REQUIREMENTS

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Identification of existing survey control points and property limits.

1.4 SUBMITTALS

- .1 Submit name and address of surveyor to Contract Administrator.
- .2 On request of Contract Administrator, 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.

1.5 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in the Place of the Work, acceptable to Contract Administrator.

1.6 SURVEY REFERENCE POINTS

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

1.7 SURVEY REQUIREMENTS

- .1 Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, landscaping features, fill placement, and topsoil placement.
- .4 Stake slopes.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation, column locations, and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify Contract Administrator in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.
- .2 Advise the Contract Administrator of a reasonable assumption of probable conditions when determined.

1.9 EXAMINATION

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

1.10 PREPARATION

- .1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .2 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.11 EXISTING SERVICES

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

1.12 SURVEY RECORD

- .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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Execution requirements for all Work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 70 00 - Examination and Preparation.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TOLERANCES

- .1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.
- .2 Do not permit tolerances to accumulate beyond effective or practical limits.
- .3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Contract Administrator before proceeding.
- .4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching to complete the Work.
- .2 Perform required excavation and fill to complete the Work.
- .3 Fit several parts together, to integrate with other Work.
- .4 Uncover Work to install ill-timed Work.
- .5 Remove and replace defective or non-conforming Work.
- .6 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.
- .7 Provide openings in non-structural elements of Work for penetrations of electrical and mechanical Work. Limit opening dimensions to minimal sizes required, and performed in a neat and clean fashion.
- .8 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .9 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .10 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry or concrete work without prior approval.
- .11 Restore Work with new Products in accordance with requirements of Contract Documents.
- .12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, for full thickness of the constructed element.
- .14 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Cleaning prior to acceptance.
- .3 Final product cleaning.

1.2 RELATED REQUIREMENTS

- .1 This section describes requirements applicable to all Sections within Divisions 02 to 49.
- .2 Section 01 74 19 – Construction Waste Management and Disposal

Part 2 Products

2.1 CLEANING MATERIALS

- .1 Cleaning Agents and Materials: Low VOC content.

Part 3 Execution

3.1 PROGRESSIVE CLEANING

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Contract Administrator or other contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.
- .3 Clear snow and ice from area of construction, remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Containers:
 - .1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.
- .6 Remove waste material and debris from site and deposit in waste containers at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finish 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 enclosure 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.

3.2 CLEANING PRIOR TO ACCEPTANCE

- .1 Prior to applying for Substantial Performance of the Work, 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 Contract Administrator or other contractors.
- .5 Do not burn waste materials on site.
- .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, 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, 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 Clean and polish surface 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 roofs, gutters, areaways, and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition; clean filters of mechanical equipment.
- .18 Clean roof surfaces, and drainage components.
- .19 Remove debris and surplus materials from crawl space areas and other accessible concealed spaces.
- .20 Remove snow and ice from access to facilities.

3.3 FINAL PRODUCT CLEANING

- .1 Execute final cleaning prior to final project assessment. Refer to Section 01 74 00.
- .2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- .3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- .4 Clean filters of operating equipment.

- .5 Remove waste and surplus materials, rubbish, and construction facilities from the site.
- .6 Clean site; sweep paved areas, rake clean landscaped surfaces.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section includes the following, which form a part of the Contractor's commitment to reduce construction waste and divert materials from landfilling, in accordance with GG (TRM-NC) Sections 5.6.1.1, 5.6.1.2, 5.6.1.3, and 5.6.1.4:
 - .1 Pre-construction waste management plan.
 - .2 Final waste management summary report.
 - .3 Waste management report

1.2 WASTE MANAGEMENT REQUIREMENTS

- .1 City requires that this project generate the least amount of trash and waste possible.
- .2 Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- .3 Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- .4 Comply with applicable local environmental regulations related to waste management and pollution control.
- .5 Contractor shall develop a pre-construction Waste Management Plan designed to implement strategies for reducing construction waste and diverting materials from landfilling by way of reuse or recycling. Refer to GG (TRM-NC) Section 5.6.1.1.
- .6 Contractor shall develop monthly Waste Management Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- .7 Contractor shall develop a final Waste Management Report summarizing results of the implementation of the pre-construction waste management plan. Refer to GG (TRM-NC) Section 5.6.1.2, 5.6.1.3, and 5.6.1.4.
- .8 Methods of trash/waste disposal that are not acceptable are:
 - .1 Burning on the project site.
 - .2 Burying on the project site.
 - .3 Dumping or burying on other property, public or private.
 - .4 Other illegal dumping or burying.
 - .5 Incineration, either on- or off-site.

1.3 RELATED REQUIREMENTS

- .1 Section 01 61 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- .2 Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- .3 Section 02 41 00 - Demolition: List of items to be salvaged from the existing building for relocation in project or for City.

1.4 DEFINITIONS

- .1 Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- .2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- .4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- .5 Non-toxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- .6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- .8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .9 Return: To give back reusable items or unused products to vendors for credit.
- .10 Reuse: To reuse a construction waste material in some manner on the project site.
- .11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- .12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals: Submit preconstruction Waste Management Plan, Waste Disposal Reports, and Waste Management Report in accordance with procedures specified in Section 01 35 66.13 - Sustainability Certification Project Procedures - Green Globes.
- .3 Waste Management Plan: Submit Waste Management Plan within 14 days after receipt of Award of Contract, or prior to any trash or waste removal, whichever occurs sooner. Include the following information:
 - .1 Strategies planned for construction waste reduction, salvaging, recycling, returning to supplier/manufacturer, or other methods for diverting trash/waste from landfill.
 - .2 Facility, hauler, or service provider that will handle each material being diverted.

-
- .3 Whether construction and demolition materials will be separated on-site or commingled.
 - .4 Reporting and record keeping provisions.
 - .5 Identify person responsible for implementing Waste Management Plan.
 - .6 Target construction waste rate per GG (TRM-NC) Section 5.6.1.3.
 - .7 Target waste diversion rate.
 - .8 Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - .9 Identify structural and non-structural/interior elements targeted for diversion, and what percentage of structural systems from the existing building on site will be retained and incorporated into the new building.
 - .10 Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
- .4 Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
- .1 Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - .2 Submit Report on a form acceptable to City.
 - .3 Landfill disposal: Include the following information:
 - .1 Identification of material.
 - .2 Amount, in cubic metres, of trash/waste material from the project disposed of in landfills.
 - .3 State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - .4 Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - .4 Recycled and salvaged materials: Include the following information for each:
 - .1 Identification of material, including those retrieved by installer for use on other projects.
 - .2 Amount, in cubic meters, date removed from the project site, and receiving party.
 - .3 Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - .4 Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - .5 Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 - .5 Material reused on project: Include the following information for each:
 - .1 Identification of material and how it was used in the project.
 - .2 Percentage of structural systems, and non-structural interior systems/elements retained and incorporated, calculated per GG (TRM-NC) Sections 5.5.1.1 and 5.5.1.2.
 - .6 Other disposal methods: Include information similar to that described above, as appropriate to disposal method.

- .5 Final Waste Management Report: Submit at Substantial Completion. Include the following information:
 - .1 Weight or volume of the total quantity of construction and demolition waste.
 - .2 Calculated construction waste per unit area for the project, calculated per GG (TRM-NC) Section 5.6.1.3
 - .3 Weight or volume of the major categories of materials that were reused or recycled.
 - .4 Percentage of construction waste, including building demolition waste and packaging, that was diverted from landfill through recycling, reuse, repurposing, or composting, calculated per GG (TRM-NC) Section 5.6.1.4.
 - .5 Reuse/recycling rate for each major category of waste material.
 - .6 Overall reuse/recycling rate for the project.
 - .7 Description of the processing of materials through source separate or by a comingled waste hauler.
 - .8 Copies of receipts and invoices used to track the progress of the waste management effort.
 - .9 A statement that describes if a waste recycling facility was used whether it was certified by a government or non-government organization.
 - .10 The organization and contact information of the author of the waste management summary report and the name and contact information of the person at the off-site recycling facility responsible for date collection and reporting.

Part 2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, provincial and local requirements, pertaining to legal disposal of construction and demolition waste materials.

2.2 PRODUCT SUBSTITUTIONS

- .1 See Part B - Bidding Procedures for substitution submission procedures.
- .2 For each proposed product substitution, submit the following information in addition to requirements specified in Part B - Bidding Procedures:
 - .1 Relative amount of waste produced, compared to specified product.
 - .2 Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
 - .3 Proposed disposal method for waste product.
 - .4 Markets for recycled waste product.

Part 3 Execution

3.1 WASTE MANAGEMENT PROCEDURES

- .1 See Sections 01 31 19, 01 32 00, and 01 33 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- .2 See Section 01 74 00 - Cleaning and Waste Processing for additional requirements related to trash/waste collection.

- .3 See Section 02 41 00 for list of items to be salvaged from the existing building for relocation in project or for City.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- .1 Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- .2 Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, City, and Contract Administrator. Post Waste Management Plan on site where workers are able to review content regularly.
- .3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- .4 Meetings: Discuss waste management goals and issues at project meetings.
 - .1 Pre-construction meeting.
 - .2 Regular job-site meetings.
- .5 Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - .1 Provide containers as required.
 - .2 Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
 - .3 Locate enclosures out of the way of construction traffic.
 - .4 Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - .5 Keep recycling and waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- .6 Hazardous wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- .7 Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- .8 Reuse of materials on-site: Set aside, sort, and protect separated products in preparation for reuse.
- .9 Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Starting equipment in preparation for adjusting and commissioning.

1.2 RELATED REQUIREMENTS

- .1 Section 01 79 00 - Demonstration and Training.
- .2 Section 01 91 13 – General Commissioning (CX) Requirements.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

Part 2 Products

Part 3 Execution

3.1 STARTING SYSTEMS

- .1 Coordinate schedule for start-up of various equipment and systems.
- .2 Notify Contract Administrator, five Business Days prior to start-up of each item.
- .3 Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- .4 Verify tests, metre readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- .5 Verify that wiring and support components for equipment are complete and tested.
- .6 Execute start-up under supervision of applicable Subcontractors' personnel in accordance with manufacturers' written instructions.
- .7 When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- .8 Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.2 CONTRACTOR START UP

- .1 Contractor shall perform the following during start-up:
 - .1 Start equipment and systems.
 - .2 Test, adjust and balance equipment and systems.
 - .3 Demonstrate equipment and systems as specified in Section 01 79 00.
 - .4 Complete and submit start-up reports including:
 - .1 Contractor's system and equipment start up reports.
 - .2 Testing, adjusting and balancing reports.
 - .3 Manufacturers' equipment start up reports.
 - .5 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with requirements of Contract Documents.

- .6 Correct Contract deficiencies and defects identified as a result of the foregoing and as may be identified by the Contract Administrator.
- .7 Execute and complete approved Change Orders.
- .8 Perform other work and activities required for fulfillment of prerequisites to Interim Acceptance of the Work.
- .2 Commissioning Agent will perform the following during start-up:
 - .1 Perform preliminary interim inspections as necessary.
 - .2 Witness manufacturers' equipment start-up.
 - .3 Verify starting, testing, adjusting and balancing by Contractor.
 - .4 Provide start-up reports for all systems and equipment and review and approve Contractor start-up reports.
 - .5 Cooperate in systems and equipment demonstration and instruction.
 - .6 Initiate Change Orders as required.
 - .7 Verify correction of Contract deficiencies and defects by Contractor.
 - .8 Verify execution of Change Orders performed by Contractor.
 - .9 Perform other activities related to Substantial Completion of the Work.

3.3 PERFORMANCE TESTING

- .1 Performance testing will be performed by the Commissioning Agent and:
 - .1 Completed prior to Substantial Completion.
 - .2 Completed when all systems have been balanced and tested and are operating to the satisfactory of the Commissioning Agent.
- .2 The Commissioning Agent will do the following during Performance Testing:
 - .1 Carry out a series of preplanned systems and equipment operating tests under conditions simulating, to the extent possible, full and partial operating loads.
 - .2 Record test results.
 - .3 Diagnose problems and determine whether they are the result of Contract Deficiencies.
 - .4 Initiate Change Orders as required.
 - .5 Repeat tests as required following correction of deficiencies and execution of Change Orders by Contractor and verify results.
 - .6 Perform other activities related to Substantial Completion.
- .3 Contractor shall perform the following during Performance Testing:
 - .1 Correct Contract deficiencies and defects previously outstanding and those identified during performance testing.
 - .2 Execute Change Orders.

3.4 SEASONAL CONSTRAINTS

- .1 Notwithstanding requirements in this Section, additional separate cycles of Contractor start-up, performance testing and fine tuning may be needed at a later time on equipment and systems whose full operation is dependent on seasonal conditions.
- .2 Contractor's responsibilities with respect to later facility start-up activities are specified in this section.

3.5 PARTIAL USE OF WORK

- .1 When partial use of the Work is required, the applicable requirements specified in this section apply to the parts of the Work to be used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Inspections and declarations.
- .2 Closeout submittals.
- .3 Operation and maintenance manuals.
- .4 Recording actual site conditions – As-Builts.
- .5 Record documents.
- .6 Final survey.
- .7 Warranties and bonds.
- .8 Maintenance materials, special tools and spare parts.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 79 00 - Demonstration and Training.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DEFINITIONS

- .1 As-Built Documents: Project documents that are annotated by the Contractor during construction to record changes in the Work.
- .2 Record Documents: As-built documents consisting of Drawings and Specifications produced, usually electronically, from information derived from the Contractor's as-built documents.

1.4 REFERENCES

- .1 WCA/MAA Technical Bulletin #15 – Operations and Maintenance Manuals, dated December 24, 2001.

1.5 INSPECTIONS AND DECLARATIONS

- .1 Substantial Performance:
 - .1 Contractor's Pre-Substantial Performance Inspection:
 - .1 Before requesting Substantial Performance review, the Contractor and Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .2 Notify Contract Administrator of Contractor's Pre-Substantial Performance inspection dates.
 - .3 After conducting pre-substantial performance inspection, notify Contract Administrator in writing of time allotted for completion of repairs and correction of deficiencies and defects. Indicate proposed date for Substantial Performance review.

- .2 Substantial Performance Application: Once corrections have been made and Work is considered ready for Substantial Performance review, make formal application for Substantial Performance, confirming that the following has been completed:
 - .1 Work has been completed and inspected for compliance with the Contract Documents, and requirements of Substantial Performance as defined by Provincial lien legislation.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced, and are fully operational and complete.
 - .4 Certificates required by authorities having jurisdiction have been submitted.
 - .5 Certificates required by utility companies have been submitted.
 - .6 Operation of systems have been demonstrated to Contract Administrator's personnel.
 - .7 Operations and maintenance manuals, as-built drawings have been submitted to Contract Administrator.
 - .8 Application for occupancy permit has been initiated.
 - .9 Detailed listing of seasonal work and schedule for completion has been provided.
 - .10 Final cleaning including cleaning of air handling systems and ductwork.
- .3 Substantial Performance Review:
 - .1 Request Contract Administrator's review.
 - .2 Have initial operating and maintenance manuals on site for Substantial Performance review.
 - .3 Accompany Contract Administrator on Substantial Performance review to identify obvious defects or deficiencies and items requiring completion or correction.
 - .4 Upon completion of review, Contract Administrator will verify whether Substantial Performance has been achieved and advise the Contractor accordingly.
 - .5 Comply with Contract Administrator's instructions for correction of items of Work listed in closeout review report.
 - .6 Notify Contract Administrator of completion of items of Work determined in Contract Administrator's Substantial Performance review, and request review by Contract Administrator.
- .4 Declaration of Substantial Performance: When Contract Administrator considers defects and deficiencies have been corrected, and it appears requirements of Contract have been substantially performed, the Contract Administrator will determine the date of Substantial Performance of the Work, and issue a certificate of Substantial Performance.
- .2 Commencement of Warranty Periods: The date for the commencement of the warranty period shall be as set out in the Supplemental Conditions.
- .3 Commencement of Lien Periods: The date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.
- .4 Final Payment: When Contract Administrator considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.
- .5 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount, upon expiry of the lien period.

1.6 CLOSEOUT SUBMITTALS

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection with Contract Administrator's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four final copies of operating and maintenance manuals in Canadian English.
- .5 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.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective Products will be rejected, regardless of previous inspections. Replace Products at own expense.
- .8 Pay costs of transportation.

1.7 OPERATION AND MAINTENANCE MANUALS

- .1 Submission:
 - .1 Prepare operation and maintenance instructions and data using personnel experienced in maintenance and operation of described products.
 - .2 Two weeks before Substantial Performance of the Work, submit to the Contract Administrator, one initial copy of operating and maintenance manuals.
 - .3 Initial copy will be returned after Substantial Performance, with Contract Administrator's comments.
 - .4 Revise content of documents as required before final submittal.
 - .5 Should comments be extensive, the Contract Administrator may require the initial submission to be repeated before Substantial Performance.
 - .6 Two weeks prior to final inspection of the Work, submit to the Contract Administrator, one electronic copy and four final hard copies of operating and maintenance manuals in English.
- .2 Organize data in accordance with WCA/MAA Technical Bulletin #15, and as follows:
 - .1 Text:
 - .1 Hard copy: Manufacturer's printed data.
 - .2 Electronic copy: Provide electronic documents in accordance with requirements for electronic submissions in Section 01 33 00 – Submittal Procedures.
 - .2 Drawings:
 - .1 Hard copies: with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 - .2 Electronic: CAD and PDF copies of drawings in ledger size.
 - .3 Provide full size drawings in 1:1 scaled CAD files in dwg format on DVD, when size is not practical for inclusion as paper drawings.

- .3 Contents – Each Volume:
 - .1 Table of Contents: Include:
 - .1 Title of project.
 - .2 Date of submission.
 - .3 Names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
 - .5 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .2 Materials and Finishes:
 - .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .2 Include instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .3 Building Envelope: Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
 - .3 Each Item of Equipment and Each System:
 - .1 Include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 - .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
 - .3 Include installed colour coded wiring diagrams.
 - .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 - .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - .6 Provide servicing and lubrication schedule, and list of lubricants required.
 - .7 Include manufacturer's printed operation and maintenance instructions.
 - .8 Include sequence of operation by controls manufacturer.
 - .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - .10 Provide installed control diagrams by controls manufacturer.
 - .11 Provide Contractor's coordination Drawings, with installed colour-coded piping diagrams.
 - .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - .14 Include test and balancing reports.
 - .15 Additional requirements: As specified in individual specification sections.

- .4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .5 Warranties and bonds.
- .6 List of spare parts and maintenance materials.
- .7 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .8 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including pressure vessel acceptance, code compliance certificate, life safety systems performance certificate.
- .9 Training documentation: Refer to Section 01 79 00.

1.8 RECORDING ACTUAL SITE CONDITIONS – AS-BUILTS

- .1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Contract Administrator.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Maintain documents in clean, dry and legible condition. Do not use for construction purposes.
- .5 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.
- .6 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.
- .7 Other Documents: Maintain manufacturer's certifications, field test records, and inspection certifications, required by individual specifications sections.

1.9 RECORD DOCUMENTS

- .1 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of Drawing and specification files provided by the Contract Administrator, as follows:
 - .1 Drawings: AutoCAD 2000 or later.
 - .2 Specifications: Adobe Acrobat.
- .2 Mark revised documents as RECORD DOCUMENTS. Include all revisions.

- .3 Employ a competent computer drafts person to indicate changes on the electronic set of record drawings. Provide updated record drawings in Adobe Acrobat and AutoCAD 2000 or later.
- .4 Submit completed record documents to Contract Administrator on a DVD, accompanied by one hard copy set.

1.10 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 70 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.
- .2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.11 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 10 Business Days after completion of the applicable item of work.
- .4 Except for items put into use with Contract Administrator'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 submittals.

1.12 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

- .1 Package spare parts, maintenance materials, and special tools in suitable containers, labelled for maintenance use. Clearly identify contents of each package (eg. one mechanical seal and one pump casing gasket for pump P-1 located in Room 123). Include catalogue, serial or replacement number for each part.
- .2 Maintenance Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Operations and Maintenance Manual.
 - .4 Obtain receipt for delivered maintenance materials, and submit prior to final payment.
- .3 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Operations and Maintenance Manual.
 - .4 Obtain receipt for delivered spare parts, and submit prior to final payment.

- .4 Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Operations and Maintenance Manual.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of Products, equipment and systems to facility personnel.
- .2 Seminars and demonstrations.

1.2 RELATED REQUIREMENTS

- .1 Section 01 91 13 – General Commissioning (CX) Requirements.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DESCRIPTION

- .1 Demonstrate operation and maintenance of building systems and equipment to facility personnel two weeks prior to date of Substantial Performance.
- .2 Contract Administrator will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

- .1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
- .2 Instruct facility personnel, and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Contract Administrator's approval.
- .2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.6 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with:
 - .1 Section 08 42 29 – Automatic Entrances.
 - .2 Section 08 36 27 – Folding Bay Doors
 - .3 Section 22 05 00 – Common Work for Mechanical
 - .4 Section 22 42 01 – Plumbing Specialties
 - .5 Section 22 47 00 – Plumbing Equipment
 - .6 Section 23 05 93 – Testing, Adjusting, and Balancing
 - .7 Section 23 21 23 – HVAC Pumps
 - .8 Section 23 24 00 – Geothermal Ground Loop
 - .9 Section 23 34 39 – Ceiling Fans
 - .10 Section 23 52 16 – Boilers – Condensing
 - .11 Section 23 55 33 – Unit Heaters – Fuel Fired
 - .12 Section 23 81 40 – Water Source Heat Pumps

- .13 Section 25 30 00 – Instruments and Control Elements
- .14 Section 25 90 00 – Sequence of Operation
- .15 Section 26 05 00 – Electrical – Common Work Results.

- .2 Testing, adjusting, and balancing have been performed, and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that suitable conditions for demonstration and instructions are available.
- .2 Verify that designated personnel are present.
- .3 Prepare agendas and outlines.
- .4 Establish seminar organization.
- .5 Explain component design and operational philosophy and strategy.
- .6 Develop equipment presentations.
- .7 Present system demonstrations.
- .8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

- .1 Prepare agendas and outlines including the following:
 - .1 Equipment and systems to be included in seminar presentations.
 - .2 Name of companies and representatives presenting at seminars.
 - .3 Outline of each seminar's content.
 - .4 Time and date allocated to each system and item of equipment.
 - .5 Provide separate agenda for each system.

3.3 SEMINAR ORGANIZATION

- .1 Coordinate content and presentations for seminars.
- .2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.
- .3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
- .4 Coordinate proposed dates for seminars with Contract Administrator and select mutually agreeable dates.

3.4 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 the basis of instruction.
- .3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

3.5 TIME ALLOCATED FOR INSTRUCTION

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Section 08 42 29 – Automatic Entrances: two hours of instruction.
 - .2 Section 08 36 27 – Folding Bay Doors : two hours of instruction.
 - .3 Section 22 42 01 – Plumbing Specialties: 0.5 hours of instruction
 - .4 Section 22 47 00 – Plumbing Equipment : 0.5 hours of instruction
 - .5 Section 23 21 23 – HVAC Pumps: 0.5 hours of instruction
 - .6 Section 23 24 00 – Geothermal Ground Loop: 0.5 hours of instruction
 - .7 Section 23 34 39 – Ceiling Fans: 0.25 hours of instruction
 - .8 Section 23 52 16 – Boilers – Condensing: 0.5 hours of instruction
 - .9 Section 23 55 33 – Unit Heaters – Fuel Fired: 0.25 hours of instruction
 - .10 Section 23 81 40 – Water Source Heat Pumps: 1 hour of instruction
 - .11 Section 25 30 00 – Instruments and Control Elements: 0.5 hours of instruction
 - .12 Section 25 90 00 – Sequence of Operation: 0.5 hours of instruction

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to performance verification of components, equipment, sub-systems, systems, and integrated systems.
 - .2 Acronyms
 - .1 Cx - Commissioning
 - .2 CxA - Commissioning Authority
 - .3 BCxA – Building Envelope Commissioning Authority
 - .4 O&M - Operation and Maintenance
 - .5 CVF - Component Verification Form
 - .6 FT – Functional Test
 - .7 TAB - Testing, Adjusting, and Balancing

1.2 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 08 08 00 - Commissioning of Openings

1.3 DEFINITIONS

- .1 Commissioning: The process for achieving, verifying, and documenting that the facility and its systems are planned, designed, installed, and tested to ensure that they meet the original project requirements.
Commissioning Team:
 - .1 City Representative: Representative of the City.
 - .2 Commissioning Authority (CxA): Party engaged by the City to lead commissioning activities, and coordinate other team members.
 - .3 Building Envelope Commissioning Authority (BCxA): Party engaged by the City to lead building envelope commissioning activities, and coordinate other team members.
 - .4 Contract Administrator: Representatives of the design team, including the Architect and any discipline sub-consultants.
 - .5 Contractor: Representatives of the construction team, including the General Contractor and any sub-contractors and suppliers of equipment.

1.4 REFERENCE STANDARDS

- .1 ASHRAE Guideline 0-2019 - The Commissioning Process
- .2 ANSI/ASHRAE/IES Standard 202–2018 - Commissioning Process for Buildings and Systems

1.5 GENERAL

- .1 Commissioning is a formal, systematic process of ensuring that building systems perform interactively according to the design intent and the City's operational needs.

- .2 Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
 - .1 Applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted standards and they receive adequate operational checkout by installing contractors.
 - .2 Proper performance of equipment and systems is documented.
 - .3 O&M documentation left on site is complete.
 - .4 The City's operating personnel are adequately trained.
- .3 The Contractor is responsible for demonstrating equipment and systems, troubleshooting, and making adjustments as required to the satisfaction of the CxA.
 - .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 tested 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.

1.6 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, the Contractor shall correct deficiencies, re-verify equipment, and components within the non-functional system, including related systems as deemed required by the CxA and/or related design authority, to ensure effective performance.
- .2 Contractor costs for corrective work, additional tests, and inspections to ensure proper performance of such items to be borne by Contractor.
- .3 Contractor shall pay for CxA labour associated with excessive retesting of systems.

1.7 COORDINATION

- .1 The following are members of the commissioning team:
 - .1 The City Representative
 - .2 Commissioning Authority (CxA)
 - .3 Building Envelope Commissioning Authority (BCxA)
 - .4 Contract Administrator
 - .5 Contractor

1.8 CONFLICTS (BETWEEN SPECIFICATION SECTIONS)

- .1 Report conflicts between requirements of this section and other specification sections to the Contractor before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification (through RFI process) will result in application of the design authority's intent on the issue.

1.9 COMMISSIONING SCHEDULE

- .1 The Contractor will provide Cx schedule to CxA for review and comment.
- .2 The Contractor will provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Commissioning site visits
 - .2 Component verification completion
 - .3 Startup and pre-functional activities

- .4 Functional testing dates
 - .5 The City training
 - .6 Seasonal or deferred testing.
- .3 All parties are responsible to address scheduling problems and make necessary notifications in a timely manner to expedite the commissioning process.

1.10 SYSTEMS TO BE COMMISSIONED

- .1 The following systems will be commissioned for this project (if applicable):

Electrical

Lighting & Occupancy Control
Electrical Distribution Panels
Transformers
Diesel Generator
Transfer Switch
Duct Mounted Electric Heaters

Plumbing

Domestic hot water heaters
Storage Tank
Circulation pumps
Expansion tank
Sump Pumps

HVAC

Energy Recovery Ventilators
Make-up Air Units
Heat Pumps (Geothermal)
Boiler
Hydronic Pumps
Hydronic Coil
Heat Exchanger
Glycol Fill Station
Expansion Tanks
Air & Sediment Separator
Exhaust & Ceiling Fans
Condensing Unit
Unit Heaters
Range Hood
Motorized Dampers
Testing, Adjusting, and Balancing Work

Direct Digital Controls (DDC)

Central Building Automation System
Building Envelope (See Sections 07 08 00 and 08 08 00)

1.11 MEETINGS

- .1 Commissioning Kickoff Meeting. The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance.
- .2 Miscellaneous Meetings. Other meetings will be planned and conducted by the CxA at the discretion of the CxA as construction progresses. These meetings will cover coordination, deficiency resolution, and planning issues with particular Contractors.

1.12 SUBMITTALS (SHOP DRAWINGS)

- .1 The CxA requires submittal documentation for facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team.

- .2 These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them and provide feedback, where in the opinion of the CxA, correction is required. O&M manuals must be submitted in electronic (pdf) format.

1.13 COMPONENT VERIFICATION FORM CHECKLISTS AND INITIAL CHECKOUT

- .1 The following procedures apply to all equipment to be commissioned (see Section 1.7 for list of equipment and systems).
- .2 Component Verification Forms (CVF). CVF checklists document that the equipment and systems are installed as per the design intent and good practice. Component Verification Forms for a given system must be successfully completed prior to functional testing.
 - .1 CVFs will be developed in an electronic format (pdf) by the CxA and electronic copies will be provided to Contractors. Contractors are responsible to execute and document the CVF checklist on-site and return to the CxA for inclusion in the final report. The CxA will verify the installation and accuracy of the CVFs using an audit process.
 - .2 CVFs are used to track and document that the proper equipment has been specified, submitted, and installed. The forms capture typical maintenance information such as tag #, model, service, location, nameplate data, static submittal data, etc.
 - .3 A Sample CVF has been attached (Section 1.11) for bid purposes.
- .3 Issues identified during commissioning inspections will be documented by the CxA on the issue tracking log.
 - .1 Contractors shall respond to issues and ensure correction.

1.15 SYSTEM START-UP

- .1 Start-up Plan. The Contractor will provide a detailed startup plan for all commissioned equipment for review by the CxA.
- .2 The startup plan will include blank startup forms (provided by the manufacturer, or otherwise) for commissioned systems.
 - .1 The CxA may attend startups at their discretion to ensure that startup documentation and procedures are being followed as required.
 - .2 The Contractors and vendors shall execute start-up.
 - .3 Provide the CxA with a signed and dated copy of the completed start-up report.
- .3 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 checklists.
 - .4 Start-up reports.
 - .5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.
- .4 Submit required startup documentation including, but not limited to:
 - .1 Mechanical Systems
 - .1 Major equipment manufacturers startup reports (MUAs, Boilers, Heat Pumps, etc.).
 - .2 Piping pressure tests.
 - .3 Sprinkler verification reports.
 - .4 TAB report.
 - .2 Electrical Systems
 - .1 Electrical equipment test reports (megger tests, harmonic distortion testing).
 - .2 Generator start-up report and load test results.
 - .3 ATS start-up report.
 - .4 Low voltage lighting system test report.
 - .5 Fire Alarm verification report.
 - .3 Controls
 - .1 Control point end-to-end verification report.
 - .2 CO/NOx sensor calibration reports.

1.16 FUNCTIONAL TESTING

- .1 Refer to Section 1.7 for the list of systems to be commissioned.
- .2 Functional testing demonstrates that each system is operating according to the documented design intent and Contract documents. Each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part and full load). Verifying the sequences of operation is required for all modes. Proper responses to modes and conditions such as power failure, freeze conditions, fire alarm conditions, equipment failure, etc. may also be tested.
- .3 Functional Tests will be developed in an electronic format (pdf) by the CxA and electronic copies will be provided to Contractors.
- .4 The CVFs for a given system's equipment must be completed prior to the functional test.

- .5 The Contractors and/or vendors shall execute the functional tests as a pre-functional test to verify correct system operation and provide the CxA with a signed and dated copy of the completed tests prior to formal functional testing with the CxA present.
- .6 Issues identified during functional testing will be documented by the CxA on the issue tracking log.
 - .1 Contractors shall respond to issues and ensure correction.
- .7 A Sample functional test has been attached (Section 1.14) for bid purposes.

REMAINDER OF PAGE LEFT INTENTIONALLY BLANK

1.17 SAMPLE FUNCTIONAL TEST

Functional Testing for AHU-1, ERV-1 and Reheat

Line #	Test	Expectation	First Test Status	Re-Test Status	Completed By	Date
AHU-1.F01	System Off	BMS commands system off during unoccupied mode - unit dampers close to outdoor air, supply fan is off. Verify by operational check.				
AHU-1.F02	Startup	When in occupied mode, BMS commands dampers to full return position, supply fans starts. Verify by operational check and trends.				
AHU-1.F03	Occupancy Schedule	Verify schedule with Owner. <i>Occupied schedule should be same for ERV-1, except for morning warm up periods, tests below.</i>				
AHU-1.F04	Morning Warm Up/Cool Down	AHU will operate in a warm up/cool down mode to bring the space under temperature control prior to occupancy. AHU will operate on full return in this mode, with ERV-1 off.				
AHU-1.F05	Supply Air Temperature Control: Heating	Hydronic Heating coil and modulating valve heat supply air when called to control zone temperature. Verify by operational check and trends.				
AHU-1.F06	Supply Air Temperature Control: Free Cooling	When OAT allows, free cooling mode on the AHU is enabled to maintain supply temperature at setpoint. Outdoor air damper modulates open to control supply air temperature. This sequence is to be staged and integrated with ERV-1 free-cooling. Relief Damper to open during this mode. Verify by operational check and trends.				
AHU-1.F07	Supply Air Temperature Control: Hydronic Cooling	Hydronic Cooling coil and modulating valve cool supply air when called to control zone temperature. Verify by operational check and trends.				
AHU-1.F08	Zone Temperature Control	Verify that AHU adequately controls <i>average</i> zone temperature to setpoint, nominally 72°F (22°C), adjustable.				
AHU-1.F09	Zone Temperature Control: Unoccupied Mode	Verify that AHU adequately controls <i>average</i> zone temperature on fields to setpoint, nominally 78°F (25.5°C), adjustable, in cooling mode. Unoccupied heating mode setpoint to be 60°F (15.5°C), adjustable.				
AHU-1.F10	Graphics & Trends	Verify graphics indicate space temperature and setpoint, AHU enable status, AHU fan status and speed, heating/cooling valve positions, mixed air temperature, OA and return air enthalpy, supply temp SP, and supply air temperature. Trends to be enabled on all points.				

Functional Testing for AHU-1, ERV-1 and Reheat

Line #	Test	Expectation	First Test Status	Re-Test Status	Completed By	Date
AHU-1.F11	Alarms	BMS to alarm on: - supply fan failure (x2) - supply air temperature differential from setpoint - high filter differential pressure (nominal 0.7"wc, adjustable) - freezestat alarm with shutdown at 40°F (4.4°C), heating valve opens fully, requiring manual restart				
ERV-1.F01	System Off	BMS commands system off during unoccupied mode - unit dampers close to outdoor air, supply and exhaust fans are off. This includes morning warmup periods. Verify by operational check.				
ERV-1.F02	Startup	When in occupied mode, BMS commands dampers open, supply and exhaust fans start (constant speed fans). Verify by operational check and trends.				
ERV-1.F03	Supply Air Temperature Control: Free Cooling	When OAT allows, and in sequence with AHU-1 free cooling, free cooling mode on the ERV is enabled by BMS. Dampers remain fixed during this mode, switching only once every 3 hours.				
ERV-1.F04	Supply Air Temperature Control: Heat Recovery	When OAT allows, and in sequence with AHU-1, heat recovery mode on the ERV is enabled by BMS. Dampers operate routinely during this mode, reversing flow every 2 minutes. Verify by operational check and trends.				
ERV-1.F05	Graphics & Trends	Verify graphics indicate space temperature and humidity, ERV enable status, ERV mode command, supply and exhaust fan status, heating valve positions, supply temp SP, supply temperature, and exhaust air temperature.				
ERV-1.F06	Alarms	BMS to alarm on: - supply fan failure - exhaust fan failure - supply air temperature differential from setpoint - high filter differential pressure (nominal 0.7"wc, adjustable)				

1.18 SEVEN (7) DAY INTEGRATED SYSTEM TESTING

- .1 A 7-Day Integrated Systems Test will be completed to ensure proper building performance and operation. An additional test will be completed during seasonal testing.
- .2 General Acceptance requires that the systems operate as one entity as intended and that documentation is provided indicating such.
- .3 Issues identified during seven-day testing will be documented by the CxA on the issue tracking log.
 - .1 Contractors shall respond to issues and ensure correction.

1.19 DEFERRED/SEASONAL TESTING

- .1 Functional tests requiring specific environmental conditions (seasonal tests) will be deferred until after occupancy
- .2 The Contractors and/or vendors shall execute the deferred/seasonal tests as a pre-functional test to verify correct system operation and provide the CxA with a signed and dated copy of the completed tests prior to formal functional testing with the CxA present.
- .3 Issues identified during deferred/seasonal testing will be documented by the CxA on the issue tracking log.
 - .1 Contractors shall respond to issues and ensure correction.

1.20 ISSUE TRACKING LOG

- .1 Contractors shall respond to issues noted on the issue tracking log within 7 days indicating the corrective action taken.
- .2 CxA may request the contractor demonstrate successful resolution of items noted on the tracking log.

1.21 THE CITY TRAINING

- .1 The Contractor is responsible for training of O & M staff to ensure they have all information necessary to operate and maintain commissioned features and systems.
- .2 Submit a training plan and schedule to CxA for review.
- .3 Training plan will address the following topics (at a minimum)
 - .1 Design intent
 - .2 Use of Operations and Maintenance (O&M) Manuals
 - .3 Control Drawings and Schematics
 - .4 Startup and Shutdown
 - .5 Unoccupied operations
 - .6 Seasonal changeover
 - .7 Manual operations
 - .8 Alarms
 - .9 System interactions
 - .10 Energy conservation optimizations
 - .11 Health and safety
 - .12 Special maintenance or replacement
 - .13 Occupant interaction
 - .14 Systems response to operating conditions

- .15 Contractor shall document training exercises with attendance sheets and implementation of training surveys.
- .16 A training evaluation form has been attached (Section 1.19) for bid purposes.
- .4 Training is in accordance with ANSI/ASHRAE/IES Standard 202–2018, Commissioning Process for Buildings and Systems, and ASHRAE Guideline 0-2019, The Commissioning Process.

REMAINDER OF PAGE LEFT INTENTIONALLY BLANK

1.22 SAMPLE TRAINING EVALUATION FORM



Commissioning Project Management Services

420 – 70 Arthur St.
Winnipeg, MB, R3B 1G7
Tel: 204.669.6818
Fax: 204.944.1123
www.i-designs.ca

Sample Project Name

City, Province

Training Survey

Date:

Name:

Training Covered:

1. Was the Instructor familiar with the equipment? Yes No

2. Was the topic covered completely? Yes No

3. Were your questions answered? Yes No
(if No, list questions?)

4. Overall, are you satisfied? Yes No

Comments

1.23 SYSTEMS MANUAL

- .1 Contractor to provide the following documentation to the CxA for inclusion in the systems manual:
 - .1 As-built architectural drawings (electronic copy)
 - .2 As-built mechanical drawings (electronic copy)
 - .3 As-built electrical drawings (electronic copy)
 - .4 As-built controls drawings and cut sheets (electronic copy)
 - .5 Operations and Maintenance manuals (electronic copy)
 - .6 Occupancy permit.

1.24 AUTHORITIES HAVING JURISDICTION (I.E. GOVERNMENT AND UTILITY AUTHORITIES)

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for CxA 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 regulations of authority having jurisdiction.
- .3 Provide copies to Contract Administrator and CxA within 5 days of the test.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Building demolition excluding removal of hazardous materials and toxic substances.
- .2 Selective demolition of built site elements.
- .3 Abandonment and removal of existing utilities and utility structures.
- .4 Salvage of indicated items, including wood decking, glulam beams, and stone masonry from existing library building.

1.2 RELATED REQUIREMENTS

- .1 Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- .2 Section 01 53 00 - Temporary Construction: Site fences, security, protective barriers.
- .3 Section 01 61 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- .4 Sections 01 70 00 - Examination and Preparation, and 01 73 00 - Execution: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- .5 Section 01 74 00 - Cleaning and Waste Processing: Waste removal
- .6 Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- .7 Division 31 - Earthworkction 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.3 DEFINITIONS

- .1 Demolition: Rapid destruction of building following removal of hazardous materials.
- .2 Existing to remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- .3 Hazardous materials: Dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to asbestos PCBs, CFCs, HCFCs poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly.
- .4 Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
- .5 Remove and salvage: Carefully detach items from existing construction, in a manner to prevent damage. Store materials for reuse in the Work. Include fasteners or brackets needed for reattachment elsewhere. Deliver salvaged materials not scheduled for reuse to City.

1.4 REFERENCE STANDARDS

- .1 Transportation of Dangerous Goods Act - Transportation of Dangerous Goods Act 1992.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-demolition meeting: Conduct meeting at Project site. Convene meeting at least one week prior to beginning work of this Section to:
 - .1 Review and verify project requirements.
 - .2 Review structural load limitations of existing structures.
 - .3 Review and finalize demolition schedule.
 - .4 Review procedures for protection of adjacent buildings, components and finishes, site elements and landscaping to remain.
 - .5 Review items to be salvaged for re-use, and items to be turned over to City.
- .2 Coordination:
 - .1 Coordinate salvage of existing wood roof decking and glulam beams with subtrade responsible for repurposing decking and beams.

1.6 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Site plan: Showing:
 - .1 Vegetation and site elements to be protected.
 - .2 Areas for temporary construction and site offices.
- .3 Demolition plan: Submit demolition plan as specified by Manitoba Workplace Safety and Health Act and Regulation, and local authorities.
 - .1 Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - .2 Identify demolition firm and submit qualifications.
 - .3 Include a summary of safety procedures.
- .4 Submit list of items to be removed and salvaged before start of demolition.
- .5 Sustainable design submittals: Show evidence of compliance related to reuse of existing structures and materials.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Demolition firm qualification statement and claims history.
- .7 Project record documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.7 QUALITY ASSURANCE

- .1 Demolition firm qualifications: Company specializing in the type of work required.
 - .1 Submit evidence of experience, and claims history.

1.8 REGULATORY REQUIREMENTS

- .1 Manitoba Workplace Safety and Health Act and Regulation
- .2 Transport Canada:
 - .1 Transportation of Dangerous Goods Act.

Part 2 Products -- NOT USED

Part 3 Execution

3.1 SCOPE

- .1 Remove the entire existing library and fire station buildings designated on the Drawings.
- .2 Remove paving and curbs as indicated on Drawings.
- .3 Within area of new construction, remove foundation walls and footings to a minimum of 600 mm below finished grade.
- .4 Remove abandoned manholes and manhole covers, curb inlets and catch basins.
- .5 Remove other items indicated, for salvage, relocation, and recycling.
- .6 Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Division 31.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

- .1 Comply with other requirements specified in Division 01.
- .2 Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - .1 Obtain required permits.
 - .2 Use of explosives is not permitted.
 - .3 Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - .4 Provide, erect, and maintain temporary barriers and security devices.
 - .5 Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - .6 Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - .7 Do not close or obstruct roadways or sidewalks without permit.
 - .8 Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - .9 Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- .3 Do not begin removal until receipt of notification to proceed from City.
- .4 Do not begin removal until built elements to be salvaged or relocated have been removed.
 - .1 Remove existing roof decking scheduled to be salvaged under the supervision of the subtrade responsible for repurposing decking as soffit and cladding material.
 - .2 Remove existing glulam beams scheduled to be salvaged under the supervision of the subtrade responsible for repurposing glulam beams for dining table.
 - .3 Remove existing stone masonry scheduled to be salvaged under the supervision of the subtrade responsible for repurposing stone masonry in hardscape landscaping.

- .4 Store materials for reuse in the Work, or turn over to subtrade responsible for repurposing or reinstallation.
- .5 Deliver salvaged materials not scheduled for reuse to City.
- .5 Do not begin removal until vegetation to be relocated has been removed, and specified measures have been taken to protect vegetation to remain.
- .6 Protect existing structures and other elements that are not to be removed.
 - .1 Provide bracing and shoring.
 - .2 Prevent movement or settlement of adjacent structures.
 - .3 Stop work immediately if adjacent structures appear to be in danger.
- .7 Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- .8 If hazardous materials are discovered during removal operations, stop work and notify Contract Administrator and City; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- .9 Perform demolition in a manner that maximizes salvage and recycling of materials.
 - .1 Comply with requirements of Section 01 74 19 - Construction Waste Management and Disposal.
 - .2 Dismantle existing construction and separate materials.
 - .3 Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.3 EXISTING UTILITIES

- .1 Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- .2 Protect existing utilities to remain from damage.
- .3 Do not disrupt public utilities without permit from authority having jurisdiction.
- .4 Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to City.
- .5 Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to City.
- .6 Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- .7 Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- .8 Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.4 DEBRIS AND WASTE REMOVAL

- .1 Remove debris, junk, and trash from site.
- .2 Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19.
- .3 Leave site in clean condition, ready for subsequent work.

- .4 Clean up spillage and wind-blown debris from public and private lands.

3.5 SCHEDULE - ITEMS TO BE SALVAGED

- .1 Salvage the following from the Windsor Park Library:
 - .1 Wood decking at roof assembly. Refer to Section 06 20 00 - Finish Carpentry for scope of work to re-use material.
 - .2 Glue laminated wood beams: Quantity as required for new kitchen table. Refer to A901 Millwork for scope and Section 06 41 00 - Architectural Wood Casework for work to re-use materials.
 - .3 Broken ashlar granite at exterior cladding: Quantity as required for areas indicated in the landscape. Refer to landscape drawing L-101 Materials Plan for extent.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following work:
 - .1 Removing asbestos-containing mastic material or other non-friable material, provided removal is completed without material being broken, cut, drilled, abraded, ground, sanded or vibrated.

1.2 REFERENCE STANDARDS

- .1 Manitoba Workplace Safety and Health, MR 217/2006
- .2 Safe Work Manitoba, Guide for Asbestos Management (Nov 2020)
- .3 CSA Z94.4-11, Selection, Use, and Care of Respirators
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .2 SOR/2018-196 Prohibition of Asbestos and Products Containing Asbestos Regulations.
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 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 Amended Water: water with nonionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.
- .3 Asbestos-Containing Materials (ACMs): materials that contain 0.1 per cent or more asbestos by dry weight for friable materials or contain 1 per cent or greater for non-friable materials and are identified under Existing Conditions including fallen materials and settled dust.
- .4 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.
- .5 Authorized Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.
- .6 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 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.
- .7 Friable material: means material that:
 - .1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
 - .2 is crumbled, pulverized or powdered.
- .8 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure. Roof-top mastics and sealants are considered non-friable.

- .9 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.
- .10 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.
- .11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proof satisfactory to Consultant that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit proof of Contractor's Asbestos Liability Insurance.
- .4 Submit to Consultant necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.
- .5 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
- .6 Submit proof satisfactory to Consultant that employees have respirator fitting and testing. Workers must be fit tested with respirator that is personally issued.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Approved list of pre-qualified abatement contractors by the City of Winnipeg:
 - .1 Advance Robotic Duct Cleaning Inc., 341 Stanley Street, Winnipeg, MB R3A 1S7
 - .2 Winnipeg Building & Decorating Ltd, 1586 Wall Street, Winnipeg, MB R3E 2S4.
 - .3 Western Waste Management Ltd., 301B DeBaets Street, Winnipeg, MB R2J 4A8
 - .4 Kepsco Construction Management Ltd., 308 RPO Corydon Ave, Winnipeg, MB R2M 3S7
 - .5 Paragon Industries Ltd., 1042 Oxford Street, Sunnyside, MB R5R 0H9
 - .6 Power Vac Services Ltd., 1355 Border Street, Winnipeg, MB R3H 0N1
 - .7 Priority Restoration Services Ltd., 1300 Church Ave, Winnipeg MB R2X 1G4
 - .8 True North Waste Management Ltd., 1131 Notre Dame Avenue, Winnipeg, MB R3E 0N4
 - .9 Breathe Easy Eco Solutions 380 Dupuy Ave., Winnipeg, MB R2J 0T4
- .2 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 time Work is performed.
- .3 Health and Safety:
 - .1 Safety Requirements: worker protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

- .2 Minimum half-face air-purifying respirator fitted with HEPA (P100) cartridges.
- .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 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.
- .6 Ensure workers wash hands and face when leaving Asbestos Work Area.
- .7 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .2 Third party air testing: A third party air quality control testing agent will be hired by The City. Work of this contract must include provisions for coordinating air quality control testing.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .4 Fold up metal banding, flatten and place in designated area for recycling.
- .5 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations.
- .6 Dispose of asbestos waste by placing into 6-mil labeled asbestos waste bag and sealing, then placing sealed bag into a second 6-mil labeled asbestos waste bag and sealing. Outer bag must be yellow.
- .7 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are available in the Pre-Demolition Asbestos Survey Reports dated November 29, 2022.
- .2 The black mastics/sealants applied to roof-top exhaust chimney at the north end of the roof and some mastic/caulking around a utility access were confirmed as non-friable ACM.
- .3 Notify Consultant of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Consultant.

1.8 SCHEDULING

- .1 Hours of Work: perform work involving during normal working hours, or as otherwise planned.

1.9 PERSONNEL TRAINING

- .1 Before beginning Work, provide Consultant satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by a competent, qualified person.

Part 2 Products

2.1 MATERIALS

- .1 Drop 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 a 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 waste bag.
 - .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 pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .5 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

Part 3 Execution

3.1 PROCEDURES

- .1 Work will be completed based on Type 1 (low risk) asbestos work as defined in Safe Work Manitoba Guide for Asbestos Management.
- .2 Ensure roof top equipment has been shut off and isolated, as needed.

- .3 Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.
 - .1 Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.
 - .2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
 - .3 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 the roof in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.
- .5 Cut and remove the exterior mastic/sealant/putty materials as identified in survey reports that contain asbestos using hand tools, including mastic on roof vent and utility connection for 955 Cottonwood, and around east side vent for 1083 Autumnwood.
- .6 Immediately place removed Asbestos Containing Material into Asbestos Waste Bags.
- .7 Ensure that all ACM is removed if equipment is to be set aside for regular waste disposal or reuse. If ACM mastic cannot be removed from metal or other material, the equipment with ACM applied should be disposed of as asbestos waste.
- .8 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.
 - .1 Use garden reservoir type low - velocity fine - mist sprayer.
 - .2 Perform Work to reduce dust creation to lowest levels practicable.
 - .3 Work will be subject to visual inspection.
 - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .9 Frequently and at regular intervals during Work and immediately on completion of work:
 - .1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and
 - .2 Drop sheets to be wetted and placed in a waste container as soon as practicable.
- .10 Cleanup:
 - .1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.
 - .2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.
 - .3 Seal waste bags and remove 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 the appropriate guidelines and regulations for asbestos disposal are followed.
 - .4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Removal or disturbance as specified of more than one square metre of friable asbestos containing material during the repair, alteration, maintenance or demolition of a building or any machinery or equipment located in the buildings located at 955 Cottonwood Road and 1083 Autumnwood Drive.
 - .2 The spray application of a sealant to friable asbestos containing material.
 - .3 Cleaning or removing air handling equipment, including rigid ducting but not including filters, in a building that has asbestos containing sprayed fireproofing.
 - .4 Repairing, altering or demolishing all or part of a kiln, metallurgical furnace or similar structure that is made in part of refractory materials that are asbestos containing materials.
 - .5 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos containing material, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.
 - .6 Repairing, altering or demolishing all or part of any building in which asbestos is or was used in the manufacture of products.

1.2 REFERENCE STANDARDS

- .1 Manitoba Workplace Safety and Health Regulations, MR 217/2006
- .2 Safe Work Manitoba, Guide for Asbestos Management (Nov 2020)
- .3 CSA Z94.4-11, Selection, Use, and Care of Respirators
- .4 Department of Justice Canada (Jus)
 - .1 SOR/2018-196 Prohibition of Asbestos and Products Containing Asbestos Regulations.
- .5 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.205-[94], Sealer for Application to Asbestos-Fibre-Releasing Materials.
- .6 Department of Justice Canada
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 WHMIS Safety Data Sheets (SDS).
- .8 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .9 Underwriters' Laboratories of Canada (ULC)
- .10 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH 7400 [Issue 3, June 2019], NIOSH Manual of Analytical Methods (NMAM), 4th Edition.

- .2 NIOSH 7402 [Issue 2, August 1994], NIOSH Manual of Analytical Methods (NMAM), 4th Edition.

1.3 DEFINITIONS

- .1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.
- .2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .3 Asbestos Containing Materials (ACMs): for friable materials, any material that contains 0.1 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust. For non-friable materials, any material that contains 1 per cent or more asbestos by weight.
- .4 Asbestos Work Areas: area where work takes place which will, or may disturb ACMs.
- .5 Authorized Visitors: Engineers, consultants or designated representatives, and representatives of regulatory agencies.
- .6 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 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.
- .7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:
- .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
 - .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.
 - .3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.
- .8 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) or poly-alpha olefins (PAO) HEPA-filter leak test.
- .9 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.
- .10 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.
- .11 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

- .12 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.
 - .1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.
- .13 Non-Friable Materials: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .14 Occupied Areas: any area of building or work site that is outside Asbestos Work Area.
- .15 Polyethylene sheeting sealed with tape: polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.
- .16 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Before beginning work:
 - .1 Submit proof satisfactory to Consultant that all asbestos workers have received appropriate training and education by a competent person on 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. Submit proof of attendance in form of certificate.
 - .2 Ensure supervisory personnel have attended asbestos abatement worker training course(s) that are specific for the Province of Manitoba. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.
 - .3 Submit layout of proposed enclosures and decontamination facilities to Consultant for review.
 - .4 Submit Provincial/Territorial and/or local requirements for Notice of Project form. For Manitoba, advance notice to Workplace Safety and Health must be provided five days prior to start of the abatement work.
 - .5 Submit proof of Contractor's Asbestos Liability Insurance.
 - .6 Submit proof satisfactory to Consultant that employees have respirator fitting and testing. Workers must be fit tested with respirator that is personally issued. Submit records and ensure fit testing has been completed within the last two years.
 - .7 Submit Worker's Compensation Board status and transcription of insurance.
 - .8 Submit documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including but not limited to following:
 - .1 Encapsulants.
 - .2 Amended water.
 - .3 Slow drying sealer.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Approved list of pre-qualified abatement contractors by the City of Winnipeg:
 - .1 Advance Robotic Duct Cleaning Inc., 341 Stanley Street, Winnipeg, MB R3A 1S7
 - .2 Winnipeg Building & Decorating Ltd, 1586 Wall Street, Winnipeg, MB R3E 2S4.
 - .3 Western Waste Management Ltd., 301B DeBaets Street, Winnipeg, MB R2J 4A8
 - .4 Kepsco Construction Management Ltd., 308 RPO Corydon Ave, Winnipeg, MB R2M 3S7
 - .5 Paragon Industries Ltd., 1042 Oxford Street, Sunnyside, MB R5R 0H9
 - .6 Power Vac Services Ltd., 1355 Border Street, Winnipeg, MB R3H 0N1
 - .7 Priority Restoration Services Ltd., 1300 Church Ave, Winnipeg MB R2X 1G4
 - .8 True North Waste Management Ltd., 1131 Notre Dame Avenue, Winnipeg, MB R3E 0N4
 - .10 R3E 0N4
 - .11 Breathe Easy Eco Solutions 380 Dupuy Ave., Winnipeg, MB R2J 0T4
- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
 - .1 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
 - .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
 - .3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures before commencing actual asbestos abatement.
 - .4 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
 - .5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
 - .6 Visitor Protection
 - .12 Third party air testing: A third party air quality control testing agent will be hired by The City. Work of this contract must include provisions for coordination air quality control testing.

.2

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal any non-asbestos-containing paper, plastic, polystyrene or corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 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 mils bags or leak proof drums. Label containers with appropriate warning labels. All containers of asbestos waste must be labeled in accordance with Part 35 of the Manitoba Workplace Safety and Health Regulation.

- .7 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Results of tests of asbestos containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are described in the Pre-Demolition Asbestos Survey Reports dated November 29, 2022.
- .2 Notify Consultant of suspect asbestos containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Consultant.

1.8 SCHEDULING

- .1 Notify Manitoba Workplace Safety and Health at least five (5) days before beginning asbestos-related Work on this Project.
- .2 Inform sub-trades of presence of asbestos containing materials identified in Existing Conditions.
- .3 Submit to Consultant a copy of the notification to WSH before start of Work.

1.9 PERSONNEL TRAINING

- .1 Before beginning Work, provide to Consultant satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing. Training must be based on Manitoba regulations and guideline documents, including specific training on Type 3 (High Risk) asbestos work, as defined within the guideline document.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Proper fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

Part 2 Products

2.1 MATERIALS

- .1 Polyethylene: minimum 0.15 mm (6 mil) thick unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: minimum 0.15 mm (6 mil) thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

- .4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by Consultant, mixed with water in concentration to provide adequate penetration and wetting of asbestos containing material.
- .5 Waste Containers: contain waste in two separate containers.
 - .1 Inner container: 0.15 mm (6 mil) thick sealable polyethylene bag [or where glove bag method is used, glove bag itself]. Bags must be labelled with asbestos waste information.
 - .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. Label containers in accordance with Manitoba Guide for Asbestos Management. Label in both official languages.
- .6 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.
- .7 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .8 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.

Part 3 Execution

3.1 PREPARATION

- .1 Work Areas:
 - .1 For the building at 955 Cottonwood Rd, the removal of friable asbestos-containing materials will generally be completed following Type 3 (High Risk) asbestos work procedures as defined in the Manitoba guideline document.
 - .1 ACM including drywall joint compound are present throughout all areas and work area for pre-demolition abatements will encompass the whole building. Gowning chambers constructed immediately within main front entrance.
 - .2 All ACM identified for the interior including non-friable materials should be removed at the same time. Removal of exterior non-friable ACM will be completed using (Type 1) Low Risk procedures.

- .3 All ACM identified must be completely removed from the building or structure.
- .2 For the building at 1083 Autumnwood Dr, the removal of friable asbestos-containing materials will generally be completed following Type 3 (High Risk) asbestos work procedures as defined in the Manitoba guideline document.
 - .1 ACM drywall joint compound and floor tiles are present for upper floors; work area is limited to the upper floors and gowning chambers access work area can be built in or around the central stairway.
 - .2 Removal of exterior non-friable ACM will be completed using (Type 1) Low Risk procedures.
 - .3 All ACM identified must be completely removed from the building or structure.
- .3 Before construction of decontamination unit, remove moveable objects and furniture from the Work Area. Any equipment or materials
- .4 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.
- .5 Preclean moveable equipment or furniture within proposed work areas using HEPA vacuum and remove from work area to an appropriate location.
- .6 Preclean fixed casework, plant, and equipment within proposed work area, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
- .7 Clean proposed work area using, where practicable, HEPA vacuum cleaning equipment. 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 equipment.
- .8 The spread of dust from the work area to be prevented by:
 - .1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.
 - .2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each chamber within the decontamination unit constructed at the entrance to the work area.
- .9 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 0.02 inches [5 Pa] of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.
- .10 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
- .11 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.
- .12 Build airlocks (decontamination unit) at entrances to and exits from work area[s] so that work area[s] are always closed off by one curtained doorway when workers enter or exit.

- .13 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)". Other suitable signage intended for use with asbestos abatements to restrict unauthorized access is considered equivalent.
 - .14 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Consultant. Use localized water spraying during fixture removal to reduce fibre dispersal.
 - .15 Maintain emergency and fire exits from work area[s], or establish alternative exits satisfactory to Authority having jurisdiction.
 - .16 Where application of water is required for wetting asbestos containing materials, shut off electrical power, 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.
 - .17 After preparation of work area and Decontamination Enclosure Systems, remove the asbestos-containing materials as described in project plans. Dispose of all materials as contaminated waste in specified containers (double-bagged in 6-mil asbestos bags; outer bag must be yellow) with asbestos labelling. Spray asbestos debris and immediate work area with amended water to reduce dust, as work progresses.
 - .18 After preparation of work area and Decontamination Enclosure Systems, for the removal of all other asbestos containing materials, remove within work area and dispose of as contaminated waste in specified containers. Spray asbestos debris and immediate work area with amended water to reduce dust, as work progresses.
- .2 Worker Decontamination Enclosure System:
- .1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:
 - .1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work area, with two curtained doorways, one to Shower Room and one to work area. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.
 - .2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Consultant before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.
 - .3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide hooks or hangers 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.

- .3 Container and Equipment Decontamination Enclosure System:
 - .1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable. If waste generated and other materials can safely and effectively be removed from containment using Worker Decontamination System, then separate decontamination chambers for waste are not needed.
 - .1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.
 - .2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.
 - .3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.
 - .4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.
- .4 Construction of Decontamination Enclosures:
 - .1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors, each sealed to the floor independently.
 - .2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .5 Maintenance of Enclosures:
 - .1 Maintain enclosures in tidy condition.
 - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
 - .3 Visually inspect enclosures at beginning and end of each working shift, unless there is a shift starting immediately.
 - .4 Visually inspect the enclosure on each day if no work is occurring, including weekends and holidays.
 - .5 Use visual evaluations and differential pressure monitors to evaluate the effectiveness of barriers when directed by Consultant.
- .6 Do not begin Asbestos Abatement work until:
 - .1 Arrangements have been made for disposal of waste.
 - .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.

- .3 Work area[s] and decontamination enclosures [and parts of building required to remain in use] are effectively segregated.
- .4 Negative Air Machine for the abatement has exhaust air directed to the outdoors, with the use of wire reinforced exhaust tubing.
- .5 Tools, equipment, and materials waste containers are on hand.
- .6 Arrangements have been made for building security, including security concerns related to the point of exhaust for Negative Air Machine.
- .7 Warning signs are displayed where access to contaminated areas is possible.
- .8 Notifications have been completed and other preparatory steps have been taken.

3.2 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.

3.3 ASBESTOS REMOVAL

- .1 All workers entering the Asbestos Work Area (enclosure) must wear protective clothing (e.g., Tyvek suits) that covers feet and includes a hood, and must wear a powered air-purifying respirator with P100 (HEPA) filters. Gloves and other PPE may also be needed.
- .2 Before removing asbestos:
 - .1 Prepare site and ensure all requirements have been met.
 - .2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .3 Remove saturated asbestos material in small sections; continue wetting material as needed. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic 6-mil bags and set aside in staging area for double-bagging.
- .4 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 (or chamber adjacent to Work Area). Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .5 After completion of stripping work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .6 After wire brushing and wet sponging to remove visible asbestos, and after encapsulating asbestos containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in process. After inspection by Consultant apply continuous coat of slow drying sealer to unfinished surfaces within the work area, including polyethylene sheeting. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.
- .7 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.

- .8 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 and sealed waste bag using damp cloths or HEPA vacuum and place in second clean waste bag, and seal the outer 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.

3.4 FINAL CLEANUP

- .1 Following final cleaning steps, and when air sampling shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by PCM microscopy method at 400X magnification phase contrast illumination, as described in NIOSH Method 7400 or equivalent, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.
- .5 Include in 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 that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.
- .7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.5 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- .1 When cleanup is complete:
 - .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.
 - .2 Re-secure mounted objects removed in course of Work in their former positions.

- .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
- .4 Repair or replace objects damaged in the course of Work, as directed by Consultant.

3.6 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Consultant to take air samples on daily basis or as needed based on work schedule outside of work area enclosure in accordance with Health Canada recommendations.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
 - .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
 - .2 Without personal monitoring samples, full-face powered air-purifying respirators with P100 filters must be used by all workers.
 - .3 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas.
- .3 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Consultant will perform air monitoring within Asbestos Work Area by aggressive methods.
 - .1 Final air monitoring results must show fibre levels of not more than 0.01 f/cc.
 - .2 Final air monitoring samples must have a total minimum volume sampled of 3,850 L.
 - .3 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
 - .4 Repeat as necessary until fibre levels are not more than 0.01 f/cc.
 - .5 Additional confirmatory testing using Transmission Electron Microscopy according to NIOSH 7402 or equivalent may also be used to evaluate air samples.

3.7 INSPECTION

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviation[s] from these requirements that have not been approved in writing by Consultant may result in Work stoppage, at no cost to the City.
- .2 Consultant 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 asbestos leakage from Asbestos Work Area has occurred or is likely to occur Consultant may order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 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, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121-2008, Douglas Fir Plywood.
 - .3 CSA O151-09, Canadian Softwood Plywood.
 - .4 CSA O153-M1980(R2008), Poplar Plywood.
 - .5 CSA-O325-07, Construction Sheathing.
 - .6 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .7 CSA-O86-09, Engineering Design in Wood.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Upon request Submit drawings stamped and signed by professional Contract Administrator registered or licensed in Province of Manitoba, Canada.
- .3 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. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Pan forms: removable steel, or reinforced plastic to match existing profiles and dimensions.
- .3 Tubular column forms: round, internally treated with release material.
 - .1 Spiral pattern may show in hardened concrete, except where column is designated architectural finish, where it shall not show in hardened concrete.
- .4 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.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .5 Form liner:
 - .1 Plywood: high density overlay.
- .6 Form release agent: non-toxic, biodegradable, low VOC.
- .7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .8 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Refer to drawings for concrete members requiring architectural exposed finishes.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 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.
- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

- .10 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .12 Line forms for following surfaces:
 - .1 Surfaces designated as architectural finish.
 - .2 Secure lining taut to formwork to prevent folds.
 - .3 Pull down lining over edges of formwork panels.
 - .4 Ensure lining is new and not reused material.
 - .5 Ensure lining is dry and free of oil when concrete is poured.
 - .6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
 - .8 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 RESHORING

- .1 Notify Contract Administrator 24 hours in advance prior to removing formwork.
- .2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Grade Beams	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs *	7 days	7 days	14 days
Beams *	7 days	7 days	14 days
Structural Shoring *	7 days	7 days	14 days

* formwork below/supporting these elements shall remain in place for the minimums stated above and then replaced with shoring posts until concrete is 28 days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required 28 day strength.

- .4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.
- .5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.

- .6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 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, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .3 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .5 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in kilograms of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated.
- .2 No measurement will be made under this Section.
 - .1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.

- .2 Lists.
- .3 Quantities of reinforcement.
- .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.
- .5 Indicate sizes, spacings 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 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

Part 2 Products

2.1 MATERIALS

- .1 Provide products containing recycled content.
- .2 Substitute different size bars only if permitted in writing by Contract Administrator.
- .3 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .4 Cold drawn annealed steel wire ties: to ASTM A82.
- .5 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.
- .6 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .7 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .9 Mechanical splices: subject to approval of Contract Administrator.
- .10 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted
- .3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.

- .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .5 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 Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

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

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete where noted on the drawings.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy coated portions of bars with covering during transportation and handling.

3.3 DOWELING PROCEDURES

- .1 For bars that are indicated as being dowelled in, drill in and epoxy grout bars as follows:
 - .1 10M bars, 200 mm
 - .2 15M bars, 250 mm
 - .3 20M bars, 350 mm
 - .4 25M bars, 400 mm
- .2 Use only approved adhesive to manufacturer's instructions. Acceptable product:
 - .1 Hilti HIT HY-150 MAX/HIT-ICE by Hilti Canada.

- .3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

3.4 FIELD TOUCH-UP

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.
- .3 Section 03 35 11 – Concrete Floor Finishes

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C250M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 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-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-13, Cementitious Materials.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Certificates:
 - .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by a Contract Administrator registered in the Province of Manitoba.
 - .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by a Contract Administrator registered in the Province of Manitoba.
- .3 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.

- .4 Concrete hauling time: submit for review by Contract Administrator deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .1 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.
 - .1 .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Contract Administrator, minimum 4 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 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:
 - .1 Hot weather concrete.
 - .2 Cold weather concrete.
 - .3 Curing.
 - .4 Finishes.
 - .5 Formwork removal.
 - .6 Joints.

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 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

- .1 Provide products containing recycled content.
- .2 The concrete constituents shall comply with the following standards:
 - .1 Cement: to CAN/CSA-A3001.
 - .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. Coarse aggregates to be normal density.
- .6 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 CONCRETE MIX REQUIREMENTS

- .1 Refer to General Notes on Drawings for concrete mix requirements.

2.3 ACCESSORIES

- .1 Evaporation retardant: Acceptable Product:
 - .1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 MasterKure CC, formerly (Kure-N-Seal) by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34 [unless otherwise noted on Drawings].
- .4 Grout: Portland Cement based non-shrink, non-metallic composition and shall meet the following requirements:
 - .1 The grout shall not exhibit bleeding or segregation at pumpable consistency.
 - .2 Compressive Strength: 25 MPa @ 1 day.
 - .3 Bond Strength (ASTM C882) 13 MPa @ 28 days.
 - .4 Positive expansion confirmed by ASTM C827.
 - .5 The grout shall not produce a vapour barrier.
 - .6 Acceptable products are one of the following only
 - .1 Sika Grout 212 by Sika Canada Inc.
 - .2 Sternson M-Bed Standard by Sternson Construction Products.
- .5 Non premixed dry pack grout: composition of non metallic aggregate Type GU cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of [25] MPa at [28] days.
- .6 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - .2 Sponge rubber: to ASTM D1752, Type I, [flexible] [firm] grade.
- .7 Stair Nosings:
 - .1 Stair Nosings: Extruded aluminum base; Proprietary, slip-resistant epoxy abrasive. 50mm width. Continuous extruded, no exposed fasteners.
 - .2 Products: Balco P-200, Length: width of stair. Extend nosing to the outside face of each handrail.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete.
 - .1 Provide minimum 24 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 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .5 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Protect previous Work from staining.
- .7 Clean and remove stains prior to application for concrete finishes.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Do not place load upon new concrete until authorized by Contract Administrator.
- .10 Stair Nosings: Install nosings before initial set of concrete. Puddle concrete and tamp nosings in place. Protect stairs and nosings from traffic for minimum 24 hours. Protect nosings from construction traffic until Substantial Completion.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Concrete floors to receive densified concrete floor finish will be installed to meet Floor Flatness (FF) rating of 40 and Floor Levelness (FL) rating of 30 in accordance with CSA A23.1/A23.2. Refer to Section 03 35 11 – Concrete Floor Finishes.
- .3 Provide power-trowel burnished finish to surfaces that will receive seamless flooring, porcelain tile, and for surfaces scheduled to be receive concrete sealer or densifier.
- .4 In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains.
- .5 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 Contract Administrator.
 - .2 Where approved by Contract Administrator, 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 Contract Administrator.

- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator 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.
- .6 Anchor bolts:
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with [shrinkage compensating grout] [chemical grout].
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .7 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .8 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .9 Finishing:
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Use curing methods compatible with applied finish on concrete surfaces.
- .10 Curing:
 - .1 Cure and protect concrete in accordance with requirements CSA A23.1.
 - .2 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. See General Notes on structural drawing for Class of Exposure.
- .11 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 Contract Administrator.
- .12 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator.
 - .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] [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.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contract Administrator for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .2 Frequency and Number of Tests:
 - .1 Concrete Tests:
 - .1 Not less than one strength test per 50 cubic metres of concrete placed and not less than one test for each class of concrete placed on any one day.
 - .2 Air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.
- .3 Contract Administrator may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.4 DEFECTIVE CONCRETE

- .1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.
- .4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.
- .5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.
- .6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Surface treatments for concrete floors and slabs, referred to in Section 09 06 00 - Finish Schedule as "CONC-D" and "CONC-S".

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- .3 Section 03 35 30 - Bonded Concrete Overlays: Finishing of concrete toppings to tolerance, curing.

1.3 REFERENCE STANDARDS

- .1 CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate the work with concrete floor placement and concrete floor curing.
 - .2 No satisfactory chemical or cleaning procedure is available to remove petroleum stains from concrete surface. Ensure the following prevention measures are taken:
 - .1 Diaper hydraulic powered equipment to avoid concrete staining.
 - .2 Prohibit vehicle parking on concrete surfaces to be polished.
 - .3 Prohibit pipe cutting operations on concrete surfaces to be polished.
 - .4 Prohibit storage of items over concrete surfaces to be polished for minimum 28 days after concrete placement.
 - .5 Prohibit storage of ferrous metals on concrete surfaces to be polished.
 - .6 Do not allow acids and acidic detergents to come into contact with concrete surfaces to be polished.
 - .7 Protect concrete surfaces to be polished from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment.
 - .8 Inform trades that slab must be continuously protected in accordance with manufacturer's instructions.
- .3 Pre-installation meeting:
 - .1 Conduct meeting at project site to comply with requirements in Division 01.
 - .2 Conduct meeting before placing concrete to discuss concrete placing requirements, including tolerances and flatness, with respect to polished concrete floor finishes.
 - .3 Meeting attendees to include: Concrete producer, concrete placer, concrete finisher, manufacturer's representative of liquid applied densifier, City, Contract Administrator, and Contractor.

- .4 Meeting agenda shall include, but not be limited to:
 - .1 Discussion and evaluation of substrate conditions, surface preparations, sequence of procedures, and other preparatory work.
 - .2 Protecting concrete floor surfaces until polishing work begins.
 - .3 Details of each step of grinding, honing, and polishing operations.
 - .4 Application of liquid applied products.
 - .5 Protecting polished concrete floors after polishing work is complete.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- .3 Sustainable design submittals: Submit evidence of compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Installer qualification statement.
- .5 Maintenance data: Provide data on maintenance and renewal of applied finishes.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications:
 - .1 Minimum 10 projects performed within three years of similar type, size and complexity, with adequate number of skilled workers who are thoroughly trained and experienced.
 - .2 Familiar with specified requirements and methods needed for proper performance of work of this Section.
 - .3 Approved or certified by concrete densifier manufacturer.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control for additional requirements.
- .2 Construct mock-up of densified concrete under conditions similar to those that will exist during application, using same personnel who will perform the work, to demonstrate surface finish, colour variations and to determine an acceptable level of workmanship.
- .3 Mock-up size: Two, 3 m square, on both main and second floors.
- .4 Locate where directed.
- .5 Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in manufacturer's sealed packaging, including application instructions.

1.9 SITE CONDITIONS

- .1 Maintain light level equivalent to a minimum 200 W light source at 2.5 m above the floor surface over each 6 m square area of floor being finished.

- .2 Do not finish floors until interior heating system is operational.
- .3 Maintain ambient temperature of 10 degrees C minimum.

Part 2 Products

2.1 PERFORMANCE CRITERIA

- .1 Room perimeter and field areas: Same level of finish.

2.2 DENSIFIERS AND HARDENERS - CONC-D

- .1 Liquid densifier/hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
 - .1 Composition: Sodium- or lithium silicate.
 - .2 Maximum VOC content: In accordance with Section 01 61 16.
 - .3 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.
- .2 Sealer/enhancer: Non-film forming, stain- and soil-inhibitor, penetrating sealer as recommended by densifier manufacturer, and compatible with densifier.
 - .1 Maximum VOC content: In accordance with Section 01 61 16.
 - .2 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.
- .3 Control joint filler: Two-component, semi-rigid self-levelling polyurea joint filler, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - .1 Durometer hardness, Type A: 80, minimum, after seven days when tested in accordance with ASTM D2240.
 - .2 Colour: To be selected by Contract Administrator from manufacturer's standard colours. Joint width, minimum: 3 mm.
 - .3 Joint width, maximum: 6 mm.
 - .4 Joint depth: Provide product suitable for joints up to 50 mm, or in accordance with manufacturer's instructions.
 - .5 Maximum VOC content: In accordance with Section 01 61 16.
 - .6 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.

2.3 COATINGS

- .1 Low gloss clear coating - CONC-S: Transparent, non-yellowing, water-based coating.
 - .1 Composition: Acrylic polymer-based.
 - .2 Non-volatile content: 25 percent, minimum, when measured by volume.
 - .3 Maximum VOC content: In accordance with Section 01 61 16.
 - .4 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that floor surfaces are acceptable to receive the work of this section.

- .1 Concrete floors to receive densified concrete floor finish will be installed to meet Floor Flatness (FF) rating of 40 and Floor Levelness (FL) rating of 30 in accordance with CSA A23.1/A23.2.
 - .2 Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
- 3.2 GENERAL**
- .1 Finish floors and slabs in general conformance with CSA A23.1/A23.2, and as follows:
 - .1 Provide power-trowel burnished finish to surfaces that will receive seamless flooring, porcelain tile, and for surfaces scheduled to be receive concrete sealer or densifier.
 - .2 In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains.
 - .2 Apply materials in accordance with manufacturer's instructions.
- 3.3 PREPARATION**
- .1 Protect adjacent surfaces non-finished areas from drips, overflow, and overspray. Immediately remove excess material.
 - .2 Prepare and clean concrete surfaces, free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.
 - .3 Limit and control damage from excessive dust caused by polishing procedure.
- 3.4 COATING APPLICATION**
- .1 Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
 - .2 Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
 - .3 Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for sealing and workmanship.
- 3.5 DENSIFIERS AND HARDENERS**
- .1 Apply densifiers and hardeners in accordance with manufacturer's instructions, and as follows:
 - .1 Apply undiluted to point of rejection in accordance with manufacturer's instructions.
 - .2 Remove excess liquid.
 - .3 Allow to cure according to manufacturer's instructions.
 - .2 Sealer/enhancer:
 - .1 Apply sealer in accordance with manufacturer's recommendations.
 - .2 Apply sealer in accordance with manufacturer's recommendations, and allow to cure before final polishing.
- 3.6 JOINT TREATMENT**
- .1 Control joint spacing: 3048 mm, locations confirmed by Contract Administrator.

- .2 Preparation:
 - .1 Dry re-saw control joints using concrete saw with diamond blade and vacuum attachment. Remove laitance and debris from joint. Provide clean, sound, abraded surface.
 - .2 Remove surface contaminants including but not limited to dust, grease, curing compounds, impregnations, waxes, foreign particles and disintegrated materials that may affect bond.
 - .3 Protect adjacent floor surface over-spill staining with tape or other means approved by joint filler manufacturer.
- .3 Mix and apply joint filler in accordance with manufacturer's instructions.
- .4 Apply filler to full depth of control joints. Maintain steady flow of material to eliminate overlapping.
- .5 Slightly overfill joints. Shave level with adjacent joint edges within 24 hours of placing.

3.7 PROTECTION

- .1 Protect finished floor surfaces from damage and wear during construction operations. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application.

3.8 CLEANING

- .1 Remove temporary covering and clean flooring just prior to Substantial Performance. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Floor planks.
- .2 Connection plates, brackets, and hangers.
- .3 Grouting plank joint keys.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-place Concrete.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 775/A 775M Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .2 ASTM C 260, Standard Specification for Air-entraining Admixtures for Concrete.
 - .3 ASTM C 494/C 494M-99ae1, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D 412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
 - .5 ASTM D 2240, Standard Test Method for Rubber Property - Durometer Hardness.
 - .6 ASTM A 416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - .7 ASTM A 185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .8 ASTM A 82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181, Ready Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5, A8, A23.5, A362, A363, A456.1, A456.2, A456.3).
 - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .3 CAN3-A23.3, Design of Concrete Structures for Buildings.
 - .4 CAN3-A23.4/A251, Precast Concrete - Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.
 - .5 CAN/CSA-A23.5, Supplementary Cementing Materials.
 - .6 CSA-A3000, Cementitious Materials Compendium.
 - .7 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.
 - .8 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .9 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .10 CSA-W47.1, Certification of Companies for Fusion Welding for Steel Structures.
 - .11 CSA-W48.01, Filler Metals and Allied Materials for Metal Arc Welding
 - .12 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .13 CSA-W59, Welded Steel Construction (Metal Arc Welding).

- .14 CSA-W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 American Concrete Institute (ACI)
 - .1 ACI 303R, Guide to Cast-in-Place Architectural Concrete Practice.
- .5 Canadian Precast/Prestressed Concrete Institute (CPCI)
 - .1 Design Manual (4th edition) – Precast and Prestressed Concrete
- .6 UL - Underwriters' Laboratories Inc., Fire Resistance Directory.

1.4 DESIGN REQUIREMENTS

- .1 Size components to withstand design loads as indicated on the structural drawings.
- .2 Maximum Allowable Deflection of Floor Planks: 1/360 span, cambered to achieve flat surface under dead load.
- .3 Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.
- .4 Grouted Keys: Capable of transmitting a factored horizontal shear force of 30kN/m minimum or as required by design.
- .5 Calculate structural properties of framing members in accordance with CSA A23.3.
- .6 Utilize the CPCI Design Manual.

1.5 TOLERANCES

- .1 Tolerance of precast elements to CAN3-A23.4, Section 10.
- .2 Length of precast elements not to vary from design length by more than plus or minus 25 mm.
- .3 Maximum variation from design camber shall be L/1000 but at no point greater than 20mm. Differential camber between adjacent slabs shall be a maximum of L/600 but at no point greater than 25 mm.

1.6 SUBMITTALS

- .1 Shop Drawings:
 - .1 Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, camber, finishing schedules, methods of handling and erection, sleeves, inserts and relationship to adjacent materials.
 - .2 Ensure each drawing submitted bears stamp and signature of qualified professional Contract Administrator licensed in province of Manitoba, Canada.
 - .3 Indicate design loads, deflections, and cambers.
- .2 Mock-up: Contract Administrator to be notified when first plank is cast to review surface finish.
- .3 Fabricator's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.7 QUALITY ASSURANCE

- .1 Maintain plant records and quality control program during production of precast planks. Make records available upon request.

1.8 QUALIFICATIONS

- .1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by Canadian Standards Association in appropriate categories according to CSA-A251.
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting tender and to specifically verify as part of tender that plant is currently certified in appropriate categories: Structural Prestressed.
- .3 Only precast elements fabricated in such certified plants to be acceptable to the City, and plant certification to be maintained for duration of fabrication, erection, and until warranty expires.
- .4 Welding companies certified to CSA-W47.1.
- .5 Design precast concrete members under direct supervision of a Professional Structural Contract Administrator experienced in design of this work and licensed in the Province of Manitoba.

1.9 REGULATORY REQUIREMENTS

- .1 Conform to CSA 23.3 and the National building Code of Canada 2005 amended by the Manitoba Building Code and any other applicable Codes and documents.

1.10 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, protect and handle products to site.
- .2 Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

1.11 COORDINATION

- .1 Coordinate the Work of framing components not post tensioned but directly associated with the Work of this section.
- .2 Coordinate field cut openings with affected section.
- .3 Coordinate location of hanger tabs and devices for mechanical and electrical work.

1.12 WARRANTY

- .1 Contractor hereby warrants that precast element will not spall or show visible evidence of corrosion of embedded steel and cracking, except for normal hairline shrinkage cracks, in accordance with General Conditions, but for 10 years.

Part 2 Products

2.1 MATERIALS

- .1 Cement, aggregates, water, admixtures, colouring admixture: to CAN/CSA- A23.1 and CAN3-A23.4.

- .2 Cementitious materials: to CAN/CSA-A3000.
- .3 Use same brands and source of cement and aggregate for entire project to ensure uniformity of colouration and other mix characteristics.
- .4 Reinforcing steel: to CAN/CSA-G30.18, ASTM A775/A775M.
- .5 Prestressing steel: ASTM A416/A416M, uncoated, seven-wire, low-relaxation, Grade 270 stranded steel cable; ultimate tensile stress of 270 ksi (1860 MPa).
- .6 Welded wire fabric: to ASTM-A185.
- .7 Hardware and miscellaneous materials: to CAN/CSA-A23.1.
- .8 Forms: to CAN/CSA-A23.4/ A251.
- .9 Anchors and supports: to CAN/CSA G40.21, Type 350 W.
- .10 Welding materials: to CSA-W47.1.
- .11 Welding electrodes: to CSA-W48.1 and certified by Canadian Welding Bureau.
- .12 Galvanizing: hot dipped galvanizing with minimum zinc coating of 610 g/m² to CAN/CSA-G164.
- .13 Steel primer: to CAN/CGSB-1.40.
- .14 Zinc-rich primer: to CAN/CGSB-1.181.
- .15 Bearing pads: smooth, ultra-high molecular weight polyethylene plastic.
- .16 Air entrainment admixtures: to ASTM C260. The use of chloride containing admixtures is strictly forbidden.
- .17 Chemical admixtures: to ASTM C494/C494M.
- .18 Shims: smooth, ultra-high molecular weight polyethylene plastic.
- .19 Weephole tubes: purpose made plastic.

2.2 MIXES

- .1 Concrete.
 - .1 Proportion normal density concrete in accordance with CSA-A23.1-04, Alternative 1 to give properties as required by design.
- .2 Grout.
 - .1 Cement grout: 1 parts type 10 Portland cement, 2 parts sand, sufficient water for placement and hydration.
 - .2 Minimum compressive strength: 25 MPa.
 - .3 Shrinkage compensating grout: to Section 03 30 00 - Cast-in-Place Concrete.

2.3 MANUFACTURED UNITS

- .1 Manufacture units in accordance with CAN3-A23.4, and CSA-A251.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit that will not be exposed.
- .3 Provide hardware suitable for handling elements.

2.4 FABRICATION

- .1 Embed anchors, inserts, plates, angles, and other items at locations indicated.
- .2 Provide openings required by other sections, at locations indicated.

2.5 COMPONENTS

- .1 Size as noted on structural drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are ready to receive work.
- .2 Verify supporting structure is ready to receive work.

3.2 PREPARATION

- .1 Prepare support devices for the erection procedure and temporary bracing.

3.3 ERECTION

- .1 Do precast concrete work in accordance with CAN3-A23.4 AND CAN3-A23.3.
- .2 Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- .3 Align and maintain uniform horizontal and end joints, as erection progresses.
- .4 Maintain temporary bracing in place until final connection is made. Protect members from staining.
- .5 Install bearing pads.
- .6 Adjust differential camber between precast members to tolerance before final attachment and grouting.
- .7 Adjust differential elevation between precast members to tolerance before final attachment.
- .8 Grout plank joints, trowel smooth.
- .9 Prevent grout leakage.
- .10 Secure units in place. Perform welding in accordance with CSA W59.

3.4 ERECTION TOLERANCES

- .1 Erect members level and plumb within allowable tolerances.

3.5 PROTECTION OF FINISHED WORK

- .1 Protect finished Work.
- .2 Protect members from damage caused by field welding or erection operations.
- .3 Provide non-combustible shields during welding operations.

3.6 CLEANING

- .1 Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.
- .3 Section 03 35 11 – Concrete Floor Finishes

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .3 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C260M-10a, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C494/C494M-10a Standard Specification for Chemical Admixtures for Concrete.

1.3 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.4 ABBREVIATIONS

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
- .2 SCM – Supplemental cementing materials.
- .3 SSD - Saturated surface dry.
- .4 WRA – Water reducing agent.

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 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Cement: to CAN/CSA-A3001.
 - .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 CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: ASTM C260.
 - .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 MIX REQUIREMENTS

- .1 Proportion normal density concrete in accordance with CSA-A23.1, Table 5, Alternative 1 to obtain the following performance:
 - .1 Bonded Concrete Overlay.
 - .1 Class of exposure: N
 - .2 Minimum compressive strength at 28 days: 32 MPa.
 - .3 Water: cementitious ratio: max. 0.45
 - .4 Air category: None
 - .5 Supplemental Cementing Materials (SCM): Class CI Fly-Ash.
 - .6 Volume of SCM: Normal (less than 30% replacement).
 - .7 Nominal size of coarse aggregate: 14 mm.
 - .8 Slump at point of discharge: consistent with placement and consolidation methods, equipment, and site conditions and as approved by Contract Administrator.

2.3 BONDING SLURRY

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.45 in accordance with CSA-A23.1 and as follows:
 - .1 1.0 kg Type GU to CSA A3001.
 - .2 1.0 kg SSD concrete sand to CSA A23.1.
 - .3 0.40 kg Water to CSA A23.1.
 - .4 High range water reducing agent to ASTM C494/C494M as required and approved by Contract Administrator.

- .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labelled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
- .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" (3 mm) over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

2.4 ACCESSORIES

- .1 Evaporation reducer: Acceptable Product:
 - .1 MasterKure ER 50 formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

2.5 REINFORCEMENT

- .1 Reinforcing Mesh: as per drawings.
- .2 Provide chairs of suitable height to hold mesh in centre of new overlay. Chair spacing not to exceed 18" on-centre in each direction or as required to support the weight of placing personnel with minimal deflection.

Part 3 Execution

3.1 CONCRETE SURFACE PREPARATION

- .1 Within 24 hours prior to placement, shot blast the substrate to texture the concrete and remove loose deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Prepare vertical surface by sandblasting, grinding, bush hammering, or other suitable method. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .4 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the substrate.
- .5 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .6 Saturate substrate for a period of not less than 6 hours prior to infilling. Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 Final cleaning: High pressure waterblast substrate at minimum 4,000 psi to remove any residual dust, dirt, debris, or other materials which could reduce bond.

- .8 Prior to placement remove standing water from all depressions and allow substrate to become saturated, surface-dry (SSD) with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove any standing water by vacuuming.

3.2 MIX PRODUCTION

- .1 Concrete to be mixed, delivered, and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready-mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
 - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
 - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
 - .3 WRA addition shall occur at the batch plant or on site. Site addition of WRA will be the responsibility of the concrete supplier.
- .4 Slump and air must be measured both before and after addition of WRA.
- .5 The addition of water to the concrete to increase slump and aid in pumping is strictly forbidden.

3.3 PLACEMENT

- .1 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .3 Bonding Slurry Application:
 - .1 Apply the specified bonding slurry to a SSD substrate.
 - .2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" (3 mm) over entire area. Collect and remove all coarse aggregate prior to placement of the concrete.
- .4 Place concrete while the slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bonding slurry dries prior to placement of the repair material, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .5 Place concrete work in accordance with CSA-A23.1.
- .6 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.
- .7 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.

- .8 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.
- .9 The concrete must be internally vibrated by use of a floating vibratory screed to consolidate the top surface. Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.
- .10 Continuously consolidate and finish to specified elevations.
- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1.
- .2 Finishing:
 - .1 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.
 - .2 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.
 - .3 Surface free of all trowel marks and ridges.
 - .4 Concrete floors to receive densified concrete floor finish will be installed to meet Floor Flatness (FF) rating of 40 and Floor Levelness (FL) rating of 30 in accordance with CSA23.1/A23.2.
 - .5 Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.5 CURING

- .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or application of an evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
- .2 Bonded concrete overlays to be wet cured with burlap for a minimum of 7 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.
- .3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" (75 mm) and be securely held in place without marring the concrete surface.
 - .1 Days 1 through 6: Maintain burlap in a continuously wet condition throughout the curing period. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.

- .2 Day 7: Discontinue re-wetting procedures allowing burlap to dry naturally.
- .5 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.

3.6 JOINTS

- .1 Control joints and construction joints shall be formed, tooled, or sawcut via specialized dry-process cutting (eg. "Soff-Cut"). Sawcutting 24 hours following placement will not be permitted.
 - .1 Sawcut to a minimum of one 1 1/2" (38 mm) or one-quarter of the depth of the slab, whichever is greater, following initial set of concrete.
 - .2 Timing of the saw cutting will vary with weather conditions however are typically completed within 1 to 4 hours after final finishing. Timing of the saw cutting will be the responsibility of the Contractor.
- .2 Location and frequency of control joints to be site determined.

3.7 FIELD QUALITY CONTROL

- .1 Concrete tests consisting of slump, air, and 3 cylinders for compressive strength to be completed at not less than one test per 50 cubic metres of concrete placed and not less than one test for each day of placement.
- .2 The bond strength between the overlay and substrate will be measured in accordance with CSA-A23.2-6B. The minimum acceptable bond strength between the overlay and substrate is 0.90 MPa at 28 days
- .3 Direct pull-out tensile tests to determine bond strength will be completed as follows:
 - .1 Minimum (3) tests will be completed within the first phase of repairs.
 - .2 Not less than one (1) bond test will be completed in each subsequent phase.
 - .3 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.
- .4 Testing agency to submit copies of concrete test reports directly to The City and Contract Administrator.
- .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.8 DEFECTIVE CONCRETE

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 12 – Masonry Mortar and Grout
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .3 Section 04 05 23 – Masonry Accessories
- .4 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A165 Series-04, Standards on Concrete Masonry Units.
 - .2 CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CSA-A371-04, Masonry Construction for Buildings.

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, specifications and datasheet and include product characteristics, performance criteria, limitations and colours.
- .3 Samples:
 - .1 Provide samples as follows:
 - .1 Two of each type of masonry unit specified, including special shapes, supplemented with specific requirements in Section 04 22 00 – Concrete Unit Masonry.
 - .2 Two cured, coloured samples of mortar, illustrating mortar colour and colour range, supplemented with specific requirements in Section 04 05 12 - Masonry Mortar and Grout.
 - .3 Two of each type of masonry accessory and flashing specified, supplemented by specific requirements in Section 04 05 23 - Masonry Accessories.
 - .4 One of each type of masonry anchorage, reinforcement and connector proposed for use, supplemented by specific requirements in Section 04 05 19 - Masonry Anchorage and Reinforcing.
 - .5 Submit samples for testing to laboratories employing technicians certified / trained in procedures for testing masonry units.
- .4 Informational Submittals
 - .1 Submit manufacturer's installation instructions.
 - .2 Test reports and product certificates.

1.4 QUALITY ASSURANCE

- .1 Test Reports
 - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.

- .2 Submit laboratory test reports certifying compliance of masonry units and mortar with specification requirements.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacturer: capable of providing field service representation during construction and approving application method.
 - .2 Installer: experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 - .3 Masons: company or person specializing in masonry installations with 5 years documented experience with masonry work similar to this project.
 - .1 Masons employed on this project must demonstrate ability to reproduce mockup standards.

1.6 MOCK-UP

- .1 Construct mock-ups in accordance with Section 01 45 00 – Quality Control.
- .2 Construct mock-ups as follows:
 - .1 Construct 1200 mm 1200 mm wide interior concrete masonry unit wall mock-up, including corner conditions, sill conditions and head conditions. Include application of sealer to verify selections made under sample submittals and to demonstrate aesthetic effects of material and execution using materials indicated for final unit of work.
 - .2 Location: As directed by Contract Administrator.
 - .3 Mock-up used to judge workmanship, substrate preparation, operation of equipment and material application.
 - .4 Approved mock-up may remain as part of the Work.
 - .5 Allow 24 hours for inspection of mockup by Contract Administrator before proceeding with Work.
 - .6 When accepted by Contract Administrator, mockup will demonstrate minimum standard for this Work.
 - .7 Start Work only upon receipt of written acceptance of mockup by Contract Administrator.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in accordance with Section 01 61 00 - Product Requirements.
- .2 Deliver materials to job site in dry conditions.
- .3 Storage and Handling Protection:
 - .1 Keep materials dry until use.
 - .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.8 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.
- .2 Weather Requirements: to CSA-A371.
- .3 Cold weather requirements:
 - .1 To CSA-A371 with following requirements.
 - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.
 - .3 Maintain temperature of masonry above 0 degrees C for minimum of 7 days, after mortar is installed.
 - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
 - .4 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
 - .3 Spray mortar surface at intervals and keep moist for maximum of three days after installation.

Part 2 Products

2.1 MATERIALS

- .1 Masonry materials are specified elsewhere in related Sections

Part 3 Execution

3.1 INSTALLERS

- .1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

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 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section.

- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
- .3 Verification of Conditions:
 - .1 Verify that:
 - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of masonry.
 - .2 Field conditions are acceptable and are ready to receive work.
 - .3 Built-in items are in proper location, and ready for roughing into masonry work.

3.4 PREPARATION

- .1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent materials from damage and disfiguration.
- .4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

3.5 INSTALLATION

- .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.6 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, in exposed masonry and replace with undamaged units.
- .2 Jointing:
 - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
 - .2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
 - .3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cutting:

- .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
- .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In:
 - .1 Build in items required to be built into masonry.
 - .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
 - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .5 Wetting of bricks:
 - .1 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1000 mm²: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
 - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .6 Support of loads:
 - .1 Use 20 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units unless noted on drawings.
 - .2 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.
- .7 Provision for movement:
 - .1 Leave 3 to 6 mm space below shelf angles.
 - .2 Leave 20 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
 - .3 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .8 Loose steel lintels:
 - .1 Install loose steel lintels. Centre over opening width.
- .9 Control joints:
 - .1 Construct continuous control joints as indicated.
- .10 Expansion joints:
 - .1 Build-in continuous expansion joints as indicated.
- .11 Interface with other work:
 - .1 Cut openings in existing work as indicated.
 - .2 Openings in walls: approved by Contract Administrator.
 - .3 Make good existing work. Use materials to match existing.

3.7 SITE TOLERANCES

- .1 Tolerances in notes to CSA-A371 apply.

3.8 FIELD QUALITY CONTROL

- .1 Inspection and Testing will be carried out by Testing Laboratory designated by Contract Administrator.

- .2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

3.9 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.10 PROTECTION

- .1 Protect masonry and other work from markings and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .2 Temporary Bracing:
 - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
 - .2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .3 Moisture Protection:
 - .1 Keep masonry dry using waterproof, nonstaining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
 - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
 - .3 Air Temperature Protection: protect completed masonry as recommended in 1.7 SITE CONDITIONS.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .3 Section 04 05 23 – Masonry Accessories
- .4 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A371-04, Masonry Construction for Buildings.
 - .4 CAN/CSA-A3000-03, Cementitious Materials Compendium; CAN/CSA-A3002-[03], Masonry and Mortar Cement.

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, specifications and datasheets.
- .3 Samples: Provide duplicate samples of specified coloured grout.
- .4 Informational Submittals:
 - .1 Submit two copies of WHMIS MSDS – Material Safety Data Sheets. Indicate VOC's mortar, grout and admixtures.
 - .2 Submit manufacturer's installation instructions.
 - .3 Product certificates.
 - .4 Test reports.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Submit laboratory test reports.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:

- .1 Portland Cement: to CAN/CSA-A3000.
- .2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA A179.
- .3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA A179.
- .4 Packaged Dry Combined Materials for mortar: to CAN/CSA A179.
- .3 Aggregate: supplied by one supplier. To CAN/CSA A179.
- .4 Water: clean and potable.
- .5 Lime: To CAN/CSA A179.
- .6 Mortar:
 - .1 To CSA A179.
 - .2 Use aggregate passing 1.18mm sieve where 6mm thick joints are indicated.
 - .3 White mortar: use white Portland cement, and white masonry cement to produce mortar type specified.
 - .4 Colour: ground coloured natural aggregates or metallic oxide pigments, use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample.
 - .5 Non-staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type.
 - .6 Mortar type:
 - .1 Exterior, parapet, and load bearing Walls: type S mortar having a minimum strength of 12 MPa at 28 days.
 - .2 Non-Loadbearing Walls: type N mortar having a compressive strength of 5 MPa at 28 days. proportion specifications.
 - .7 Colour mortars:
 - .1 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
 - .2 Use clean mixer for coloured mortar.
 - .8 Pointing Mortar:
 - .1 Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into a ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
- .7 Grout:
 - .1 To CSA A179.
 - .2 Mix grout to semi-fluid consistency.
 - .3 Do not use calcium chloride or chloride based admixtures.

2.2 SOURCE QUALITY CONTROL

- .1 Use same brands of materials and source of aggregates for entire project.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CAN/CSA A179 except where specified otherwise.

3.3 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 12 – Masonry Mortar and Grout
- .3 Section 04 05 23 – Masonry Accessories
- .4 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A370-04, Connectors for Masonry.
 - .4 CAN/CSA A371-04, Masonry Construction for Buildings.
 - .5 CAN/CSA G30.18-M92(R2007), Billet-Steel Bars for Concrete Reinforcement.
 - .6 CSA-S304.1-04, Design of Masonry Structures.
 - .7 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

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, specifications and datasheets.
- .3 Shop Drawings:
 - .1 Shop Drawings shall consist of bar bending details, lists and placing drawings.
 - .2 On placing drawings, indicate sizes, spacing, location, and quantities of reinforcement and connectors.
- .4 Informational Submittals:
 - .1 Provide 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.

Part 2 Products

2.1 MATERIALS

- .1 Bar reinforcement: Steel to CAN/CSA A371 and CAN/CSA G30.18, Grade 400.

- .2 Connectors: to CAN/CSA A370 and CSA-S304.1.
- .3 Corrosion protection:
 - .1 To CSA-S304.1.
- .4 Single Wythe Joint Reinforcement: ladder type:
 - .1 Cold drawn steel wire conforming to ASTM A82.
 - .2 Standard Joint Reinforcement consisting of 3.66mm (9ga) longitudinal wires and 3.66mm cross or diagonal wires.
 - .3 Yield Strength is 480MPa.
- .5 Anchors: to CAN/CSA A370.

2.2 FABRICATION

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

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcement steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcement work.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

- .1 Supply and install masonry reinforcement in accordance with CSA-A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of placement of reinforcement.

3.3 LADDER REINFORCING

- .1 Install in accordance with CAN/CSA A370 and CAN/CSA A371.
- .2 Install horizontal joint reinforcement every second course. Every course for stack bond.
- .3 Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
- .4 Place joint reinforcement continuous in first joint below top of walls.
- .5 Lap joint reinforcement ends minimum 150 mm.
- .6 Connect stack bonded unit joint corners and intersections with strap anchors 200 mm on centre.

3.4 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA-S304.1, CAN/CSA A371, and CAN/CSA A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA A371.

3.5 GROUTING

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

3.6 LATERAL SUPPORT AND ANCHORAGE

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

3.7 MOVEMENT JOINTS

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

3.8 FIELD BENDING

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

3.9 FIELD TOUCH-UP

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

3.10 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools, and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .3 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D2240-[05(2010)], Standard Test Method for Rubber Property - Durometer Hardness.
- .2 CSA Group
 - .1 CAN/CSA-A371-[04(R2009)], Masonry Construction for Buildings.
 - .2 CAN/CSA-ISO 14021-[00(R2009)], Environmental Labels and Declarations - Self Declared Environmental Claims (Type II Environmental Labelling).

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 masonry accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional Contract Administrator registered or licensed in the Province of Manitoba, Canada.
 - .2 Indicate on drawings:
 - .1 Flashing, installation details, sizes, spacing, location and quantities of fasteners.

1.4 QUALITY ASSURANCE

- .1 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Manufacturer's Instructions: submit manufacturer's instructions as follows:
 - .1 Submit installation instructions for brick vents, weeps, vents, screens and flashings not supplied by other Sections.

1.5 SITE MEASUREMENTS

- .1 Make site measurements necessary to ensure proper fit of members.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

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

Part 2 Products

2.1 MATERIALS

- .1 Movement joint filler: purpose-made elastomer durometer hardness to ASTM D2240 of size and shape indicated.
 - .1 Use low VOC products.
 - .2 Material type: rubber, PVC, closed cell neoprene.

2.2 MOISTURE CONTROL

- .1 Cell vents: polypropylene plastic, honeycomb design.
 - .1 Size: to suit brick dimensions.
- .2 Mortar diverters: shaped and sized to suit cavity spaces.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Contract Administrator.
 - .2 Inform Contract Administrator 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 Contract Administrator.

3.2 INSTALLATION: MATERIALS

- .1 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.
- .2 Reglets: install reglets at locations indicated on drawings.

3.3 INSTALLATION: MOISTURE CONTROL

- .1 Mortar diverters: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.
- .3 Grout Screens: 6 mm square monofilament screen fabricated from high-strength, non-corrosive polypropylene polymers to isolate flow of grout in designated areas.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 Cleaning and Waste Processing.
 - .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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 12 – Masonry Mortar and Grout
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .4 Section 04 05 23 – Masonry Accessories.

1.2 DEFINITIONS

- .1 CMU(s): Concrete masonry unit(s).
- .2 Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A165 Series-2004, CSA Standards on Concrete Masonry Units.
 - .2 CAN/CSA A371-04, Masonry Construction for Buildings.
 - .3 CSA S304.1-04, Design of Masonry Structures.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings: For the following:
 - .1 Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - .2 Provide Shop Drawings for concrete masonry.
- .3 Samples: Submit: Provide (4) Full-size units as samples for verification of masonry units selected, including special shapes indicated.
 - .1 (1) sample with burnished finish texture and application of sealer.
 - .2 (1) sample without burnished finish texture and application of sealer
 - .3 (1) sample without burnished finish texture and no application of sealer
 - .4 (1) sample with burnished finish texture and no application of sealer.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: provide product data, including manufacturer's printed data sheets.

1.6 QUALITY ASSURANCE

- .1 Test Reports
 - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.

- .2 Submit laboratory test reports certifying compliance of masonry units and mortar with specification requirements.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 1.7 MOCK-UP**
 - .1 Refer to Section 04 05 00 Common Work Results for Masonry.
- 1.8 DELIVERY, STORAGE AND HANDLING**
 - .1 Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 - .2 Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp. Protect from dampness and freezing.
 - .3 Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
 - .4 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
- 1.9 WASTE MANAGEMENT AND DISPOSAL**
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management.
- 1.10 AMBIENT CONDITIONS**
 - .1 Cold and Hot Weather Requirements: comply with requirements of CAN/CSA-A371.
- Part 2 Products**
- 2.1 CONCRETE MASONRY UNITS**
 - .1 Architectural concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).
 - .1 Classification: H/15/A/M.
 - .2 Size: Modular – Mason to confirm whether existing block is imperial or metric prior to ordering block.
 - .3 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.
 - .4 Profile/Texture for Architectural Concrete Unit Masonry:
 - .1 Surface texture:
 - .2 Exposed Finish: Smooth face units with one or more faces ground. (burnished finish) where exposed. Refer to Section 09 06 00 Finish Schedule for extents.
 - .3 Concealed Finish: Smooth face units.
 - .5 Basis of design:

- .1 Terrazzo Block Burnished Architectural Masonry Unit as manufactured by Expocrete. Color: Grigio Naturale.
- .2 Burnished Architectural Series, Burnished Block as manufactured by Amstone. Color: To be selected from Intermediate Series.

2.2 MASONRY CONNECTORS

- .1 Refer to Section 04 05 19 - Masonry Anchorage and Reinforcing.

2.3 ACCESSORIES

- .1 Control Joint Sealant and Back-up Materials: as specified in Section 07 92 00 – Joint Sealants.
 - .1 In fire-resistance rated partitions, provide ceramic fibre blanket behind backer rod and sealant.
 - .2 Sealer: Clear penetrating water repellent sealer.
 - .1 Basis of design: Fabrishield 218 GFB.

2.4 CLEANING COMPOUNDS

- .1 Cleaning compounds compatible with masonry units and in accordance with manufacturer's written recommendations and instructions.
- .2 Tri-sodium phosphate is an acceptable cleaning agent where required. Muriatic acid is not acceptable.

2.5 TOLERANCES

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation between units within specific job lot not to exceed 2 mm.
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
 - .3 Out of square tolerance not to exceed 2 mm.
- .2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm.
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
 - .3 Out of square tolerance not to exceed 2 mm.
 - .4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify surfaces and conditions are ready to accept work of this Section.
- .2 Commencing installation means acceptance of existing substrates.

3.2 PREPARATION

- .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

- .1 Erect masonry in accordance with CSA A371, CSA S304.1, and reviewed Shop Drawings.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- .4 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- .5 Concrete block units:
 - .1 Bond: running unless noted.
 - .2 Coursing height: 200 mm for one block and one joint.
 - .3 Jointing:
 - .1 Concave where exposed or where paint or other finish coating is specified.
 - .2 Flush joints: where concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating, and to height to suit resilient base where resilient base is applied to painted walls.
 - .4 Where partitions extend to underside of structure use standard CMU for portion of partitions above ceiling.
- .6 Special Shapes:
 - .1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
 - .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
 - .3 End bearing: not less than 200 mm unless noted on drawings.

3.4 REINFORCEMENT

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

3.5 CONNECTORS

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

3.6 FLASHING

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

3.7 MORTAR PLACEMENT

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

3.8 CONSTRUCTION

- .1 Cull out masonry units, in accordance with CAN/CSA A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.
- .2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .3 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .4 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .5 Install movement joints and keep free of mortar where indicated.
- .6 Hollow Units: spread mortar setting bed from outside edge of face shells.
 - .1 Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness.
 - .2 Avoid excess mortar.
- .7 Solid Units: apply mortar over entire vertical and horizontal surfaces.
 - .1 Avoid bridging of airspace between brick veneer and backup wall with mortar.
- .8 Ensure compacted head joints.
 - .1 Use full or face-shell joint as indicated.
 - .2 Fill cross webs of CMU between reinforced and non-reinforced walls to prevent grout from flowing to cores of unreinforced masonry.
- .9 Tamp units firmly into place.
- .10 Do not adjust masonry units after mortar has set.
 - .1 Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .11 Tool joints after mortar has achieved initial set up.
- .12 Do not interrupt bond below or above openings.

3.9 REPAIR/RESTORATION

- .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.10 CLEANING

- .1 Standard Block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
- .2 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- .3 Pointing: During tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- .4 In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- .5 Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - .1 Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - .2 Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 BLOCK SEALER

- .1 Apply as per manufacturer's application instructions.
- .2 Schedule: Apply to all interior masonry block surfaces.

3.12 PROTECTION

- .1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .2 Temporary Bracing:
 - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
 - .2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .3 Moisture Protection:
 - .1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by construction.
 - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

Part 1

General

1.1 SECTION INCLUDES

- .1 Thin brick.
- .2 Grout.
- .3 Setting material.
- .4 Cementitious backer board.

1.2 RELATED REQUIREMENTS

- .1 Section 05 41 00 - Structural Metal Stud Framing: Steel stud backup for masonry veneer.
- .2 Section 07 05 43 - Cladding Support Systems
- .3 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

1.3 REFERENCE STANDARDS

- .1 ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2010 (Reaffirmed 2016).
- .2 ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- .3 ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- .4 ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- .5 ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.
- .6 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .7 ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale 2020.
- .8 ASTM C1405 - Standard Specification for Glazed Brick (Single Fired, Brick Units) 2022.
- .9 CAN/CSA A179 - Mortar and Grout for Unit Masonry 2014.
- .10 NCMA MSV - Installation Guide for Adhered Manufactured Stone Veneer 5th edition, 2021.
- .11 TTMAC (IM) - Tile Installer Technical Handbook 2018/2019.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Convene one week before starting work of this section to:
 - .1 Verify project requirements.
 - .2 Review installation instructions and substrate conditions.
 - .3 Sequence work of related sections.
 - .4 Co-ordination with other building subtrades.
 - .5 Review manufacturer's installation instructions.

- .6 Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
- .7 Review flashing, special details, wall penetrations, openings, and condition of other construction that may affect proper installation of manufactured masonry.
- .8 Review temporary protection requirements for manufactured masonry during and after installation.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data for thin brick units, thin-set mortar, grout, and waterproofing.
- .3 Shop Drawings: Indicate layout, corners, anchorages, attachment system, trim, flashing, and accessories; and special details.
- .4 Samples: Submit four samples of each shape of thin brick units to illustrate colour, texture, and extremes of colour range.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment, compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content,; and VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's certificate: Certify that thin brick units, mortar, grout, and waterproofing meet or exceed specified requirements.
- .7 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.
- .2 Construct mock-ups as follows:
 - .1 Wall mock-up panel minimum size 2.4 m long by 1.8 m high; include thin brick, thin-set mortar, grout, accessories, substrate, representative wall openings, and waterproofing, each special shape of thin brick in mock-up. Include in wall mock-up or provide separate mock-up of termination of thin brick at decorative formed metal plate at edge.
 - .2 Soffit mock-up including the edge detail between vertical wall and soffit.
- .3 Locate where directed.
- .4 Mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect thin-set mortar and grout materials from freezing or overheating in accordance with manufacturer's instructions.
- .2 Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.9 SITE CONDITIONS

- .1 Maintain materials and surrounding air temperature to manufacturer's recommended temperature range before, during and after completion of masonry work.

Part 2 Products

2.1 THIN BRICK

- .1 Manufacturers:
 - .1 Elgin Butler; EB Thin Brick.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Thin brick: Ceramic glazed, to ASTM C1088. Provide products containing recycled content.
 - .1 Type: TBS.
 - .2 Size: Square, 200 mm modular.
 - .3 Thickness: 20 mm.
 - .4 Tolerances: 1.6 mm.
 - .5 Colour: #8800 Classic Red.
 - .6 Special shapes: Including square corner (EBTB 4W2B SPL), rectangular stretcher (EBTB 4PA SPL), closure brick (EBTB 4P10B SPL).
 - .7 Protective coating: Ceramic glaze, ASTM C1405 Type I - single faced, Grade S - standard, Class exterior.

2.2 MORTAR MATERIALS

- .1 Use only factory pre-mixed packaged dry materials for mortar, with addition of water only.
- .2 Thin-set mortar: Prepackaged, pre-blended latex modified dry materials to ANSI A118.4, ANSI A118.11, and ANSI A118.15; freeze-thaw stable, for adhering thin brick veneer to cement board substrates.
 - .1 Products:
 - .1 Laticrete; MVIS Hi-Bond Veneer Mortar.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.3 GROUT MATERIALS

- .1 Pointing mortar: Factory-prepared masonry pointing mortar formulated from a blend of high-strength portland cement, graded aggregates, and colour-fast pigments; designed to be mixed with water. Colour selected by Contract Administrator from manufacturer's full range.
 - .1 Product:
 - .1 Laticrete; MVIS Premium Masonry Pointing Mortar.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Flexible grout: Silicone rubber to ASTM C920, non-solvent curing type; colour selected by Contract Administrator from full range of colours to match other grout materials.
 - .1 Applications: Expansion joints and other sealant-filled joints in adhered masonry, including control, contraction, and isolation joints.
 - .2 Products:
 - .1 Laticrete; Latasil.

- .2 Substitutions: See Part B - Bidding Procedures.
- .3 Water: In accordance with CAN/CSA A179.
- 2.4 SUBSTRATE MATERIALS**
 - .1 Cement backer board: Cementitious type complying with ANSI A118.9; high density, glass fibre reinforced, 13 mm thick; 100 mm wide coated glass fibre tape for joints and corners.
- 2.5 ACCESSORIES**
 - .1 Cleaning solution: Non-acidic, not harmful to masonry work or adjacent materials.
 - .2 Air and water barrier: Single component, fluid applied, vapour permeable; waterproofing, crack isolation, and air barrier membrane.
 - .1 Product:
 - .1 Laticrete; Air & Water Barrier.
 - .2 Substitutions: See Part B - Bidding Procedures.
 - .3 Flashing mortar: Manufacturer's recommended material, epoxy-based, trowel-applied, flexible waterproof flashing.
- Part 3 Execution**
 - 3.1 EXAMINATION**
 - .1 Verify that site conditions are acceptable and are ready to receive thin brick veneer in accordance with thin brick manufacturer and NCMA MSV.
 - .2 Verify that related items provided under other sections are properly sized and located.
 - .3 Verify that built-in items are in proper location, and ready for installation of thin brick veneer.
 - 3.2 PREPARATION**
 - .1 Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions.
 - .1 Tape joints and corners. Embed joint tape in layer of setting mortar.
 - .2 Stagger joints so four corners do not come together in same plane. Level surfaces to acceptable flatness tolerances.
 - .2 Prepare substrate surfaces for installation in accordance with setting material manufacturer's instructions.
 - 3.3 INSTALLATION**
 - .1 Exterior applications: Comply with NCMA MSV and TTMAC (IM) Method 305W, Detail A Exterior Use for exterior walls, and 315C Detail B for soffits on cement backer board, with air and water barrier membrane.
 - .2 Seal movement joints at wall openings and penetrations with flexible grout silicone sealant.
 - 3.4 COURSING**
 - .1 Establish lines, levels, and coursing indicated. Protect from displacement.

.2 Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

.3 Brick units:

.1 Bond: as indicated.

.2 Mortar joints: Concave. Tool joints with wood or plastic jointing tool.

3.5 CONTROL AND EXPANSION JOINTS

.1 Form movement joints as detailed on Drawings.

3.6 CUTTING AND FITTING

.1 Cut and fit for pipes, conduit, and other penetrations in accordance with thin brick veneer manufacturer's instructions. Coordinate with other sections of work to provide correct size, shape, and location.

3.7 CLEANING

.1 Remove excess mortar and mortar smears as work progresses.

.2 Clean soiled surfaces in accordance using manufacturer's recommended products and methods.

.3 Use non-metallic tools in cleaning operations.

3.8 PROTECTION

.1 Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions .
- .2 Section 05 21 00 – Steel Joist Framing.
- .3 Section 05 31 00 – Steel Decking.
- .4 Section 05 41 00 – Structural Metal Stud Framing.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A193/A193M-08, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
 - .3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A325-07a, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A325M-08, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
 - .6 ASTM A490M-04ae, Standard Specification for High-Strength Steel Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-01(R2007), Limit States Design of Steel Structures.
 - .4 CAN/CSA-S136-07, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W55.3-1965(R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .8 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International

- .1 SSPC SP-2, SP-7.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional Contract Administrator registered or licensed in Province of Manitoba, Canada.
- .3 Erection drawings:
 - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .4 Fabrication drawings:
 - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional Contract Administrator licensed in the Province of Manitoba, Canada.
- .5 Samples :
 - .1 Upon request, prepare sample of typical exposed structural connections in accordance with AISC Specifications of Architecturally exposed structural steel for approval of Contract Administrator. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.
- .6 Source Quality Control Submittals:
 - .1 Submit 2 copies of mill test reports 4 weeks prior to fabrication of structural steel.
 - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
 - .2 Provide mill test reports certified by metallurgists qualified to practice in Province of Manitoba, Canada.
- .7 Fabricator Reports:
 - .1 Upon request, provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.
- .8 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.
 - .1 .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes .

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.

- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated. Connections shall be designed for minimum 50% of beam shear capacity.
- .3 For composite construction select or design minimum end connection to resist reaction resulting from factored movement resistance as tabulated in the "Handbook of the Canadian Institute of Steel Construction" assuming 100% shear connection with depth of steel deck and/or slab shown on drawings.
- .4 Upon request, Submit sketches and design calculations stamped and signed by qualified professional Contract Administrator licensed in Province of Manitoba, Canada for non standard connections.

2.2 MATERIALS

- .1 Provide products containing recycled content.
- .2 Structural steel: All rolled, or steel structural sections shall be G40.21-350W, ASTM A992 or ASTM A572 Grade 50. All Hollow structural sections to be G40.21-350W class C or ASTM A500-C. All angles, channels and plates shall be G40.21-300W.
- .3 Anchor bolts: ASTM A307 Grade C or ASTM F1554 Grade 36 weldable, provided by steel supplier and set by the General Contractor. Where ASTM F1554 Grade 55 anchor bolts are used, bolts to be weldable grade steel.
- .4 Bolts, nuts and washers: to ASTM A307, ASTM A325M, and ASTM A490/A490M as required.
- .5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .6 Shop paint primer:
 - .1 Steel not receiving finish painting: one coat of CISC/CPMA 1-73A quick drying shop primer
 - .2 Steel receiving finish painting: one coat of CISC/CPMA 2-75 quick drying shop primer.
- .7 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².

- .8 Shear studs: to CSA W59, Appendix H.

2.3 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59.
- .3 Continuously seal members by continuous welds where indicated. Grind smooth.

2.4 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel as follows:
 - .1 Steel not receiving finish painting: One coat of CISC / CPMA 1-73a quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP2.
 - .2 Steel receiving finish painting: One coat of CISC / CPMA 2-75 quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP7.
 - .3 Exterior structural steel: All exterior structural steel shall be hot-dipped galvanized unless noted.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter.
- .3 Apply one coat of primer in shop to steel surfaces, except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of slip-critical connections.
 - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59.

- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 MARKING

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Contract Administrator.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Contract Administrator.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Contract Administrator.
- .3 Submit test reports to Contract Administrator within 2 weeks of completion of inspection.
- .4 The City will pay costs of tests as specified in Section 01 21 00 – Allowances.
- .5 Test shear studs in accordance with CSA W59.

3.6 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 00 - Painting.
 - .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP7 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 00 0 Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 12 23 – Structural Steel For Buildings.
- .2 Section 05 31 00 - Steel Deck.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-S16-01, Limit States Design of Steel Structures.
 - .3 CSA-S136-94(R2001), Cold Formed Steel Structural Members.
 - .4 CSA-W47.1-92(R2001), Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA-W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .6 CSA-W59-03, Welded Steel Construction (Metal Arc Welding).

1.3 QUALITY ASSURANCE

- .1 Submit 2 copies of mill test reports at least 4 weeks prior to fabrication of steel joists and accessories. Reports to show:
 - .1 Chemical and physical properties.
 - .2 Other details of steel to be incorporated into work.
 - .3 Certification by qualified metallurgists confirming that tests conform to requirements of CSA G40.20/G40.21
- .2 Upon request, supply affidavit prepared by fabricator of structural steel joists stating that materials and products used in fabrication conform to this specification.

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

- .1 Design steel joists and bridging to carry loads indicated on drawings in accordance with CAN/CSA-S16, CSA-S136.
- .2 Design joists and anchorages for uplift forces as indicated.
- .3 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.

- .4 Limit floor and roof joist deflection due to specified live load to L/360 and deflection due to specified total load to L/240.
- .5 Upon request, submit 2 copies of calculations and joist design drawings for typical joists for Contract Administrator review at least 4 weeks prior to fabrication and/or delivery.

1.5 SUBMITTALS

- .1 Shop Drawings:
 - .1 Submit shop details and erection drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit drawings stamped and signed by qualified professional Contract Administrator registered in the province Manitoba, Canada.
 - .3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.
 - .4 Provide particulars, on shop drawings, relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.
- .2 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.
 - .1 .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes .

Part 2 Products

2.1 MATERIALS

- .1 Provide products containing recycled content.
- .2 Structural steel: to CSA-G40.20/G40.21 and CSA-S136.
- .3 Welding materials: to CSA-W59.
- .1 Shop paint primer:
 - .1 Steel not receiving finish painting: one coat of CISC/CPMA 1-73A quick drying shop primer
- .2 Shear studs: to CSA-W59, Appendix H.

2.2 FABRICATION

- .1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA-S16.1, CSA-S136, and in accordance with reviewed shop drawings.
- .2 Weld in accordance with CSA-W59.
- .3 Provide top and bottom chord extensions where indicated.
- .4 Provide diagonal and horizontal bridging and anchorages as required.
- .5 Weld studs to top chords for attachment purposes.

- .6 Install shear studs in accordance with CSA-W59.

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel as follows:
 - .1 Steel not receiving finish painting: One coat of CISC / CPMA 1-73a quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP2.
 - .2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter.
 - .3 Apply one coat of primer in shop to steel surfaces, except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of slip-critical connections.
 - .5 Below grade surfaces in contact with soil.
 - .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
 - .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
 - .6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16, and CSA-S136.
- .2 Welding: in accordance with CSA-W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA-W47.1 for fusion welding and/or CSA-W55.3 for resistance welding.
- .4 Provide certification that welded joints are qualified by Canadian Welding Bureau.

3.2 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Contract Administrator.
- .2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Contract Administrator will determine extent of and identify all inspections.
- .3 Submit test report to Contract Administrator 2 weeks after completion of inspection.
- .4 The City will pay costs of tests as specified in Section 01 21 00 – Allowances.
- .5 Test shear studs in accordance with CSA-W59.

3.3 ERECTION

- .1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16.1, CSA-S136, and in accordance with reviewed erection drawings.
- .2 Complete installation of all bridging and anchorages before placing construction loads on joists.
- .3 Field cutting or altering joists or bridging that are not shown on shop drawings: to be reviewed by Contract Administrator.
- .4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.4 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 00 - Painting.
 - .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP7 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 12 23 – Structural Steel For Buildings.
- .2 Section 05 21 00 – Steel Joist Framing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-01a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-01a, Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.79-1978(R1999), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
 - .2 CAN/CSA-S16.1-94(R2000), Limit States Design of Steel Structures.
 - .3 CSA-S136-94(R2001), Cold Formed Steel Structural Members.
 - .4 CSA W47.1-92(R2001), Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .6 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 10M-96, Standard for Steel Roof Deck.
 - .2 CSSBI 12M-96, Standard for Composite Steel Deck.

1.3 DESIGN REQUIREMENTS

- .1 Design steel deck using limit states design in accordance with CSA S136.

1.4 SUBMITTALS

- .1 Shop Drawings:
 - .1 Submit shop drawings, erection, and shoring drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit drawings stamped and signed by qualified professional Contract Administrator registered or licensed in Province of Manitoba, Canada.
 - .3 Submit design calculations if requested by Contract Administrator.
 - .4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

- .5 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.
- .2 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.
- .1 .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes .

Part 2 Products

2.1 MATERIALS

- .1 Provide products containing recycled content.
- .2 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather, unpainted finish, thickness as indicated on structural drawings.
- .3 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
- .4 Zinc (Z) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75, coating, for exterior surfaces exposed to weather, thickness as indicated on structural drawings.
- .5 Acoustic insulation: fibrous glass 17.5 kg/m³ density profiled to suit deck flutes.
- .6 Closures: as indicated in accordance with manufacturer's recommendations.
- .7 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.
- .8 Primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .9 Shear studs: to CSA W59.

2.2 TYPES OF DECKING

- .1 Steel roof deck: thickness and profile as per structural drawings, interlocking side laps.
- .2 Acoustic steel roof deck: thickness and profile as per structural drawings, non-cellular, perforated on vertical face of flutes, interlocking side laps. Flat sheet for cellular deck.
- .3 Composite steel floor deck: thickness and profile as per structural drawings, interlocking side laps.

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.

- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

- .1 Erect steel deck as indicated and in accordance with CSA S136, and in accordance with reviewed erection drawings.
- .2 Butt ends: to 1.5 to 3 mm gap. Install steel cover plates over gaps wider than 3 mm.
- .3 Lap ends: to 50 mm minimum.
- .4 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.
- .5 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
- .6 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mill scale and other foreign matter.
- .7 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.
- .8 Place and support reinforcing steel as indicated.

3.3 CLOSURES

- .1 Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 Frame deck openings with any one dimension between 150 to 300 mm with minimum L64x64x6.4 each side of opening perpendicular to flutes. Angle shall be welded to at least two flutes on each side of opening.
- .3 Deck supplier shall reinforce openings over 300mm to 450mm across the flutes with suitable reinforcement based on a structural analysis of the loads involved.
- .4 For deck openings with any one dimension greater than 450 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

- .1 Install connections in accordance with CSSBI recommendations as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Formed steel stud exterior wall and soffit framing.

1.2 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Weather Barriers: Weather barrier over sheathing.
- .2 Section 09 21 16 - Gypsum Board Assemblies: Exterior gypsum-based wall sheathing.
- .3 Section 09 22 16 - Non-Structural Metal Framing.

1.3 REFERENCE STANDARDS

- .1 ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- .2 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .3 ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2021a.
- .4 CAN/CGSB 1.181 - Ready-Mixed Organic Zinc-Rich Coating 1999.
- .5 CSA S136 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016.
- .6 CSA S16 - Design of Steel Structures 2019.
- .7 CSSBI 51 - Lightweight Steel Framing Design Manual 2006, with Errata (2007).
- .8 MBC - Manitoba Building Code 2011.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- .3 Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, type and location of fasteners, and design thickness exclusive of coatings, and accessories or items required of related work.
 - .1 Describe method for securing studs to tracks and for bolted framing connections.
 - .2 Design data:
 - .1 Shop Drawings signed and sealed by a professional structural engineer.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.

- .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Designer's qualification statement.
- .6 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Designer qualifications: Design framing system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the Province in which the Project is located.
- .2 Installer qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

Part 2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Provide design, materials and fabrication in accordance with CSA S16 and CSA S136.

2.2 FRAMING SYSTEM

- .1 Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- .2 Design requirements: Provide completed framing system having the following characteristics:
 - .1 Design: Perform design, fabrication and erection of the work of this Section based on Limit States Design principles using factored loads and resistances, determined in accordance with CSA S136.
 - .2 Structural performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
 - .3 Design loads: As indicated on Drawings.
 - .4 Live load deflection meeting the following, unless otherwise indicated:
 - .1 Exterior walls: Maximum horizontal deflection under wind load of $L/600$ of span where thin brick cladding is indicated; $L/180$ elsewhere.
 - .2 Design non-axial loadbearing framing to accommodate not less than 13 mm vertical deflection.
 - .5 Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - .6 Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - .7 Soffit framing: Design steel studs support system including size and spacing of members suit soffit panels, and to accommodate expansion, contraction, dynamic movements, and wind uplift, and other applicable forces required as by the MBC.

2.3 FRAMING MATERIALS

- .1 Steel: Conforming to CSA S136; identified as to specification, type grade and mechanical properties. Provide products containing recycled content.

- .2 Studs and track: studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - .1 Thickness: As required to meet specified performance levels.
 - .2 Depth: As indicated on Drawings.
 - .3 Galvanized in accordance with ASTM A653/A653M, Z275 coating for framing components outside the exterior air/vapour barrier; Z180 elsewhere.
 - .4 Provide components fabricated from ASTM A1008/A1008M Designation SS (structural steel).
- .3 Framing connectors: Factory-made, formed steel sheet.
 - .1 Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with Z275 hot dipped galvanized coating for base metal thickness less than 3.42 mm, and factory punched holes and slots.
 - .2 Structural performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with CSA S136.
 - .3 Movement connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections at the following locations:
 - .1 Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 13 mm.
 - .2 Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 13 mm.
 - .3 Provide top track with long leg track and head of wall movement connectors; minimum track length of 3050 mm.
 - .4 Fixed connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, gusset plates, and stiffeners.
 - .5 Wall stud bridging connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on Drawings.

2.4 FASTENERS

- .1 Self-drilling, self-tapping screws, bolts, nuts and washers: Hot dip galvanized per ASTM A153/A153M.
- .2 Anchorage devices: Powder actuated, drilled expansion bolts, and screws with sleeves.

2.5 ACCESSORIES

- .1 Bracing, furring, bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- .2 Sill gasket: 6 mm thick, plate width, closed cell plastic foam from continuous rolls.
- .3 Touch up paint: Zinc rich for touching up welds and damaged metallic coating meeting requirements of CAN/CGSB 1.181

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate surfaces are ready to receive work.
- .2 Verify site measurements and adjust installation as required.

3.2 INSTALLATION OF STUDS

- .1 Fabricate and erect lightweight structural steel framing in accordance with CSSBI 51 and reviewed Shop Drawings.
- .2 Install sill gasket under bottom track of framed walls bearing on foundations.
- .3 Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 600 mm on centre. Coordinate installation of sealant with floor and ceiling tracks.
- .4 Place studs at 600 mm on centre; not more than 50 mm from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
- .5 Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- .6 Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- .7 Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- .8 Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- .9 Install intermediate studs above and below openings to align with wall stud spacing.
- .10 Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- .11 Attach cross studs to studs for attachment of fixtures anchored to walls.
- .12 Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- .13 Touch-up site welds and damaged galvanized surfaces with primer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Shop fabricated steel items.
- .2 Prefabricated fire pole and mat.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- .3 Section 09 22 16 - Non-Structural Metal Framing: Placement of metal fabrications in gypsum board partitions.
- .4 Section 09 91 00 - Painting: Paint finish.

1.3 REFERENCE STANDARDS

- .1 ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- .2 ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- .3 ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- .4 ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber 2020.
- .5 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel 2013 (Reaffirmed 2018).
- .6 CSA W47.1 - Certification of Companies for Fusion Welding of Steel 2019.
- .7 CSA W59 - Welded Steel Construction 2018.
- .8 CWB 112E - Welding Symbols Study Guide 2004.
- .9 SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- .10 SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).
- .11 SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate supports for dining table, wall-mounted counters, and benches with work of Section 06 41 00 - Architectural Wood Casework.
 - .2 Coordinate supports embedded in partition framing with Section 09 21 16 - Gypsum Assemblies.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

- .2 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - .1 Indicate welded connections using The Canadian Welding Bureau (CWB) symbols CWB 112E.
 - .2 Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
 - .1 Include the following, as applicable:
 - .1 Design criteria.
 - .2 Engineering analysis depicting stresses and deflections.
 - .3 Member sizes and gauges.
 - .4 Details of connections.
 - .5 Support reactions.
 - .6 Bracing requirements.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Welder qualifications: Submit evidence of CWB certification and welder qualifications indicating specific welding competencies associated with the type of work being performed by welders.
- .5 Fabricator's qualification statement: Use fabricator experienced in fabricating structural steel similar to that indicated for this Project and with record of successful in service performance, and sufficient production capacity to fabricate structural steel without delaying the Work.

1.6 QUALITY ASSURANCE

- .1 Design ladders under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Province in which the Project is located.
- .2 Fabricator qualifications: Fabricator certified by CWB to CSA W47.1.

Part 2 Products

2.1 MATERIALS - STEEL

- .1 General: Provide materials containing recycled content.
- .2 Steel sections: CSA G40.20/G40.21.
- .3 Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- .4 Bolts, nuts, and washers: ASTM A307, Grade A, galvanized to ASTM A153/A153M where connecting galvanized components.
- .5 Welding materials: CSA W59; type required for materials being welded.
- .6 Shop and touch-up primer: SSPC-Paint 15, complying with VOC content and emission restrictions specified in Section 01 61 16.

- .7 Touch-up primer for galvanized surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC content and emission restrictions specified in Section 01 61 16.

2.2 FABRICATION

- .1 Fit and shop assemble items in largest practical sections, for delivery to site.
- .2 Fabricate items with joints tightly fitted and secured.
- .3 Continuously seal joined members by intermittent welds and plastic filler.
- .4 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- .5 Exposed mechanical fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- .6 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FABRICATED ITEMS

- .1 Ladders: Steel; with mounting brackets and attachments; prime paint finish for roof hatch access ladder. Refer to Drawings for configuration.
- .2 Ladder safety cage: Steel; with mounting brackets and attachments; prime paint finish.
 - .1 Provide primary hoops at tops and bottoms of cages. Provide secondary intermediate hoops spaced not more than 1200 mm o.c. between primary hoops.
 - .2 Fasten assembled safety cage to ladder rails and adjacent construction by welding or with bolted fasteners unless otherwise indicated.
- .3 Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- .4 Dining table legs, miscellaneous supports and brackets: Steel, formed to profiles indicated or as required. Pre-drill for countersunk screw, bolts, and other fasteners. Prime paint finish.
- .5 Wall-hung counter and vanity top supports: CSA G40.20/G40.21 steel angles with anchoring devices, and size as indicated Shop Drawings, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish. Where indicated, conceal supports within gypsum board partition cavity.

2.4 PREFABRICATED FIRE POLE

- .1 Fire pole: Stationary stainless steel pole, maximum 63.5 mm diameter, wall thickness based on diameter and length, complete with ceiling and floor flanges, and landing mat.
 - .1 Mat: Closed-cell black neoprene to ASTM D1056; 50 mm thick by 813 mm dia., dove-tailed.
 - .2 Product:
 - .1 McIntire Brass Works, Inc. Model 19.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.5 FINISHES - STEEL

- .1 Prime paint steel items.
 - .1 Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.

- .2 Exceptions: Do not prime surfaces in direct contact with concrete, where site welding is required, and items to be covered with sprayed fireproofing.
- .2 Prepare surfaces to be primed in accordance with SSPC-SP 3.
- .3 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- .4 Prime painting: One coat.
- .5 Galvanizing of non-structural items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.6 FABRICATION TOLERANCES

- .1 Squareness: 3 mm maximum difference in diagonal measurements.
- .2 Maximum offset between faces: 1.5 mm.
- .3 Maximum misalignment of adjacent members: 1.5 mm.
- .4 Maximum bow: 3 mm in 1.2 m.
- .5 Maximum deviation from plane: 1.5 mm in 1.2 m.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- .1 Clean and strip primed steel items to bare metal where site welding is required.
- .2 Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

- .1 Install items plumb and level, accurately fitted, free from distortion or defects.
- .2 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- .3 Site weld components as indicated on Shop Drawings.
- .4 Perform site welding in accordance with CSA W59.
- .5 Obtain approval prior to site cutting or making adjustments not scheduled.
- .6 After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- .7 Touch-up galvanized surfaces with galvanizing repair paint.

3.4 TOLERANCES

- .1 Maximum variation from plumb: 6 mm per story, non-cumulative.
- .2 Maximum offset from true alignment: 6 mm.
- .3 Maximum out-of-position: 6 mm.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Stairs with preformed grating treads.
- .2 Structural steel stair framing and supports.
- .3 Handrails and guards.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 03 30 00 - Cast-in-Place Concrete: Placement of sleeves in concrete.
- .3 Section 05 52 13 - Pipe and Tube Railings: Metal handrails and balusters other than specified in this section.
- .4 Section 09 91 00 - Painting: Paint finish.

1.3 REFERENCE STANDARDS

- .1 ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- .2 ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- .3 ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- .4 ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- .5 ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- .6 ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, Metric Dimensions 830 MPa and 1040 MPA Minimum Tensile Strength 2022.
- .7 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel 2013 (Reaffirmed 2018).
- .8 CSA S16 - Design of Steel Structures 2019.
- .9 CSA W47.1 - Certification of Companies for Fusion Welding of Steel 2019.
- .10 CSA W59 - Welded Steel Construction 2018.
- .11 CSA W178.1 - Certification of Welding Inspection Organizations 2018.
- .12 CSA W178.2 - Certification of Welding Inspectors 2014.
- .13 CWB 112E - Welding Symbols Study Guide 2004.
- .14 NAAMM AMP 510 - Metal Stairs Manual 1992.
- .15 NAAMM MBG 531 - Metal Bar Grating Manual 2017.
- .16 NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual 2009.
- .17 SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

- .18 SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).
- .19 SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide product data for preformed grating stair treads.
- .3 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - .1 Indicate welded connections using The Canadian Welding Bureau (CWB) symbols (CWB 112E).
 - .2 Include the design engineer's seal and signature on each sheet of Shop Drawings.
- .4 Design data: As required by authorities having jurisdiction.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Welders' certificates: Comply with applicable CWB standards for classification of work being performed.
- .7 Designer's qualification statement.
- .8 Fabricator's qualification statement: Provide documentation of the required years of experience.

1.5 QUALITY ASSURANCE

- .1 Structural designer qualifications: Professional Structural Engineer experienced in design of this work and licensed in the Province in which the Project is located, or personnel under direct supervision of such an engineer.
- .2 Welder qualifications: Show certification of welders employed on the Work, verifying CWB qualification within the previous 12 months.
- .3 Fabricator qualifications:
 - .1 A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

Part 2 Products

2.1 METAL STAIRS - GENERAL

- .1 Regulatory requirements: Provide design, materials and fabrication in accordance with CSA S16 and NAAMM AMP 510 and Canadian Welding Bureau certification requirements.
 - .1 Fabricator certified by Canadian Welding Bureau to CSA W47.1.
 - .2 Perform welding review in accordance with CSA W178.1 and CSA W178.2.

- .2 Metal stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
 - .1 Structural design: Provide complete stair and railing assemblies complying with the following:
 - .1 Stair capacity: Uniform live load of 4.8 kPa and a concentrated load of 4.8 kN with deflection of stringer or landing framing not to exceed 1/360 of span.
 - .2 Dimensions: As indicated on Drawings.
 - .3 Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 - .4 No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 - .5 Separate dissimilar metals using paint or permanent tape.
 - .3 Metal jointing and finish quality levels:
 - .1 Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
 - .1 Welded joints: Welded on back side wherever possible.
 - .2 Welds exposed to view: Ground smooth; not required to be flush.
 - .3 Bolts exposed to view: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
 - .4 Metal surfaces to be painted: Sanded smooth, suitable for satin or matte finish.
 - .4 Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
 - .5 Anchors and related components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.2 METAL STAIRS WITH GRATING TREADS

- .1 Jointing and finish quality level: Service, as defined above.
- .2 Risers: Open.
- .3 Treads: Preformed steel bar grating.
 - .1 Grating type: Welded.
 - .2 Bearing bar size: 32 high by 4.7 mm thick, minimum.
 - .3 Spacing: 19-W-4.
 - .4 Top surface: Serrated.
 - .5 Nosing: Checkered plate.
 - .6 Nosing width: 32 mm, minimum.
 - .7 Anchorage to stringers: End plates welded to grating, bolted to stringers.
 - .8 Finish: Galvanized after fabrication.
- .4 Stringers: Rolled steel channels.
 - .1 Stringer depth: 250 mm.
 - .2 End closure: Sheet steel of same thickness as risers welded across ends.
 - .3 Finish: Shop primed; site painted.

- .5 Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- .6 Railings: Steel pipe railings.

2.3 HANDRAILS AND GUARDS

- .1 Stringer- and wall-mounted rails: Round HSS, pipe or tube rails unless otherwise indicated.
 - .1 Outside diameter: 38 mm.
 - .2 Finish: Shop primed; site painted.
- .2 Guards:
 - .1 Top and intermediate rails: Round HSS, pipe or tube rails unless otherwise indicated.
 - .1 Outside diameter: 38 mm.
 - .2 Infill at pipe railings: Pipe or tube rails sloped parallel to stair; horizontal at guards.
 - .1 Outside diameter: 38 mm.
 - .2 Material: Steel pipe or tube, round.
 - .3 Vertical spacing: As indicated.
 - .4 Jointing: Welded and ground smooth and flush.
 - .3 End and intermediate posts: Same material and size as top rails.
 - .1 Horizontal spacing: As indicated on Drawings.
 - .2 Mounting: Welded to top surface of stringer, or welded to sleeve cast into concrete topping when installed in concrete.
 - .4 Finish: Shop primed; site painted.

2.4 MATERIALS

- .1 General: Provide materials containing recycled content.
- .2 Steel sections and plate: CSA G40.20/G40.21.
- .3 Steel tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- .4 Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- .5 Preformed bar grating stair treads: Standard-duty welded bar grating stair treads, preassembled from hot-dip galvanized steel, complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes, complete with carrier plates for bolted connection to stringers, and checkerplate nosing.
 - .1 Surface: Serrated.
 - .2 Finish: Mill finished.
 - .3 Tread depth: 278 mm.
 - .4 Tread width: 762 mm.
 - .5 Basis-of-Design Product:
 - .1 McNicols; 640431T662.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.5 ACCESSORIES

- .1 Steel bolts, nuts, and washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
- .2 Welding materials: CSA W59; type required for materials being welded.
- .3 Shop and touch-up primer: SSPC-Paint 15, complying with VOC content and emission restrictions specified in Section 01 61 16.
- .4 Touch-up primer for galvanized surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC content and emission restrictions specified in Section 01 61 16.

2.6 SHOP FINISHING

- .1 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- .2 Do not prime surfaces in direct contact with concrete or where site welding is required.
- .3 Prime painting: Use specified shop- and touch-up primer.
 - .1 Preparation of steel: In accordance with SSPC-SP 3 - Power Tool Cleaning.
 - .2 Number of coats: One.
- .4 Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
 - .1 Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- .1 When site welding is required, clean and strip primed steel items to bare metal.
- .2 Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.3 INSTALLATION

- .1 Install components plumb and level, accurately fitted, free from distortion or defects.
- .2 Provide anchors, plates, angles, hangers, struts, and sleeves required for connecting stairs to structure.
- .3 Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- .4 Provide welded site joints where specifically indicated on Shop Drawings. Perform site welding in accordance with CSA W59.
- .5 Other site joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- .6 Obtain approval prior to site cutting or creating adjustments not scheduled.
- .7 After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.4 TOLERANCES

- .1 Maximum variation from plumb: 6 mm per story, non-cumulative.
- .2 Maximum offset from true alignment: 6 mm.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Wall mounted handrails.
- .2 Stair railings and guardrails, other than railings at metal stairs.
- .3 Mezzanine and fire pole platform railings and guardrails.
- .4 Guardrail at 201 Outdoor Area.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 03 30 00 - Cast-in-Place Concrete: Placement of sleeves in concrete.
- .3 Section 04 20 00 - Unit Masonry: Placement of anchors in masonry.
- .4 Section 05 51 00 - Metal Stairs: Handrails other than those specified in this section.
- .5 Section 09 21 16 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
- .6 Section 09 91 00 - Painting: Paint finish.

1.3 REFERENCE STANDARDS

- .1 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel 2013 (Reaffirmed 2018).
- .2 CSA S16 - Design of Steel Structures 2019.
- .3 CSA W47.1 - Certification of Companies for Fusion Welding of Steel 2019.
- .4 CWB 112E - Welding Symbols Study Guide 2004.
- .5 SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- .6 SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).
- .7 SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - .1 Indicate welded connections using The Canadian Welding Bureau (CWB) symbols (CWB 112E).
 - .2 Include the design engineer's seal and signature on each sheet of Shop Drawings.
- .3 Samples: Submit two samples of gate hardware.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Designer's qualification statement.
- .6 Fabricator's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Structural designer qualifications: Professional Structural Engineer experienced in design of this work and licensed in the Province in which the Project is located, or personnel under direct supervision of such an engineer.
- .2 Welder qualifications: Show certification of welders employed on the Work, verifying CWB qualification within the previous 12 months.
- .3 Fabricator qualifications:
 - .1 A qualified steel fabricator that is certified by the Canadian Institute for Steel Construction (CISC).
 - .2 Fabricator: Certified to CSA W47.1.
 - .3 A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

Part 2 Products

2.1 RAILINGS - GENERAL REQUIREMENTS

- .1 Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of CSA S16, and applicable Building Code.
- .2 Concentrated loads: In accordance with applicable Building Code, design railing assembly, wall rails, and attachments to resist a concentrated force of 0.9 kN applied at any point on the top of the assembly and in any direction, without damage or permanent set.
- .3 Uniform loads: In accordance with applicable Building Code, design railing assembly, wall rails, and attachments to resist a uniform load of not less than 0.7 kN/m applied in any direction to the railing assembly.
- .4 Allow for expansion and contraction of members and building movement without damage to connections or members.
- .5 Dimensions: See Drawings for configurations.
 - .1 Top, bottom and intermediate rails, and wall-mounted rails: 38 mm diameter, round.
 - .2 Posts: 38 mm diameter, round.
 - .3 Pickets:
 - .1 Guard at Stair S-1 and S-2: 13 mm diameter solid bar.
 - .2 Guard at exterior railing: Flat bar.
- .6 Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - .1 For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
 - .2 For anchorage to stud walls, provide backing plates, for bolting anchors.
 - .3 Posts: Provide sleeves to be cast into concrete, for site welding of posts.

- .7 Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.2 STEEL RAILING SYSTEM

- .1 General: Provide materials containing recycled content.
- .2 Hollow, and rolled steel sections and plate: CSA G40.20/G40.21, Grade 300W.
- .3 Welding fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- .4 Exposed fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- .5 Gate hardware:
 - .1 Hinges: Self-closing, spring loaded, quantity and size to suit gate weight.
 - .2 Stop: Steel plate
- .6 Shop and touch-up primer: SSPC-Paint 15, complying with VOC content and emission restrictions specified in Section 01 61 16.

2.3 FABRICATION

- .1 Accurately form components to suit specific project conditions and for proper connection to building structure.
- .2 Fit and shop assemble components in largest practical sizes for delivery to site.
- .3 Fabricate components with joints tightly fitted and secured.
- .4 Welded joints:
 - .1 Exterior components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - .2 Interior components: Continuously seal joined pieces by intermittent welds and plastic filler.
 - .3 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.4 SHOP FINISHING

- .1 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- .2 Do not prime surfaces in direct contact with concrete or where site welding is required.
- .3 Prime painting: Use specified shop- and touch-up primer.
 - .1 Preparation of steel: In accordance with SSPC-SP 3 for interior components, SSPC-SP 6 for exterior components.
 - .2 Number of coats: One.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- .1 Clean and strip primed steel items to bare metal where site welding is required.
- .2 Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.3 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- .3 Anchor railings securely to structure.
 - .1 Weld guards to top of HSS at fire pole platforms, hose wash landings, and hose wash mezzanine.
 - .2 Weld posts to sleeves set in concrete where guard or railing is installed in concrete.
- .4 Site weld anchors as indicated on Shop Drawings. Touch-up welds with primer. Grind welds smooth.
- .5 Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

- .1 Maximum variation from plumb: 6 mm per floor level, non-cumulative.
- .2 Maximum offset from true alignment: 3 mm.
- .3 Maximum out-of-position: 3 mm.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Interior and exterior fabrications made of formed metal sheet and plate, secondary supports, and anchors to structure, including:
 - .1 Closures, trim, and filler panels.
 - .2 Door controller mounting plates.
 - .3 Soffit vents.
 - .4 Exterior aluminum plate top caps.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 05 50 00 - Metal Fabrications: Non-decorative metal fabrications.
- .3 Section 07 42 13.23 - Metal Composite Material Wall Panels: Supply of metal composite sheet material for decorative formed metal components.
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim: Formed metal flashings and trim.
- .5 Section 07 64 13 - Standing Seam Metal Wall Cladding: Flashing, trim, and closures associated with metal wall cladding.

1.3 REFERENCE STANDARDS

- .1 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- .2 ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- .3 NAAMM AMP 500-06 - Metal Finishes Manual 2006.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - .1 Show actual site measurements on Shop Drawings.
 - .2 Differentiate between shop and site fabrication.
 - .3 Indicate substrates and adjacent work with which the fabrications must be coordinated.
 - .4 Include large-scale details of anchorages and connecting elements.
 - .5 Include large-scale details or schematic, exploded or isometric diagrams to fully explain fabrication.
- .3 Verification samples: For each finish product specified, minimum size 300 mm square, representing actual product in colour and texture, including attachment hardware.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.

- .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Fabricator's qualification statement.
- .6 Maintenance data: Care of finishes and warranty requirements.

1.5 QUALITY ASSURANCE

- .1 Fabricator qualifications: Company specializing in fabricating products specified in this section.
 - .1 For CMP decorative formed metal items: Approved by CMP sheet manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Exercise care in unloading, storing and installing decorative formed metals to prevent bending, warping, twisting and surface damage.
- .2 Avoid contact with other materials that might cause staining, denting, or other surface damage.

Part 2 Products

2.1 FORMED METAL FABRICATIONS - GENERAL

- .1 Shop assembly: Preassemble items to greatest extent possible. Minimize site splices and site assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.
- .2 Coordination: Match dimensions and attachment of formed metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.
- .3 Forming: Profiles indicated. Maximize lengths. Fold exposed edges to form hem indicated or ease edges to radius indicated with concealed stiffener. Provide flat, flush surfaces without cracking or grain separation at bends.
- .4 Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.
- .5 Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.
- .6 Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.
- .7 Welding and brazing: Weld or braze joints continuously. Grind, fill or dress to produce smooth, flush, exposed surfaces. Do not discolour metal. Grind smooth, polish, and restore damaged finishes to required condition.
 - .1 Ease exposed edges to small uniform radius.
- .8 Performance requirements:
 - .1 Thermal movements:
 - .1 Allow for thermal movements in exterior decorative metal fabrications due to temperature changes. Prevent buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

- .2 Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

2.2 FORMED METAL FABRICATIONS - SHEET METAL

- .1 General: Provide materials containing recycled content.
- .2 Closures, trim and fill panels:
 - .1 Form closures from type and thickness of metal indicated.
 - .2 Conceal fasteners when possible.
 - .3 Drill and tap holes for securing to other surfaces.
 - .4 Provide gaskets where indicated or needed for continuous seal at adjacent surfaces.
 - .5 Mitre or cope at corners and reinforce with bent metal plate. Form tight joints.
- .3 Soffit vents: Form soffit vents from prefinished perforated sheet aluminum, minimum 1.27 mm thick, to profiles indicated. Conceal fasteners. Coordinate anchoring with adjacent construction.
 - .1 Perforations: 3 mm dia. on 4.76 mm staggered centres (60 degree stagger).
 - .2 Open area: 40 percent.
 - .3 Finish: Powder coated, colour black.

2.3 FORMED METAL FABRICATIONS - CMP SHEET

- .1 CMP material supplied under Section 07 42 13.23 - Metal Composite Material Wall Panel.
- .2 CMP sheet fabrications, general: Assemble metal panels, fasteners, and anchors in configurations and dimensions shown on Drawings.
 - .1 Anchor panels to supporting framing without exposed fasteners.
- .3 Panels: Formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
 - .1 Reinforce corners with riveted aluminum angles.
 - .2 Provide concealed attachment to supporting structure by securing attachment clips to back of panel with pre-applied tape; attachment members may also function as stiffeners.
 - .3 Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
 - .4 Fabricate panels under controlled shop conditions.
 - .5 Where final dimensions cannot be established by site measurement before commencement of manufacturing, make allowance for site adjustments without requiring site fabrication of panels.
 - .6 Fabricate as indicated on Drawings and as recommended by CMP sheet manufacturer.
 - .1 Make panel lines, breaks, curves and angles sharp and true.
 - .2 Keep plane surfaces free from warp or buckle.
 - .3 Keep panel surfaces free of scratches or marks caused during fabrication.

2.4 SOLID METAL PLATE FABRICATIONS

- .1 Wall top caps:
 - .1 Factory fabricated and factory finished, solid metal plate top caps.
 - .1 Provide concealed attachment to supporting structure.
 - .2 Fabricate as indicated on Drawings, in single-length piece per location.
 - .3 Dress exposed edges and ends of metal smooth, and free from sharp edges
 - .2 Material: Aluminum plate to ASTM B209M, alloy 3003-H14, minimum 4.76 mm thick, minimum.
 - .3 Aluminum finish: Factory applied PVDF coating to AAMA 2605. Finish face and edges of panels.
 - .4 Colour: Custom colour to match glazed brick.

2.5 MATERIALS

- .1 General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolouration, or other imperfections exposed to view on finished units.
- .2 Aluminum sheet and plate: ASTM B209M, 5005-H32 minimum; alloy and temper recommended by aluminum producer and finisher for use and finish indicated. Provide material having recycled content.
- .3 Metal composite material (CMP) sheet: Supplied under Section 07 42 13.23.
- .4 Fasteners, General: Same basic metal and alloy as formed metal sheet unless indicated otherwise. Do not use metals incompatible with the materials joined.
 - .1 Of type, material, size, quantity, corrosion resistance, holding power, and other properties required to fasten and support decorative formed metal components to substrates.
- .5 Z-clip system for CMP panels: Extruded aluminum clip and rail system, maximum projection 7.4 mm, maximum lift-off 12 mm, mechanically-fastened rail, 3M VHB tape pre-applied to clip for peel-and-stick application on back of CMP panel.
 - .1 Products: Monarch Metal VHB Clip.
- .6 Gaskets: As required to seal joints in decorative formed metal and remain weathertight; as recommended in writing by decorative formed metal manufacturer.
- .7 Isolation coating: Manufacturer's alkali-resistant coating, complying with VOC content and emission restrictions specified in Section 01 61 16.

2.6 FINISHES

- .1 Finishes, General: Comply with NAAMM AMP 500-06.
 - .1 Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions and surface blemishes to match sheet.
 - .2 Protect mechanical finishes on exposed surfaces from damage.
 - .3 Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
 - .4 Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

- .2 Aluminum finishes:
 - .1 Superior performing organic coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
 - .2 Colour: As indicated.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify dimensions, tolerances, and interfaces with other work.
- .2 Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
- .3 If substrate preparation is responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.
- .4 Notify Contract Administrator in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Protect adjacent work areas and finish surfaces from damage during installation.

3.3 INSTALLATION - SHEET METAL AND PLATE FABRICATIONS

- .1 Locate and place decorative formed sheet metal items level and plumb; align with adjacent construction. Cut, drill and fit as required to install.
- .2 Do not cut or abrade sheet metal finishes that cannot be completely restored in the site. Return such items to manufacturer or fabricator for required alterations and refinishing or provide new items.
- .3 Use concealed anchorages where possible. Provide washers where needed on bolts or screws to protect metal surfaces and make weathertight connection.
- .4 Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers indicated.
- .5 Install gaskets, joint fillers, insulation, sealants, and flashings as work progresses.
 - .1 Make exterior decorative formed sheet metal items weatherproof.
 - .2 Make interior decorative formed metal items soundproof or lightproof as required.
- .6 Corrosion protection: Apply permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with incompatible substrate materials. Prevent corrosion damage to material and finish.

3.4 INSTALLATION - CMP FABRICATIONS

- .1 Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- .2 Comply with instructions and recommendations of CMP sheet manufacturer and fabricator, and with approved Shop Drawings.
- .3 Install securely allowing for necessary thermal and structural movement; comply with fabricator's instructions for installation of concealed fasteners.

- .4 Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- .5 Do not form panels on site unless required by fabricator and approved by the Contract Administrator; comply with CMP sheet manufacturer's instructions and recommendations for site forming.
- .6 Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- .7 Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
 - .1 Variation from plane or location: 13 mm in 9.0 m of length and up to 19 mm in 92 m, maximum.
 - .2 Deviation of vertical member from true line: 3.2 mm in 7.5 m run, maximum.
 - .3 Deviation of horizontal member from true line: 3.2 mm in 7.5 m run, maximum.
 - .4 Offset from true alignment between two adjacent members abutting end to end, in line: 0.8 mm, maximum.
- .8 Replace damaged products.

3.5 CLEANING

- .1 Restore finishes damaged during installation and construction period. Return items that cannot be refinished on site to manufacturer or fabricator. Refinish entire unit or provide new units.
- .2 Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- .3 Remove temporary coverings and protection of adjacent work areas.
- .4 Clean installed products in accordance with manufacturer's instructions.

3.6 PROTECTION

- .1 Protect installed products from damage during construction.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Non-structural dimension lumber framing.
- .2 Rough opening framing for doors, windows, and roof openings.
- .3 Sheathing.
- .4 Roof-mounted curbs.
- .5 Preservative treated wood materials.
- .6 Miscellaneous framing and sheathing.
- .7 Communications and electrical room mounting boards.
- .8 Concealed wood blocking, nailers, and supports.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 06 18 00 - Glued-Laminated Construction.

1.3 REFERENCE STANDARDS

- .1 ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- .2 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .3 CAN/CSA O80 Series - Wood Preservation 2015.
- .4 CAN/CSA O121 - Douglas Fir Plywood 2017 (Reaffirmed 2022).
- .5 CAN/CSA O141 - Softwood Lumber 2005 (Reaffirmed 2019).
- .6 CSA O325 - Construction Sheathing (Adopted NIST PS 2-18 , with Canadian Deviations) 2021.
- .7 NLGA (SGRNL) - Standard Grading Rules for Canadian Lumber 2017.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide technical data on wood preservative materials and application instructions.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to sustainably harvested wood; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

Part 2 Products

2.1 GENERAL REQUIREMENTS

- .1 Dimension lumber: Comply with CAN/CSA O141 and requirements of specified grading agencies.
 - .1 If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
- .2 Lumber fabricated from old growth timber is not permitted.
- .3 Provide sustainably harvested wood, third-party certified or labeled; see Section 01 61 00 - Product Requirements for requirements.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- .1 Grading agency: National Lumber Grading Authority NLGA (SGRNL)
- .2 Sizes: Nominal sizes as indicated on Drawings, S4S.
- .3 Moisture content: S-dry or MC19.
- .4 Stud framing (38 by 38 mm through 38 by 140 mm):
 - .1 Grade: No. 2.
- .5 Joist and small beam framing (38 by 140 mm through 89 by 390 mm): As indicated on structural Drawings.
- .6 Miscellaneous framing, blocking, nailers, grounds, and furring:
 - .1 Lumber: S4S, No. 2 or Standard Grade.
 - .2 Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

- .1 Roof, parapet, and soffit sheathing: Thickness indicated; meeting requirements of CSA O325
 - .1 Material: Douglas Fir Plywood, CAN/CSA O121
 - .2 Bond classification: Exterior
 - .3 Grade: SHG
- .2 Telecommunications, data and electrical room mounting boards: Plywood sheathing.
 - .1 Material: Douglas Fir Plywood, CAN/CSA O121.
 - .2 Thickness: 19 mm.
 - .3 Bond classification: Exterior.
 - .4 Grade: G1S.
 - .5 End use mark: W.
 - .6 Flame spread: Surface applied fire retardant coated, limiting flame spread to FS25 when tested in accordance with CAN/ULC S102.
- .3 Other applications:

- .1 Plywood concealed from view, located within exterior enclosure: Douglas Fir Plywood, CAN/CSA O121, Grade SHG, Exterior.

2.4 ACCESSORIES

- .1 Fasteners and anchors:
 - .1 Metal and finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - .2 Anchors: Toggle bolt type for anchorage to hollow masonry.
- .2 Joist hangers: Hot dipped galvanized steel, sized to suit framing conditions.
 - .1 For contact with preservative treated wood in exposed locations, provide minimum Z550 galvanizing complying with ASTM A653/A653M.

2.5 FACTORY WOOD TREATMENT

- .1 Treated lumber and plywood: Comply with requirements of CAN/CSA O80 Series - Use Category System for wood treatments determined by use categories, expected service conditions and specific applications.
 - .1 Preservative-treated wood: Mark each piece of wood with producer's stamp certifying level and type of treatment in accordance with CAN/CSA O80 Series.
- .2 Preservative treatment:
 - .1 Exterior, preservative pressure treatment of lumber and plywood, No Ground Contact (UC3): CAN/CSA O80 Series, with Use Category UC3A, Commodity Specification A using waterborne preservative .
 - .1 Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - .2 Treat lumber exposed to weather.
 - .3 Treat lumber in contact with roofing, flashing, or waterproofing.
 - .4 Treat lumber in contact with masonry or concrete.
 - .5 Treat lumber less than 450 mm above grade.
 - .6 Treat lumber in other locations as indicated.
 - .2 Preservative for site application to cut surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application on site; and complying with VOC content and emission restrictions specified in Section 01 61 16.

Part 3 Execution

3.1 PREPARATION

- .1 Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

- .1 Select material sizes to minimize waste.
- .2 Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- .3 Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

- .1 Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- .2 In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- .3 In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- .4 Provide the following specific non-structural framing and blocking:
 - .1 Cabinets and shelf supports.
 - .2 Wall brackets.
 - .3 Handrails.
 - .4 Grab bars.
 - .5 Towel and bath accessories.
 - .6 Wall-mounted door stops.
 - .7 Marker boards.

3.4 INSTALLATION OF CONSTRUCTION PANELS

- .1 Wall sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.
- .2 Communications and electrical room mounting boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 610 mm on center on all edges and into studs in field of board.
 - .1 At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - .2 Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - .3 Install adjacent boards without gaps.
 - .4 Size and location: As indicated on Drawings.

3.5 SITE APPLIED WOOD TREATMENT

- .1 Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- .2 Allow preservative to dry prior to erecting members.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry

1.2 REFERENCES

- .1 American National Standards Institute/National Particleboard Association (ANSI/NPA)
 - .1 ANSI/APA PRG 320-2017: Standard for Performance-Rated Cross-Laminated Timber.
- .2 American Society of Mechanical Engineers (ASME)
 - .1 ASME B18.2.1-2012 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws.
- .3 ASTM International
 - .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A47/A47M-99 (2014), Standard Specification for Ferritic Malleable Iron Castings.
 - .3 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .4 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - .5 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 CSA International
 - .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
 - .2 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
 - .3 CSA O86 Consolidation-14, Engineering Design in Wood.
 - .4 CSA O112.9-10 (R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
 - .5 CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
 - .6 CAN/CSA-O122-16, Structural Glued-Laminated Timber.
 - .7 CSA O177-06 (R2015), Qualification Code for Manufacturer's of Structural Glued-Laminated Timber.
 - .8 CSA S16-14, Design of Steel Structures.
 - .9 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures
- .5 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-V52-2-2015, FSC Principles and Criteria for Forest Stewardship.
- .6 Green Seal Environmental Standards (GS)
 - .1 GS-11-11, Paints and Coatings.
- .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-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .9 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual – current edition.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section on-site installation, with Contract Administrator, Construction Manager and CLT supplier & contractor 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 building subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.
 - .2 Hold project meetings every week, or as project requires.
 - .3 Ensure key personnel attend.
 - .4 Contract Administrator will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled 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 for glue-laminated and cross-laminated construction and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional Contract Administrator registered or licensed in Province of Manitoba, Canada.
 - .2 Submit erection drawings in accordance with CSA O86 & CSA S16.
 - .3 Shop drawings for members: indicate stress grade, service grade and appearance grades, shop applied finishes, camber, cuts, ledgers, holes and connection details.
- .3 Samples:
 - .1 Submit for review and acceptance of each finish.
 - .2 Samples returned for inclusion into work.
 - .3 Submit 2 samples of connector plates.
- .4 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

- .5 Test and Evaluation Reports: submit certified test reports from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
- .7 Manufacturer's Reports:
 - .1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 – FIELD QUALITY CONTROL.
 - .3 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements.
 - .1 .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes .

1.5 **QUALITY ASSURANCE**

- .1 Qualifications :
 - .1 Manufacture structural glued-laminated and cross-laminated members in plant certified as meeting requirements by a certification agency accredited by the Standards Council of Canada.
 - .2 Fabricator for welded steel connections certified to CSA W47.1.
 - .3 Certification of material protective sealer.

1.6 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 –Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Apply protective sealer to glued-laminated and cross-laminated units before shipping unless specified otherwise.
 - .3 Wrap architectural classification grade members prior to leaving plant with a moisture resistant wrapping.
 - .4 Use padded, non-marring slings for handling glued-laminated and cross-laminated members.
 - .5 Protect corners with wood blocking.
 - .6 Make adequate provision for delivery and handling stresses.
- .3 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 and cross-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 and cross-laminated units with opaque moisture resistant membrane if stored outside.
- .5 Store and protect glued-laminated and cross-laminated products from nicks, scratches, and blemishes.
- .6 Replace defective or damaged materials with new.

Part 2 Products

2.1 STRUCTURAL MATERIALS

- .1 Provide sustainably harvested wood, certified or labeled as specified in Section 01 60 00.
- .2 Laminating stock:
 - .1 Glued-laminated: Spruce-Pine-Fir, to the product report published by a certification agency accredited by the Standards Council of Canada.
 - .2 Cross-laminated: Spruce-Pine-Fir, to the product report published by a certification agency accredited by the Standards Council of Canada.
 - .3 FSC certified.
- .3 Laminating Adhesive:
 - .1 To CSA O112.9/ CSA O112.10, to grade of service required in accordance with CAN/CSA-O122.
 - .2 Urea-formaldehyde free.
 - .3 VOC limit: 50 g/L maximum to SCAQMD Rule 1168.
- .4 Sealer for glued-laminated and cross-laminated members: penetrating type, clear, non-yellowing liquid.
 - .1 VOC limit: 550 g/L maximum to SCAQMD Rule 1113.
- .5 Fastenings:
 - .1 Split ring connectors: hot rolled carbon steel, SAE 1010, in accordance with SAE Handbook.
 - .2 Shear plate connectors:
 - .1 Pressed steel type: hot rolled carbon steel, SAE 1010, in accordance with SAE Handbook.
 - .2 Malleable iron type: to ASTM A47/A47M, grade 350.
 - .3 Lag screws: to ASME B18.2.1.
 - .4 Bolts: to ASTM A307.
 - .5 Side plates: to ASTM A36 CSA G40.20/G40.21.
 - .6 Drift pins: to ASTM A307.
 - .7 Glued-laminated timber rivets: hot dipped galvanized, to ASTM A36 & CSA G40.20/G40.21.
 - .8 Nails and spikes: to CSA B111.
 - .9 Wood screws: to ASME B18.2.1.
- .5 Shop coat primer for steel connections: to MPI #18.

2.2 FABRICATION

- .1 Fabricate members to following classifications:

- .1 Stress grade:
 - .1 Glued-laminated timber: bending, compression and/or tension members 24F-ES/NPG (beams, columns, and ties) minimum and 20F-ES/CPG for decking, unless otherwise noted on structural drawings, to the product report published by a certification agency accredited by the Standards Council of Canada.
 - .2 Cross-laminated timber: bending, compression and/or tension members E1 (slabs and panels), to the product report published by a certification agency accredited by the Standards Council of Canada.
- .2 Mark glued-laminated and cross-laminated members for identification during erection. Marks not visible in final assembly.
- .3 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.
- .4 Prime paint connections after fabrication.

2.3 FACTORY FINISHING

- .1 Applying sealer to areas to receive stained finish or preservative treatments is prohibited.
- .2 Apply one coat of wax emulsion to end grain and one coat of sealer to remainder of members.
- .3 Prepare steel connection surfaces to applicable requirements of Section 05 50 00.
- .4 Prime paint connection steel after fabrication.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glued-laminated and cross-laminated material installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Contract Administrator.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Contract Administrator.

3.2 ERECTION

- .1 Protect protective sealer from damage before erection.
 - .1 Touch up damaged areas on site with specified sealer.
- .2 Erect glued-laminated and cross-laminated members in accordance with reviewed erection drawings.
- .3 Brace and anchor members until permanently secured by structure.
- .4 Make adequate provisions for erection stresses.
- .5 Splice and join only at locations as indicated on reviewed erection drawings.

- .6 Field cutting or altering members without Contract Administrator's approval is prohibited. If approved, preservative treat cut ends.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of product.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Ensure manufacturer's representative present before and during critical periods of installation, construction of field joints & testing.
 - .4 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 During progress of Work at stages determined with manufacturer prior to commencing construction.
 - .3 Upon completion of Work, after cleaning carried out.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning and Waste Processing.
 - .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 and Waste Processing.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction (by the general contractor).
- .2 Repair damage to adjacent materials caused by glued-laminated and cross-laminated construction installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Exterior finish carpentry items, including wood soffits and wood board wall cladding

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 00 - Demolition: Salvage of existing roof decking.
- .2 Division 21 - Fire Suppression: Sprinkler piping.

1.3 REFERENCE STANDARDS

- .1 NLGA (SGRNL) - Standard Grading Rules for Canadian Lumber 2017.
- .2 WWPA - Grading Rules Western Wood Products Association.

1.4 PRICE AND PAYMENT PROCEDURES

- .1 Separate prices:
 - .1 See Tender No. 543-2022B; Part B – Bidding Procedures and Form B Prices, for separate prices affecting this section.
 - .2 This section includes base bid items and separate price items.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate salvage of existing wood roof decking with subtrade responsible for demolition of existing buildings.
 - .2 Coordinate cutouts for sprinkler heads in wood soffit panels.

1.6 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- .3 Samples: Submit two samples of wood boards for soffit and cladding 300 mm long, and duplicate exposed panel fasteners.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to sustainably harvested wood; compliance with VOC-content and VOC-emission requirements; and evidence of reuse of existing structures and materials.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Fabricator's qualification statement.

1.7 QUALITY ASSURANCE

- .1 Fabricator qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect work from moisture damage.

Part 2 Products

2.1 FINISH CARPENTRY ITEMS

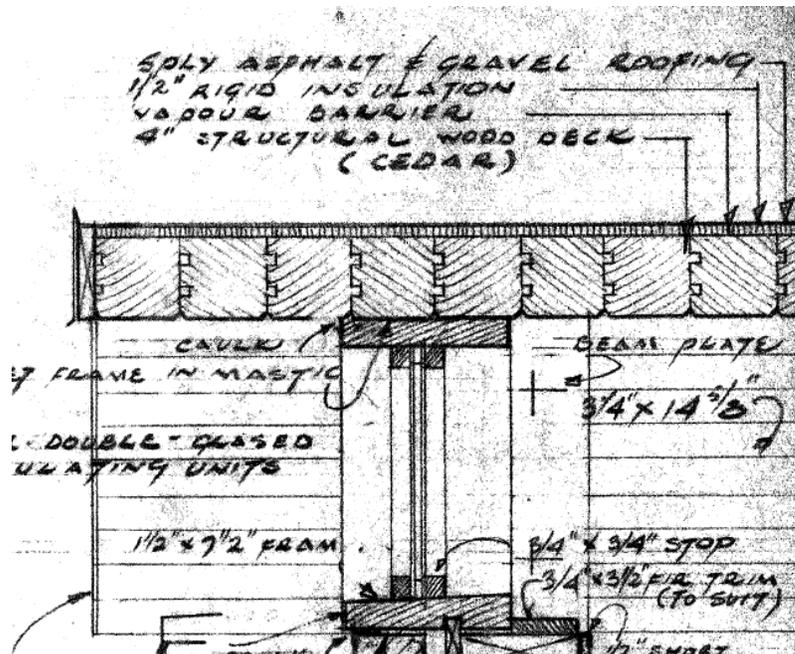
- .1 Exterior woodwork items:
 - .1 Base Bid - Wood cladding on wing walls: Cut from salvaged wood roof decking; prepare for clear finish.
 - .2 Base Bid - Wood soffits: Cut from salvaged wood roof decking; prepare for clear finish.
- .2 Separate Price - In the event it is not feasible to salvage, remove fasteners, cut and prepare existing wood decking to desired profiles, provide new materials as specified.

2.2 WOOD-BASED COMPONENTS

- .1 New wood components fabricated from old growth timber is not permitted.
- .2 New wood components: Provide sustainably harvested wood, third-party certified or labeled; see Section 01 61 00 - Product Requirements for requirements.

2.3 LUMBER MATERIALS

- .1 Salvaged materials:
 - .1 Provide wood boards for soffits and wing wall cladding sawn, planed, and sanded from salvaged cedar roof decking. See Section 02 41 00. Existing decking is anticipated to be 4-inch by 4-inch cedar double tongue-and groove nailed together. Detail below from existing building drawings is for information only.



- .2 New materials: Softwood lumber Douglas Fir species, surfaced one side, two edges, kiln-dried maximum moisture content of 15 percent, non-structural appearance lumber Finish "Superior" grade.
 - .1 Grading: In accordance with rules certified by WWPA grading rule 10.51.

2.4 FASTENINGS

- .1 Concealed fasteners: Of size and type to suit application; corrosion-resistant finish.
- .2 Exposed panel fasteners: Stainless steel flat head screws.

2.5 FABRICATION

- .1 Shop assemble soffit and wall cladding into panels, using full-length boards.
- .2 Shop finish all surfaces and ends of boards before assembling into panels.
- .3 Fasten boards to prefinished strapping from back to conceal fasteners.

2.6 SHOP FINISHING

- .1 Sand work smooth.
- .2 Transparent finish: UV-resistant, high-solids, water-repellent.
 - .1 One coat Sansin Classic penetrating undercoat.
 - .2 Two coats Sansin Precision Coat ENS Naturals Topcoat.
 - .3 Sheen: Satin.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify adequacy of backing and support framing.
- .2 Verify mechanical, electrical, and building items penetrating work of this section are placed and ready to receive this work.

3.2 INSTALLATION

- .1 Set and secure assembled panels in place, plumb and level. Align exposed fasteners.

3.3 TOLERANCES

- .1 Maximum variation from true position: 1.6 mm.
- .2 Maximum offset from true alignment with abutting materials: 0.8 mm.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Specially fabricated cabinet units.
- .2 Countertops.
- .3 Cabinet hardware.
- .4 Dining table top.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 02 41 00 - Demolition: Salvage of existing glulam beams.
- .3 Section 05 50 00 - Metal Fabrications: Supports, brackets, dining table legs.
- .4 Section 07 92 00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls.
- .5 Section 12 31 00 - Manufactured Metal Casework: Stainless steel cabinets and countertops

1.3 REFERENCE STANDARDS

- .1 ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use 2009.
- .2 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- .3 AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, Canada Version 4.0 2021.
- .4 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.
- .5 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board current edition.
- .6 GOST 3916.1 - Plywood with faces in hardwood veneer for general use 1996.
- .7 ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- .8 NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate salvage of existing glulam beams with subtrade responsible for demolition of existing buildings.
 - .2 Coordinate brackets, blocking and backing in partitions.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

- .2 Shop Drawings: Submit Shop Drawings indicating location of each item referenced to actual site dimensions, dimensioned plans and elevations, large scale details and thickness of materials, attachment devices, scribe strip locations, locations of exposed fastenings and other components as applicable to the work of this Section.
 - .1 Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections
 - .2 Show locations and sizes of cut outs and holes for plumbing fixtures, faucets, and other items installed in casework.
- .3 Samples for verification: Submit one (1) sample prior to fabrication of casework as follows; accepted samples will form the standard of acceptance for the remainder of the work.
 - .1 Glulam with transparent finish: 300 mm long, finished on two sides and one edge.
 - .2 High pressure decorative laminate clad panel products: Laid-up on specified core material, 300 mm by 300 mm for each type, colour, pattern, and surface finish, complete with specified edge banding.
 - .3 Solid surfacing materials: 150 mm square for each type, colour, pattern, and surface finish.
 - .4 Exposed cabinet fasteners, hardware and accessories: One unit for each type and finish.
- .4 Product data: Provide data for hardware and accessories.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to sustainably harvested wood; product labels, chain-of-custody records or CARB (ATCM) documentation for composite wood products; compliance with VOC-content and VOC-emission requirements; and evidence of reuse of existing structures and materials.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Maintenance data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.6 QUALITY ASSURANCE

- .1 Fabricator qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Protect units from moisture damage.
- .2 Deliver, store, and handle casework in accordance with AWMAC/WI (NAAWS) Section 13: Care and Storage.

1.8 SITE CONDITIONS

- .1 During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

- .2 Site measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings where casework is indicated to fit walls and other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work; locate concealed framing, blocking, and reinforcements that support woodwork by site measurements before being enclosed and indicate measurements on Shop Drawings.
- .3 Ambient conditions: Maintain area or room in which casework is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with AWMAC/WI (NAAWS) for relative humidity and moisture content; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where casework is being installed.

Part 2 Products

2.1 CABINETS

- .1 Quality standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.
- .2 Cabinets:
 - .1 Finish - Exposed exterior surfaces: Decorative laminate, unless otherwise indicated as solid surfacing.
 - .2 Finish - Exposed interior surfaces: Decorative laminate.
 - .3 Finish - Semi-exposed surfaces: European multi-ply with transparent finish for drawer boxes, decorative laminate elsewhere.
 - .4 Finish - Concealed surfaces: Manufacturer's option.
 - .5 Core: MDF for doors and drawer fronts, veneer core plywood elsewhere. Provide moisture-resistant core for toe kicks.
 - .6 Door and drawer front edge profiles: Square edge with thin applied band.
 - .7 Casework construction type: Type A - Frameless.
 - .8 Adjust thickness of shelves to allow for uniformly distributed loading of 90 kg with a concentrated load of 23 kg and length for maximum of L/144 deflection in full use.
 - .9 Cabinet style: Flush overlay.
 - .10 Cabinet doors and applied drawer fronts: Flush style.
 - .11 Drawer box construction: European multi-ply with multiple dovetailed joints.
 - .12 Drawer bottom construction technique: European multi-ply with construction and jointing technique as recommended by fabricator to suit drawer hardware.

2.2 WOOD-BASED COMPONENTS

- .1 Wood fabricated from old growth timber is not permitted.
- .2 Provide sustainably harvested wood, certified or labeled as specified in Section 01 61 00.
- .3 Medium-density fibreboard: ANSI A208.2, urea-formaldehyde-free (UFF) manufactured with binders containing no added urea-formaldehyde resins; no added formaldehyde (NAF), complying with CARB (ATCM); grade to suit application; sanded face
- .4 European multi-ply: Multi-ply void-free hardwood veneer core plywood, minimum nine plies for 12.7 mm thickness, 11 plies for 19 mm thickness, to GOST 3916.1; sanded two sides.
- .5 Salvaged materials:

- .1 Provide wood planks for dining table top and trestle base sawn, and sanded from salvaged glulam beams. See Section 02 41 00. Existing glulam beams are anticipated to 83 mm wide by 371 mm deep.

2.3 LAMINATE MATERIALS

- .1 High pressure decorative laminate (HPDL, or PLAM as indicated on Drawings): NEMA LD 3, types as recommended for specific applications.
 - .1 Allow for one solid colour, selected by Contract Administrator.
 - .2 Provide specific types as follows:
 - .1 Horizontal surfaces: HGS, 1.22 mm nominal thickness, colour as selected, finish as selected.
 - .2 Vertical surfaces: VGS, 0.71 mm nominal thickness, colour as selected, finish as selected.
 - .3 Backing sheet: Same thickness and colour as face laminate, except for colour as selected by fabricator for concealed surfaces.

2.4 COUNTERTOPS

- .1 Solid surfacing countertops and bench - SSC-1: Solid surfacing sheet and plastic resin casting over 12 mm thick continuous substrate.
 - .1 Flat sheet thickness: 12 mm, minimum.
 - .2 Solid surfacing sheet and plastic resin castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; colour and pattern consistent throughout thickness.
 - .1 Product:
 - .1 Wilsonart Solid Surfacing, colour Designer White D354SL.
 - .2 Substitutions: See Part B - Bidding Procedures.
 - .2 Surface burning characteristics: Comply with CAN/ULC S102 or ASTM E84 where permitted by Authority Having Jurisdiction for flame-spread rating and smoke developed classification.
 - .3 NSF approved for food contact.
 - .4 Finish on exposed surfaces: Matte, gloss rating of 5 to 20.
 - .3 Exposed edge treatment: Built up to thickness indicated; square edge.
 - .4 Back and end splashes: Same sheet material, square top; height indicated.
 - .5 Fabricate in accordance with manufacturer's instructions and AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
- .2 Plastic laminate countertops: High-pressure decorative laminate sheet bonded to medium density fiberboard substrate, conventionally fabricated and self-edge banded.
 - .1 Exposed edge treatment: Square, substrate built up to thickness indicated; covered with matching laminate.
 - .2 Back and end splashes: Of same material, same construction.
 - .3 Fabricate in accordance with AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.

2.5 DINING TABLE

- .1 Wood table top and stretcher:
 - .1 Thickness: As indicated.

- .2 Table top construction: Three salvaged glulam beams, laid flat; glued and dowelled together.
- .3 Stretcher: Salvaged glulam; through-bolted to legs.
- .4 Exposed top edges of table top: Eased, to approximately 1.5 mm radius.
- .5 Bolts: 25 mm dia.
- .6 Finish: Sanded smooth, two coat boiled linseed oil rubbed in with 48 hours between coats.

2.6 ACCESSORIES

- .1 Adhesives: Type recommended by AWMAC/WI (NAAWS) to suit application, waterproof for countertops.
 - .1 VOC content and emission restrictions: in accordance with Section 01 61 16.
- .2 Plastic edge banding: Extruded PVC, flat shaped; smooth finish; 1 mm thick, of width to match component thickness.
 - .1 Colour: to match adjacent plastic laminate surfaces.
 - .2 Use at edges of plastic laminate clad components.
- .3 Fasteners: Size and type to suit application.
- .4 Grommets: 65 mm dia. painted metal grommets for cut-outs, stainless steel finish. Allow for one grommet per workstation for a total of six. Locations as directed by Contract Administrator.
- .5 Table leg floor protectors: Dense wool pad, high-tack adhesive backed, cut to size; thickness as indicated.

2.7 HARDWARE

- .1 Adjustable shelf supports: Standard side-mounted system using recessed metal shelf standards and coordinated shelf rests, bright zinc finish, for nominal 12.7 mm spacing adjustments.
 - .1 Product:
 - .1 Knapé & Vogt; KV 255 series.
- .2 Drawer and door pulls: Type 304 stainless steel bar pull; 14 mm dia.; matte finish; 274 mm long (224 mm c/c hole spacing).
 - .1 Product:
 - .1 Hafele; Verdana Collection #117.05.630.
- .3 Cabinet locks: Keyed cylinder, two keys per lock, with snap-in removable core, keying as directed by Contract Administrator, steel, nickel-plated.
 - .1 Product:
 - .1 Hafele; Model 235.08 series cam lock body, and snap-in lock core and rosette.
- .4 Drawer slides:
 - .1 Type: Full extension.
 - .2 Static load capacity: Heavy Duty, Grade 1 HD-100, Commercial or Institutional Casework.
 - .3 Mounting: Concealed undermount.
 - .4 Features: Provide soft-close type.
 - .5 Product:

.1 Blum; Tandem Plus 563H330B with Blumotion.

- .5 Hinges: European style concealed self-closing type, steel with polished finish, 110 degree.
 - .1 Manufacturers:
 - .1 Hettich.
- .6 Murphy wall bed hardware: Counter-balanced spring loaded mechanism, aluminum bed frame, crossbar, stiffeners, tubular legs, fasteners and other accessories for a complete system. Confirm orientation. Size to suit Single/Twin, extra long mattress.
 - .1 Product:
 - .2 Murphy Wall Beds; Elite Aluminum Bed Frame and Mechanism.

2.8 FINISHING MATERIALS

- .1 Varnish and finishing materials: In compliance with AWMAC/WI (NAAWS), unless noted otherwise.

2.9 FABRICATION

- .1 Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- .2 Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- .3 Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- .4 Plastic laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
 - .1 Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - .2 Cap exposed plastic laminate finish edges with plastic trim.
- .5 Mechanically fasten plastic laminate back splash to plastic laminate countertops as recommended by laminate manufacturer at 400 mm on centre.
- .6 Countertops:
 - .1 Fabricate countertops and splashes in the largest sections practicable, with top surface of joints flush. Join lengths of tops using best method recommended by manufacturer.
 - .2 Fabricate to overhang fronts and ends of cabinets 25 mm, except where countertop butts against cabinet or wall.
 - .3 Prepare cut-outs accurately to size; replace countertops having improperly dimensioned or unnecessary cutouts or fixture holes.
 - .4 Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - .1 Secure to countertop with waterproof adhesive.
 - .2 Height: 100 mm, unless otherwise indicated.
 - .5 Provide cut-outs for plumbing fixtures, appliances, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Finish exposed cut edges to match countertop surface; seal concealed edges.

2.10 SHOP FINISHING

- .1 Sand work smooth and set exposed nails and screws.

- .2 On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- .3 Finish work in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - .1 Transparent:
 - .1 System - 11, Polyurethane, Catalyzed.
 - .2 Sheen: Satin.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify adequacy of backing and support framing.
- .2 Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

- .1 Install work in accordance with AWMAC/WI (NAAWS) requirements for grade indicated.
- .2 Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- .3 Use fixture attachments in concealed locations for wall mounted components.
- .4 Use concealed joint fasteners to align and secure adjoining cabinet units.
- .5 Carefully scribe casework abutting other components, with maximum gaps of 0.80 mm. Do not use additional overlay trim for this purpose.
- .6 Countersink anchorage devices at exposed locations. Conceal with matching caps; finish flush with surrounding surfaces.
- .7 Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- .8 Seal joint between countertop and vertical surfaces, or between back/end splashes and vertical surfaces with small continuous bead of sealant.

3.3 ADJUSTING

- .1 Adjust installed work.
- .2 Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- .1 Clean interior and exterior of casework, countertops, shelves, hardware, fittings, and fixtures.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Engineered, tested, thermally-isolated, rainscreen support system for exterior cladding at exterior walls.

1.2 RELATED REQUIREMENTS

- .1 Section 04 26 16 - Adhered Masonry Veneer
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .3 Section 07 42 13.13 - Metal Plate Wall Panels
- .4 Section 07 42 13.23 - Metal Composite Material Wall Panels
- .5 Section 07 64 13 - Standing Seam Metal Wall Cladding

1.3 REFERENCE STANDARDS

- .1 ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, 2018

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with work of other Sections making up the exterior building envelope, including metal cladding, metal composite material wall panels, thermal insulation, and weather barriers.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submission Procedures.
- .2 Product data: For each component required for complete wall system. Submit manufacturer's product literature and descriptions of testing performed on system components to indicate that they will meet or exceed performance specified, and indicating effective RSI-value calculation for entire wall assembly.
- .3 Shop Drawings: Show interface of cladding support system with adjacent construction, signed and sealed by engineer licensed in the Province in which the Project is located, detailing system installation and attachment.
 - .1 Combine with Shop Drawings for adhered masonry veneer specified in Section 04 26 16, metal plate wall panels specified in Section 07 42 13.13, metal composite material wall panels specified in Section 07 42 13.23, and standing seam metal wall cladding specified in Section 07 64 13.
- .4 Structural calculations: Submit comprehensive analysis of design loads for each type of cladding material, including dead loads, live loads and wind loads, signed and sealed by an engineer licensed in the Province in which the Project is located.
- .5 Samples: Two of each type of component, and fastener for system assembly.
- .6 Test reports.
- .7 Designer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Design engineer's qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
- .2 Test reports: Independent test results or engineered analysis for performance signed by independent agency representative signed and sealed by the qualified professional engineer responsible for their preparation, indicating effective thermal resistance of each entire wall assembly meets or exceeds effective thermal resistance indicated on the Drawings.

1.7 MOCK-UP

- .1 Mock-up: Refer to Sections 07 08 00, 07 42 13.13, 07 42 13.23, and 07 64 13.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.9 SITE CONDITIONS

- .1 Field measurements: Verify conditions prior to preparing Shop Drawings.

Part 2 Products

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

- .1 Structural performance: Provide engineered design capable of withstanding combined effects of stresses from dead loads, wind loads, normal thermal movement, and other anticipated stresses without evidence of permanent defects or failure.
 - .1 Deflection limits: Design members to withstand dead load, and wind and suction loads calculated in accordance with NBC and applicable local regulations, to maximum allowable deflection of L/600 for adhered masonry veneer, L/180 of span elsewhere.
 - .2 Wind loads: Determine loads based on minimum design wind pressures indicated.
- .2 Thermal movement: Allow for thermal movement from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- .3 Cladding accommodation: Design cladding support system configuration, size, spacing, and make adjustments as needed to accommodate support for each cladding type, including:
 - .1 Adhered masonry veneer.
 - .2 Standing seam metal wall panels.
 - .3 Metal plate wall panels.
 - .4 Metal composite material wall panels.
- .4 Tolerances:
 - .1 Accommodate deflection of structural members.
 - .2 Maintain clearances at adjacent construction.

- .3 Prevent load transfer to non-structural elements.
- .5 Thermal barriers:
 - .1 Thermally isolate metal components from each other and support wall.
 - .2 Thermally isolate fasteners from metal using thermal isolation washers or other means.
- .6 Thermal insulation:
 - .1 Design support system assembly to accommodate thickness and type of insulation specified.
 - .2 Perform thermal analysis to determine support system's effect on wall assembly.

2.2 SYSTEM DESCRIPTION

- .1 Cladding support system made up of the components indicated on the Drawings, including a thermally broken clip, and a combination of Z-girts or hat channels accommodating field-installed insulation, and for connection of wall cladding support system and cladding.

2.3 MATERIALS

- .1 Cladding support clips: Fully engineered, thermally-broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing; depth to accommodate insulation thickness, and allowing for plus or minus 12 mm adjustment for wall deviation without use of shims.
 - .1 Galvanized steel support clip: Z275 galvanized coating complying with ASTM A653/A653M support clip with integral glass fibre reinforced polyamide thermal isolator pad.
 - .2 Products:
 - .1 Northern Facades; ISO Clip.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Z-girts: Nominal 1.5 mm minimum base metal thickness or as required to meet performance requirements, structural quality steel to ASTM A653/A653M, with Z275 zinc coating. Flange face: minimum 38 mm.
 - .1 Provide perforated or slotted horizontal Z-girts where indicated.
- .3 Hat channels: Nominal 1.5 mm minimum base metal thickness or as required to meet performance requirements, structural quality steel to ASTM A653/A653M, with Z275 zinc coating. Face width: minimum 32 mm.
- .4 Fasteners: Heat-treated corrosion-resistant coated steel fasteners, of type, size, holding-power, and other properties required to fasten support system to substrate.
 - .1 Steel stud substrates: Self-drilling screw fastener.
- .5 Galvanic protection: Provide tapes and other methods as necessary to separate and prevent contact between dissimilar metals.
- .6 Sealant: Single-component sealant compatible with air/vapour barrier membrane for sealing fastener penetrations through air/vapour barrier,
 - .1 Movement capability: Plus and minus 35 percent, minimum.
 - .2 Service temperature range: Minus 40 to 82 degrees C.
- .7 Accessories: Manufacturers' recommended thermal barrier strips, perforated screens, and other accessories for a complete cladding support system.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine wall framing to verify that structural panel support members and anchorage have been installed within alignment tolerances required by cladding support system manufacturer.
 - .1 Verify that air/vapour barrier membrane has been installed over substrates.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Protect metal surfaces in contact with concrete, or other cementitious surface with isolation coating.

3.3 INSTALLATION

- .1 Erect cladding support system level, plumb, and in alignment with building features including corners, off-sets, and fenestrations.
- .2 Thermal clips:
 - .1 Mount thermal clips in accordance with reviewed Shop Drawings, manufacturer's written recommendations, and as specified using self-drilling self-tapping screws at metal stud framed walls.
 - .1 Apply compatible sealant at fasteners penetrating through air/vapour barrier membrane.
 - .2 Tighten fasteners in accordance with fastener manufacturer instructions. Do not over-compress washers.
 - .3 Attach Z-girts or hat channels to thermal clips in accordance with reviewed Shop Drawings, and as applicable to cladding support system.

3.4 TOLERANCES

- .1 Install cladding support system level, plumb, and square within 3 mm in 6 m, non-cumulative.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's field technical service: At start of installation, verify installation is in conformance with manufacturer's instructions and is suitable as cladding support system for subsequent metal wall panels.
 - .1 Confirm fastener sizing and tightening.
 - .2 Confirm support system members installed in correct orientation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Identification markings for fire and smoke rated partitions, and fire rated walls.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colours, wording, and overall dimensions.
- .3 Schedule: Completely define scope of proposed marking. Indicate location of effected walls and partitions, and number of markings.
- .4 Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

Part 2 Products

2.1 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

- .1 Regulatory requirements: Comply with the requirements of the Authority Having Jurisdiction.
- .2 Adhered fire and smoke assembly identification signs: Printed vinyl sign with factory applied adhesive backing.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate surfaces are ready to receive this work.

3.2 INSTALLATION

- .1 Locate markings as required by Authority Having Jurisdiction.
- .2 Install adhered markings in accordance with manufacturer's instructions.
- .3 Install neatly, with horizontal edges level.
- .4 Protect from damage until Date of Substantial Performance; repair or replace damaged markings.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 This section includes all labour and materials required to complete mock-up installation including component review and testing and quality control/quality assurance testing on thermal and moisture protection systems.

1.2 RELATED SECTIONS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 26 16 – Adhered Masonry Veneer
- .3 Section 07 05 43 – Cladding Support Systems
- .4 Section 07 11 13 – Bituminous Dampproofing
- .5 Section 07 13 52 – Modified Bituminous Sheet Waterproofing
- .6 Section 07 18 00 – Traffic Coatings
- .7 Section 07 21 00 – Thermal Insulation
- .8 Section 07 21 19 – Foamed-In-Place Insulation
- .9 Section 07 25 00 - Weather Barriers
- .10 Section 07 26 16 - Below-Grade Vapour Retarders
- .11 Section 07 42 13.16 – Metal Plate Wall Panels
- .12 Section 07 42 13.23 – Metal composite Material Wall
- .13 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .14 Section 07 62 00 – Sheet Metal Flashing and Trim
- .15 Section 07 64 13 - Standing Seam Sheet Metal Wall Cladding
- .16 Section 07 72 00 – Roof Accessories
- .17 Section 07 92 00 – Joint Sealants

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
 - .2 Mock-up installation field testing:
 - .1 Building Envelope Commissioning Authority to conduct testing.
 - .2 Co-ordinate testing frequency and locations with Building Envelope Commissioning Authority.
 - .3 Costs to co-ordinate, supervise, assist, and provide access for testing to be allocated to the fixed price component.
 - .3 Additional field testing of installations:
 - .1 Building Envelope Commissioning Authority to conduct testing.
 - .2 Co-ordinate testing frequency and locations with Building Envelope Commissioning Authority.
 - .3 Costs to co-ordinate supervise, assist, and provide access for testing to be allocated to the fixed price component.
-

- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C1521-19(2020) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - .2 ASTM D4541-17 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - .3 ASTM D7954/D7954M-22a Standard Practice for Moisture Surveying of Roofing and Waterproofing Systems Using Nondestructive Electrical Impedance Scanners.
 - .4 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

1.5 PRE-INSTALLATION CONFERENCE

- .1 Pre-Installation Conference in accordance with Section 01 31 19 Project Meetings.
- .2 Convene pre-installation conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Contractor, Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all aluminum windows and associated adjacent wall assembly components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.
- .4 Product Data
 - .1 Provide product data for:
 - .1 Section 04 05 00 – Common Work Results for Masonry
 - .2 Section 04 26 16 – Adhered Masonry Veneer
 - .3 Section 07 05 43 – Cladding Support Systems
 - .4 Section 07 11 13 – Bituminous Dampproofing

- .5 Section 07 18 00 – Traffic Coatings
 - .6 Section 07 21 00 – Thermal Insulation
 - .7 Section 07 21 19 – Foamed-In-Place Insulation
 - .8 Section 07 25 00 - Weather Barriers
 - .9 Section 07 26 16 - Below-Grade Vapour Retarders
 - .10 Section 07 42 13.16 – Metal Plate Wall Panels
 - .11 Section 07 42 13.23 – Metal composite Material Wall
 - .12 Section 07 52 00 – Modified Bituminous Membrane Roofing
 - .13 Section 07 62 00 – Sheet Metal Flashing and Trim
 - .14 Section 07 64 13 - Standing Seam Sheet Metal Wall Cladding
 - .15 Section 07 72 00 – Roof Accessories
 - .16 Section 07 92 00 – Joint Sealants
- .5 Shop Drawings
- .1 Provide shop drawings for:
 - .1 Section 04 26 16 – Adhered Masonry Veneer
 - .2 Section 07 05 43 – Cladding Support Systems
 - .3 Section 07 42 13.16 – Metal Plate Wall Panels
 - .4 Section 07 42 13.23 – Metal composite Material Wall
 - .5 Section 07 52 00 – Modified Bituminous Membrane Roofing
 - .6 Section 07 62 00 – Sheet Metal Flashing and Trim
 - .7 Section 07 64 13 - Standing Seam Sheet Metal Wall Cladding

1.7 TESTING AGENCY

- .1 Building Envelope Commissioning Authority to conduct testing.

1.8 QUALITY ASSURANCE

- .1 Notify the Contract Administrator and the Building Envelope Commissioning Authority in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the by the Building Envelope Commissioning Authority.
- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or Testing of thermal and moisture protection components:
 - .1 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the thermal and moisture protection components.
 - .2 Provide a minimum seventy-two (72) hours notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.
 - .2 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed thermal and moisture protection components may be periodically completed at the discretion of the Commissioning Authority.

- .2 Provide a minimum seventy-two (72) hours notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.

2 Products

2.1 NOT USED

3 Execution

3.1 ADHERED MASONRY VENEER

- .1 Provide a mock-up of the adhered masonry veneer assembly at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.2 CLADDING SUPPORT SYSTEMS

- .1 Provide a mock-up of the cladding support systems masonry veneer assembly at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.3 BITUMINOUS DAMPPROOFING

- .1 Provide a mock-up of the bituminous dampproofing at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.

- .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Adhesion testing:
 - .1 Adhesion testing shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM D4541, using a 2.25” diameter disk.
 - .2 Standard of acceptance shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer’s requirements, but not less than 15 psi. In the event of a deficit, the manufacturer shall be consulted for direction.
 - .3 Pull tests shall be completed in sets of three per each substrate type, at the discretion of the Building Envelope Commissioning Authority.
 - .4 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.4 TRAFFIC COATINGS

- .1 Provide a mock-up of the traffic coating at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.5 THERMAL INSULATION

- .1 Provide mock-ups for each type of board insulation at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.6 FOAMED IN PLACE INSULATION

- .1 Provide a mock-up of the foamed-in-place insulation at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:

- .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.7 WEATHER BARRIERS

- .1 Provide a mock-up of the weather barriers at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Adhesion testing:
 - .1 Adhesion testing shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM D4541, using a 2.25" diameter disk.
 - .2 Standard of acceptance shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer's requirements, but not less than 15 psi. In the event of a deficit, the manufacturer shall be consulted for direction.
 - .3 Pull tests shall be completed in sets of three per each discrete substrate and membrane combination, at the discretion of the Building Envelope Commissioning Authority.
 - .4 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .4 Air- leakage testing:
 - .1 Air leakage testing shall be completed by the Building Envelope Commissioning Authority at membrane seams and overlaps and at the cladding support system anchorage penetrations in accordance with ASTM E1186.
 - .2 Standard of acceptance is no observable air leakage.
 - .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.8 BELOW GRADE VAPOUR RETARDERS

- .1 Provide a mock-up of the below grade vapour retarder at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
-

- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
- .3 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.9 METAL PLATE WALL PANELS

- .1 Provide a mock-up of the metal plate wall panels at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
- .3 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.10 METAL COMPOSITE MATERIAL WALL PANELS

- .1 Provide a mock-up of the metal composite material wall panels at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
- .3 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.11 MODIFIED BITUMINOUS MEMBRANE ROOFING

- .1 Provide a mock-up of the modified bituminous membrane roofing at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
 - .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
 - .3 Air- leakage testing:
-

- .1 Air leakage testing shall be completed by the Building Envelope Commissioning Authority at membrane seams and overlaps and at the cladding support system anchorage penetrations in accordance with ASTM E1186.
- .2 Standard of acceptance is no observable air leakage at the penetrations.
- .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .4 Electrical impedance scanning:
 - .1 Electrical impedance scanning shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM D7954.
 - .2 Frequency of testing:
 - .1 Once upon Substantial Completion of the Work.

3.12 SHEET METAL FLASHING AND TRIM

- .1 Provide a mock-up of the sheet metal flashing and trim at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.13 STANDING SEAM METAL WALL CLADDING

- .1 Provide a mock-up of the standing seam metal wall cladding at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
- .3 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.14 JOINT SEALING

- .1 Provide a mock-up of the typical joints (control joints, transition joints, window rough openings, etc.), at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
 - .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
-

- .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Adhesion testing:
 - .1 Adhesion testing on fully cured joints shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM C1521, Destructive Procedure Method A.
 - .2 Adhesion testing on fully cured joints at dissimilar substrates shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM C1521, Flap Procedure.
 - .3 Standard of acceptance shall be in accordance with manufacturer's published data and as follows:
 - .1 Silicone Sealants:
 - .1 Sealant should tear cohesively within itself or elongate the 1" gauge length the extent specified in the product manufacturer's technical literature before releasing from either substrate adhesively.
 - .2 Urethane Sealants:
 - .1 Sealant should tear cohesively within itself without bond loss.
 - .4 At this time the joint will be reviewed for complete fill. The joint should not have voids, and joint dimensions should match those shown on the drawings.
 - .5 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.15 THERMOGRAPHIC SCAN

- .1 The Building Envelope Commissioning Authority shall complete a thermographic scan of the building prior to Substantial Completion.
- .2 Contractor to co-ordinate, supervise, assist, and provide access for thermographic scan including coordination with the City for mechanical system pressurization during the test.

3.16 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.
 - .2 Remediate non-conforming work identified during visual reviews and testing.
 - .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
 - .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.
 - .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the City for repairs or testing.
-

3.17 REPORTING

- .1 Building Envelope Commissioning Authority to prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Bituminous dampproofing.
- .2 Protection boards.
- .3 Drainage panels.

1.2 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .2 Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.

1.3 REFERENCE STANDARDS

- .1 ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings—Asbestos-Free 2007, with Editorial Revision (2018).

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide properties of primer, bitumen, and mastics.

1.5 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.

1.6 SITE CONDITIONS

- .1 Maintain ambient temperatures above 5 degrees C for 24 hours before and during application until dampproofing has cured.

Part 2 Products

2.1 BITUMINOUS DAMPPROOFING

- .1 Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - .1 Composition: ASTM D4479/D4479M Type I, minimum, asbestos free.
 - .2 VOC content: Not more than permitted by local, provincial, and federal regulations.
 - .3 Applied thickness: 1.5 mm, minimum, wet film.
 - .4 Products:
 - .1 Henry Company; 710-11.
 - .2 W.R. Meadows; Sealmastic 505.
- .2 Primers, mastics, and related Materials: Type as recommended by dampproofing manufacturer.

2.2 ACCESSORIES

- .1 Drainage panel: 6 mm thick formed plastic, hollowed sandwich.
- .2 Protection board: Rigid insulation specified in Section 07 21 00.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions are acceptable prior to starting this work.
- .2 Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- .3 Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

- .1 Protect adjacent surfaces not designated to receive dampproofing.
- .2 Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- .3 Seal around penetrations through dampproofing with sealing compound and reinforcing fabric before applying dampproofing.
- .4 Do not apply dampproofing to surfaces unacceptable to manufacturer.
- .5 Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

- .1 Grade beams: Apply two coats of asphalt dampproofing.
- .2 Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.
- .3 Apply bitumen with roller.
- .4 Apply bitumen in two coats, continuous and uniform, at manufacturer's recommended rate.
- .5 Apply from 50 mm below finish grade elevation down to bottom of grade beam.
- .6 Seal items watertight with mastic, that project through dampproofing surface.
- .7 Place drainage panel directly over insulation, offset joints in drainage panel with insulation panels, place to encourage drainage downward.
- .8 Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Polymethyl methacrylate (PMMA) coating for waterproofing and pedestrian traffic surfaces - Roof Types R3 and R5.

1.2 RELATED REQUIREMENTS

- .1 Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.3 REFERENCE STANDARDS

- .1 ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Include data for each component of pedestrian traffic coating system, including product characteristics and limitations. Identify dissolving solvents, and potential destructive compounds.
- .3 Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- .4 Samples: Submit two stepped samples of cured membrane system, minimum 150 by 300 mm in size, illustrating colour, surface texture, and system components applied to cement board panel.
- .5 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures, and potential incompatibilities with adjacent materials.
- .6 Applicator's qualification statement.
- .7 Maintenance data: Include procedures for stain removal, repairing surface, and cleaning.
- .8 Warranty: Submit warranty and ensure that forms have been completed in City's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- .1 Applicator qualifications: Company specializing in performing installation of traffic membrane, with minimum three years documented experience and approved by manufacturer.

1.6 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to Project site in original wrappings and containers, labeled with manufacturer's name, material or product brand name, and lot number if any.

- .2 Store resin materials in a dry, well-ventilated, secure area, protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer..
- .3 Keep away from fire or open flame.

1.8 SITE CONDITIONS

- .1 Do not apply catalyzed resin materials if there is a threat of inclement weather. Follow manufacturer's specifications for minimum and maximum ambient, material and substrate temperatures. Do not apply catalyzed resin materials unless ambient and substrate temperatures fall within resin manufacturer's published range.
- .2 Restrict traffic from area where materials are being installed or are curing.

1.9 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Correct defective Work within a five year period after Date of Substantial Performance.

Part 2 Products

2.1 TRAFFIC COATINGS

- .1 Pedestrian poly(methyl methacrylate) (PMMA) waterproof coating system: Fluid-applied low-odour PMMA system consisting of a primer, base coat, fleece reinforcement, top coat, self-leveling mortar, quartz aggregate (Roof Type R3), and trafficable colour seal/wear course.
 - .1 Application: Pedestrian roof area (Roof Type R3) and canopy roofs (Type R5).
 - .2 Substrate: Concrete for Roof Type R3; plywood for Roof Type R5, properly prepared in accordance with manufacturer's requirements..
 - .3 Cured thickness: 5.5 to 7.3 mm, with each coat fully applied.
 - .4 Colour: As selected by Contract Administrator.
 - .5 Basis-of-Design Product:
 - .1 Soprema; Alsan RS Fully Reinforced Parking Deck/Balcony/Flooring System.

2.2 MATERIALS

- .1 Aggregate surfacing: Quartz.
- .2 Accessory materials including primer, sealant, self-leveling mortar, fleece reinforcement: As recommended by membrane manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that substrate is ready to receive work, surface is clean, dry and free of substances that could adversely affect bond.
- .3 Perform moisture content- and adhesion-testing in accordance with manufacturer's instructions before and during installation of waterproofing and pedestrian traffic coatings.

3.2 PREPARATION

- .1 Clean and prepare surfaces to receive waterproofing and pedestrian traffic coating in accordance with manufacturer's instructions, and ICRI 310.2R, CSP 3 or 4.
- .2 Remove loose or friable material to provide a sound surface free of laitance, glaze, efflorescence, and any remaining loose material.
- .3 Do not apply waterproofing to surfaces unacceptable to waterproofing and pedestrian traffic coating manufacturer.
- .4 Level and patch concrete substrate with self-leveling mortar to produce surface conducive to bond.
- .5 Prepare and repair moving and non-moving cracks and cold joints in accordance with manufacturer's instructions.
- .6 Protect adjacent surfaces from damage not designated to receive waterproofing and pedestrian traffic coatings.
- .7 Mask edges and terminations to produce clean lines at membrane edges.

3.3 INSTALLATION

- .1 Mix and apply system materials in accordance with manufacturer's instructions.
- .2 Apply primer to prepared substrate to a dry film thickness recommended by manufacturer, and as applicable to substrate condition. Allow to fully cure before applying subsequent waterproofing and pedestrian traffic coating components.
- .3 Install penetration and transition flashings before installing field areas of waterproofing and pedestrian traffic coating, in accordance with reviewed Shop Drawings and manufacturer's details.
- .4 Apply reinforced field membrane over primed and prepared substrates. Embed fleece reinforcement in wet base coat, and lap in accordance with manufacturer's instructions.
- .5 Apply one coat of top coating to manufacturer's minimum dry film thickness, and allow to cure.
- .6 Finish to smooth surface sloped to drains. Cove at vertical surfaces.
- .7 Roof Type R3: Apply self-leveling mortar resin over top coat using notched trowel, and pin roll to eliminate bubbles. Broadcast quartz aggregate into wet self-leveling mortar resin to create slip resistance matching accepted sample.
 - .1 Remove excess aggregate and apply coloured seal coat.
- .8 Remove masking tape while resin is wet.

3.4 SITE QUALITY CONTROL

- .1 Require attendance on-site of waterproofing and pedestrian traffic coating manufacturer during installation of this Work.

3.5 PROTECTION

- .1 Do not permit traffic over unprotected surfaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Board insulation at perimeter foundation wall, underside of floor slabs, and exterior wall behind metal wall panels, and glazed thin brick wall finish.
- .2 Batt insulation in exterior wall and parapet construction.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .3 Section 07 11 13 - Bituminous Dampproofing: Below grade drainage board.
- .4 Section 07 52 00 - Modified Bituminous Membrane Roofing: Insulation specified as part of roofing system.
- .5 Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- .6 Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.3 REFERENCE STANDARDS

- .1 ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics 2016.
- .2 ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- .3 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.
- .4 CAN/ULC S114 - Test for Determination of Non Combustibility in Building Materials 2018.
- .5 CAN/ULC S701.1 - Standard for Thermal Insulation, Polystyrene Boards 2017.
- .6 CAN/ULC S702.1 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification 2021.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on product characteristics, performance criteria, and product limitations.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC- emission requirements for interior thermal insulation.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Installer's qualification statement.

1.5 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

1.6 SITE CONDITIONS

- .1 Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

Part 2 Products

2.1 BOARD INSULATION MATERIALS

- .1 Extruded polystyrene (XPS) foundation wall board insulation: Complies with CAN/ULC S701.1 with either natural skin or cut cell surfaces.
 - .1 Type and compressive strength: Type 3, 140 kPa, minimum, in accordance with ASTM D1621.
 - .2 Water absorption: 0.7 percent by volume, maximum, in accordance with ASTM D2842.
 - .3 Board size: 610 mm by 1220 mm.
 - .4 Board edges: Square.
 - .5 Products:
 - .1 Owens Corning; Foamular NGX C-200.
- .2 Extruded polystyrene (XPS) split slab board insulation: Complies with CAN/ULC S701.1 with either natural skin or cut cell surfaces.
 - .1 Type and compressive strength: Type 4, 210 kPa, minimum, in accordance with ASTM D1621.
 - .2 Water absorption: 0.7 percent by volume, maximum, in accordance with ASTM D2842.
 - .3 Board size: 610 mm by 1220 mm.
 - .4 Board edges: Square.
 - .5 Products:
 - .1 Owens Corning; Foamular NGX C-300.
 - .2 Dupont; Styrofoam SM.
 - .3 Substitutions: See Section 01 60 00 - Product Requirements.
- .3 Extruded polystyrene (XPS) perimeter board insulation: Premanufactured concrete-faced extruded polystyrene foam insulation manufactured in accordance with CAN/ULC S701.1.
 - .1 Thermal resistance: RSI-value of 0.88, minimum, per 50 mm thickness.
 - .2 Water absorption: 0.7 percent by volume, maximum, in accordance with ASTM D2842.
 - .3 Board size: 610 mm by 1220 mm.
 - .4 Board thickness: 75 mm not including facing.
 - .5 Face: 8 mm thick latex-modified concrete facing, grey colour with broom-textured finish.
 - .6 Mounting system: Manufacturer's galvanized steel mounting clips and fasteners.

- .7 Products:
 - .1 Tech-Crete; CFI.
- .4 Fibrous mineral wool insulation: Preformed rigid mineral fibre board insulation manufactured in accordance with CAN/ULC S702.1. Provide products containing recycled content.
 - .1 Type: 1, unfaced.
 - .2 Thermal resistance: RSI-value of 0.70, minimum, per 25 mm thickness.
 - .3 Combustibility and surface burning characteristics: Rated non-combustible in accordance with CAN/ULC S114 and having flame-spread rating (FSR) of 0 and smoke developed classification (SDC) of 0 in accordance with CAN/ULC S102.
 - .4 Board edges: Square.
 - .5 Board size: 610 mm by 1220 mm.
 - .6 Board thickness: 75 mm, applied in two layers to minimum thickness indicated.
 - .7 Products:
 - .1 ROCKWOOL; CavityRock Dual Density.
 - .2 Owens Corning; Thermafiber RainBarrier HD.
- .5 Fibrous mineral wool insulation: Preformed rigid mineral fibre board insulation manufactured in accordance with CAN/ULC S702.1. Provide products containing recycled content.
 - .1 Type 2, permeable black mineral fleece facing on one side where used as second layer in open joint cladding.
 - .2 Thermal resistance: RSI-value of 0.70, minimum, per 25 mm thickness.
 - .3 Combustibility and surface burning characteristics: Rated non-combustible in accordance with CAN/ULC S114 and having flame-spread rating (FSR) of 10 and smoke developed classification (SDC) of 10 in accordance with CAN/ULC S102.
 - .4 Board edges: Square.
 - .5 Board size: 610 mm by 1220 mm.
 - .6 Board thickness: 75 mm, applied in two layers to minimum thickness indicated.
 - .7 Products:
 - .1 ROCKWOOL; CavityRock Black.
 - .2 Owens Corning; Thermafiber RainBarrier Dark.

2.2 BATT INSULATION MATERIALS

- .1 Mineral fibre batt insulation: Unfaced, preformed mineral slag batt insulation in accordance with CAN/ULC S702.1. Provide products containing recycled content.
 - .1 Facing: None, unfaced.
 - .2 Combustibility: Rated non-combustible in accordance with CAN/ULC S114.
 - .3 Flame spread index: 5 or less, when tested in accordance with CAN/ULC S102.
 - .4 Thermal resistance: RSI-value of 0.67 per 25 mm thickness.
 - .5 Density: 32 kg/cubic metre.
 - .6 Thickness: As required to fill insulated spaces where not indicated.
 - .7 VOC emission restrictions: in accordance with Section 01 61 16.

2.3 ACCESSORIES

- .1 Insulation fasteners: Gas-set fastener, with 60 mm dia. HDPE plastic retaining washer with integrated thermal cap, and zinc-plated heat-treated carbon steel pin. Length to suit insulation thickness; type to suit substrate.

- .2 Insulation coating: Fibrous mineral wool insulation manufacturer's recommended black coating for joints and unfaced portion of black faced board that may be exposed in reveals.
- .3 Drainage board: See Section 07 11 13.
- .4 Adhesive: Type recommended by insulation manufacturer for application.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- .2 Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

- .1 Apply concrete-faced boards at top of foundation in horizontal orientation to 600 mm below grade indicated.
 - .1 Apply boards using manufacturer's clip and fastening system.
- .2 Apply adhesive to back of non-faced XPS boards:
 - .1 Three continuous beads per board length.
- .3 Install boards horizontally on foundation perimeter.
 - .1 Place boards to maximize adhesive contact.
 - .2 Install in running bond pattern.
 - .3 Butt edges and ends tightly to adjacent boards and to protrusions.
- .4 Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- .5 Immediately following application of board insulation, place drainage board over exposed insulation surfaces to extents indicated.
 - .1 Butt boards tightly, with joints staggered from insulation joints.

3.3 BOARD INSTALLATION AT EXTERIOR WALLS

- .1 Install rigid insulation between thermal clips over air/vapour barrier on exterior grade sheathing substrates.
- .2 Install boards on walls in two layers in orientation recommended by manufacturer.
 - .1 Install in running bond pattern. Stagger joints between layers.
 - .2 Butt edges and ends tightly to adjacent boards and protrusions.
 - .3 Mechanically fasten in place with gas-set fasteners appropriate for substrate, at insulation manufacturer's recommended spacing. Close thermal cap on fasteners.
 - .4 Use black-faced insulation as second layer in open joint cladding. Treat unfaced ends and joints with black coating.
- .3 Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.4 BOARD INSTALLATION IN SPLIT SLAB

- .1 Place insulation in split slabs on concrete topping.

- .2 Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- .3 Prevent insulation from being displaced or damaged while placing slab above.

3.5 BATT INSTALLATION

- .1 Install insulation in accordance with manufacturer's instructions.
- .2 Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- .3 Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- .4 Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.6 PROTECTION

- .1 Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Foamed-in-place insulation.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection

1.3 REFERENCE STANDARDS

- .1 ASTM D6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics 2021.
- .2 CAN/ULC S705.1 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification 2015.
- .3 CAN/ULC S705.2 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application 2020.
- .4 CAN/ULC S770 - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams 2015.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide product description, insulation properties, and preparation requirements.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance with VOC-content and VOC-emission requirements for wet-applied materials applied on-site within, or a part of, the building's continuous plane of air tightness.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Manufacturer's certificates: Certify that products of this section meet or exceed specified requirements. Submit CCMC evaluation report.
- .5 Manufacturer's installation instructions: Indicate special procedures, information on special environmental conditions required for installation and perimeter conditions requiring special attention.
- .6 Statement of compatibility: Letter from foamed-in-place insulation manufacturer stating that foamed-in-place insulation materials are compatible with air/vapour barrier onto which insulation is applied.
- .7 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

- .2 On-site documentation:
 - .1 Keep manufacturer's technical manual on site during application of foamed-in place insulation.
 - .2 Keep daily reports on site during application.

1.6 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Store products in strict accordance to manufacturer's instructions in temperature controlled, dry and ventilated area.

1.8 SITE CONDITIONS

- .1 Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- .2 Ensure temperature is maintained throughout curing period.

Part 2 Products

2.1 MATERIALS

- .1 Sprayed polyurethane foam insulation (SPFI): Two-component, polyurethane resin and polyol, closed cell foamed-in-place insulation containing recycled materials in accordance with CAN/ULC S705.1 and having the following minimum properties:
 - .1 Long term thermal resistance: Nominal RSI-value 1.8/50 mm in accordance with CAN/ULC S770.
 - .2 Density: Nominal 35 kg/cu m plus or minus 10 percent.
 - .3 Closed cell content: Minimum 90 percent in accordance with ASTM D6226.
 - .4 Ozone depletion potential: Zero.
 - .5 Global warming potential: Low.
 - .6 VOC content and emission restrictions: in accordance with Section 01 61 16.
 - .7 Manufacturers:
 - .1 BASF.
 - .2 Carlisle.
 - .3 Huntsman.
 - .8 Substitutions: See Part B - Bidding Procedures.

2.2 ACCESSORIES

- .1 Primer: As required by insulation manufacturer.
 - .1 VOC content and emission restrictions: in accordance with Section 01 61 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify work within construction spaces or crevices is complete prior to insulation application.

- .2 Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.2 PREPARATION

- .1 Mask and protect adjacent surfaces from over spray or dusting.
- .2 Clean surfaces which are to receive insulation, of dirt, dust, grease, loose material or other foreign matter which may inhibit adhesion.
- .3 Apply primer in accordance with manufacturer's instructions.

3.3 APPLICATION

- .1 Apply insulation in accordance with CAN/ULC S705.2, and manufacturer's instructions.
- .2 Apply insulation by spray method, to a uniform monolithic density without voids.
- .3 Apply first layer in maximum 6 mm lift, and subsequent layers in maximum 50 mm thick lifts in single pass. Allow first layer to cure before applying subsequent layers.
 - .1 Where insulation is applied over multiple days or on adjoining walls, terminate layers of insulation in stepped fashion. Avoid butt joints or cold joints in insulation. Overlap minimum 300 mm between layers.
- .4 Apply to a minimum cured thickness indicated.
- .5 Where applied to voids and gaps ensure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

3.4 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control for additional requirements.
- .2 Conduct daily visual inspection, adhesion testing and density measurements as required by CAN/ULC S705.2, and manufacturer's application guidelines. Record test results in daily reports.

3.5 CLEAN-UP

- .1 Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened.
- .2 Repair damaged areas in accordance with manufacturer's instructions.

3.6 PROTECTION

- .1 Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Air/vapour barriers: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapour resistant and air-tight.
- .2 Air barriers.

1.2 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .2 Section 07 52 00 - Modified Bituminous Membrane Roofing: Vapour retarder installed as part of roofing system.

1.3 DEFINITIONS

- .1 Weather barrier: Assemblies that form either, air barriers, or air/vapour barriers.
- .2 Air barrier: Airtight barrier made of material that is relatively air impermeable but water vapour permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapour impermeable air barriers are classified as air/vapour barriers.
- .3 Air/vapour barrier: Airtight barrier made of material that is relatively water vapour impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
 - .1 Water vapour permance: For purposes of conversion, $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm.}$

1.4 REFERENCE STANDARDS

- .1 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .2 ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission of Materials 2022.
- .3 ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- .4 CAN/ULC S710.1 - Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification 2011.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on material characteristics, performance criteria, and limitations.
- .3 Shop Drawings: Provide Drawings of special joint conditions.
- .4 Samples: Submit two samples of air barrier, 300 by 300 mm in size.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment, compliance with VOC-content and VOC-emission requirements for wet-applied materials applied on-site within, or a part of, the building's continuous plane of air tightness.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

-
- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
 - .6 Installer's qualification statement.
- 1.6 QUALITY ASSURANCE**
- .1 Installer qualifications: Use an installation company that is acceptable to the manufacturer, using workers who are trained and approved by the weather barrier manufacturer having experience with projects of similar complexity and area.
- 1.7 MOCK-UP**
- .1 Install air barrier and air/vapour barrier materials in mock-ups specified in Sections 07 42 13.16, 07 42 13.23, and 07 64 13.
 - .2 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.
- 1.8 SITE CONDITIONS**
- .1 Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.
- Part 2 Products**
- 2.1 WEATHER BARRIER ASSEMBLIES**
- .1 Air barrier:
 - .1 On outside surface of insulation where indicated use air barrier sheet, mechanically fastened type.
 - .2 Air/vapour barrier membrane:
 - .1 On outside surface of gypsum sheathing use air/vapour barrier sheet, self-adhesive type.
 - .2 At steel plate assembly at canopy tie-in and where indicated use air/vapour barrier fluid applied coating.
- 2.2 AIR BARRIER MATERIALS (WATER VAPOUR PERMEABLE AND WATER-RESISTIVE)**
- .1 Air barrier sheet, mechanically-fastened:
 - .1 Air permeance: 0.02 L/s/sq m, maximum, when tested in accordance with ASTM E2178.
 - .2 Ultraviolet (UV) and weathering resistance: Approved in writing by manufacturer for up to 120 of weather exposure.
 - .3 Seam and perimeter tape: Polyethylene self adhering type, mesh reinforced, 50 mm wide, compatible with sheet material; or integrated tape.
 - .4 Colour: Black; no product names, labels, logos or similar permitted on exposed face.
 - .5 Products:
 - .1 VaproShield, LLC; RevealShield IT Integrated Tape.
 - .2 Dorken; Delta-Fassade S PLUS.
 - .3 SRP; AirOutshield UV.

2.3 AIR/VAPOUR BARRIER MATERIALS

- .1 Air/vapour barrier sheet, self-adhered: Rubberized asphalt bonded to thermoplastic sheet.
 - .1 Air permeance: 0.02 L/s/sq m, maximum, when tested in accordance with ASTM E2178.
 - .2 Water vapour permeance: 2.87 ng/(Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.
 - .3 Ultraviolet (UV) and weathering resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
 - .4 Low temperature flexibility: Less than minus 20 degrees Celsius.
 - .5 Seam and perimeter tape: As recommended by sheet manufacturer.
 - .6 Products:
 - .1 GCP Applied Technologies; Perm-A-Barrier NPS.
 - .2 Henry; Blueskin SA LT.
 - .3 Soprema; SopraSeal Stick 1100 T WG.
 - .4 W.R. Meadows, AirShield Low Temp.
- .2 Air/vapour barrier, fluid-applied:
 - .1 Air permeance: 0.02 L/s/sq m, maximum, when tested in accordance with ASTM E2178.
 - .2 Low temperature flexibility: Less than minus 20 degrees Celsius.
 - .3 Manufacturers:
 - .1 GCP Applied Technologies; Perm-A-Barrier NPL 10
 - .2 Henry; Air-Bloc 16 MR.
 - .3 Soprema; Sopraseal Liquid Flash.
 - .4 W.R. Meadows; Air-Shield LM.

2.4 ACCESSORIES

- .1 Sealants, tapes, and accessories for sealing weather barrier and sealing weather barrier to adjacent substrates: As specified or as recommended by weather barrier manufacturer.
 - .1 VOC content and emission restrictions for wet-applied materials: in accordance with Section 01 61 16.
- .2 Flexible flashing: Self-adhesive, compatible with air/vapour barrier membrane.
 - .1 Composition: Modified bituminous sheet laminated to polyethylene sheet.
 - .2 Thickness: 1.8 mm, nominal.
- .3 Pre-formed silicone transition membrane: Pre-engineered system comprised of ribbed translucent silicone rubber extrusion, and silicone sealant.
 - .1 Products: Tremco; Proglaze ETA.
- .4 Metal transition strips: 0.91 mm thick, zinc-coated cold rolled sheet steel, with Z275 designation coating to ASTM A653/A653M. Form in longest practical lengths. Where indicated and as required, crimp transition strips to allow for 25 mm deflection.
- .5 Insulating foam sealant: One-component polyurethane air sealant foam, CAN/ULC S710.1, low-expansion, remains flexible after curing.
 - .1 VOC content and emission restrictions for wet-applied materials: in accordance with Section 01 61 16.

- .6 Thinners and cleaners: As recommended by material manufacturer.
 - .1 VOC content and emission restrictions for wet-applied materials: in accordance with Section 01 61 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.

3.2 PREPARATION

- .1 Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- .2 Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.3 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Air barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- .3 Air/vapour barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- .4 Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- .5 Mechanically-fastened sheets - On exterior:
 - .1 Install sheets shingle-fashion to shed water, with seams generally horizontal.
 - .2 Overlap seams as recommended by manufacturer but at least 150 mm.
 - .3 Overlap at outside and inside corners as recommended by manufacturer but at least 300 mm.
 - .4 Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 300 to 460 mm on centre along each framing member supporting sheathing.
 - .5 For applications specified to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
 - .6 Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 100 mm below bottom of framing and seal to foundation with sealant.
 - .7 Install air barrier and vapour retarder under jamb flashings.
 - .8 Install head flashings under weather barrier.
 - .9 At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- .6 Self-adhered sheets:
 - .1 Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
 - .2 At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
 - .3 Lap sheets shingle-fashion to shed water and seal laps air tight.

- .4 Minimize joints. Offset vertical joints minimum 300 mm.
 - .5 Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
 - .6 Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
 - .7 At wide joints, provide extra flexible membrane allowing joint movement.
 - .8 Continue membrane installation over junctions, at changes in wall construction, and other construction. Reinforce corners with additional piece of membrane cut and formed to seal corners. Caulk to ensure complete seal. Position lap seal over firm bearing.
- .7 Fluid-applied membranes:
- .1 Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
 - .2 Use flashing to seal to adjacent construction and to bridge joints.
- .8 Openings and penetrations in exterior weather barriers:
- .1 Install flashing over sills, covering entire sill frame member, extending at least 125 mm onto weather barrier and at least 150 mm up jambs; mechanically fasten stretched edges.
 - .2 At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 100 mm wide; do not seal sill flange.
 - .3 At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 230 mm wide, covering entire depth of framing.
 - .4 At head of openings, install flashing under weather barrier extending at least 100 mm beyond face of jambs; seal weather barrier to flashing.
 - .5 At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 - .6 Service and other penetrations: Form flashing around penetrating item and seal to weather barrier surface.
 - .7 Seal fastener penetrations with joint sealant.
 - .8 Fill gaps and voids between heads, jambs, and sills and their rough openings, and where indicated on the Drawings with backer rod and sealant, or polyurethane air sealant foam as indicated on Drawings.

3.4 INSTALLATION - STEEL TRANSITION STRIP

- .1 Provide metal transition strips between curtain wall and door frames and adjacent wall materials, and elsewhere indicated using longest practical lengths. Position lap seal over firm bearing.
- .2 Bridge and cover discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints. Form smooth transition from one substrate plane to another with sheet-steel transition strip mechanically fastened to structural framing to provide continuous support for air/vapour barrier membranes.
- .3 Fasten L-shape sheet steel transition strip at roof-to-wall transition. Seal laps with sealant. Stagger joints in transition strip with joints in wall air/vapour barrier. Minimum 300 mm legs.
- .4 Clean and prime sheet steel substrate to receive membrane materials in accordance with membrane manufacturer's instructions.
- .5 Apply 150 mm wide strip of self-adhesive membrane along joints. Roll firmly in place.

- .6 Apply 150 by 150 mm patch of self-adhesive membrane centred over fasteners.

3.5 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, for additional requirements.
- .2 Allow access for inspection and testing of installed air and vapour membranes, and repair of deficiencies before placement of insulation materials.
- .3 Do not cover installed weather barriers until required inspections have been completed.
- .4 Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- .5 Take digital photographs of each portion of the installation prior to covering up.

3.6 PROTECTION

- .1 Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Underslab vapour retarder.

1.2 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

1.3 REFERENCE STANDARDS

- .1 ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- .2 ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on material characteristics and installation instructions.

1.5 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.

1.6 SITE CONDITIONS

- .1 Do not apply on frozen ground.

Part 2 Products

2.1 MATERIALS

- .1 Underslab vapour retarder: To ASTM E1745, Class A, 0.381 mm thick.
 - .1 Manufacturers:
 - .1 Stego; Stego Wrap (15 mil) Vapor Barrier.
 - .2 WR Meadows; Perminator 15.
 - .3 Layfield; VaporFLEX 15.
 - .4 Substitutions: See Part B - Bidding Procedures.

2.2 ACCESSORIES

- .1 Joint sealing tape: Air resistant pressure sensitive adhesive tape, type recommended by vapour retarder manufacturer, 100 mm wide.
- .2 Pointing mastic: Pre-mixed cold-applied single-component polymeric flexible sealing compound, designed for use with vapour retarder.
- .3 Pipe collars: Construct pipe collars from sheet vapour retarder material and pressure sensitive tape per manufacturer's instructions.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.
- .2 Verify sub-grade is properly prepared and at correct elevation, level, smooth without sharp projections that could puncture underslab vapour retarder.
- .3 Report unsatisfactory conditions to the Contract Administrator in writing.

3.2 PREPARATION

- .1 Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.3 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions and ASTM E1643.
- .2 Use sheets of largest practical size to minimize joints. Lap joints 150 mm and tape continuously. Roll seams.
- .3 Seal vapour retarder to foundations using pointing mastic, and mechanically fasten to inside face of grade beams and foundation walls as indicated.
- .4 Seal penetrations, including pipe penetrations, with fabricated collar and in accordance with manufacturer's instructions.
 - .1 Repair small punctures and tears with sealing tape before work is concealed.
 - .2 Where damage to vapour retarder exceeds tape width, repair with additional layer of vapour retarder, minimum 150 mm overlap in all directions from edge of damage.
 - .1 Tape continuously around perimeter of patch.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Metal plate panels for walls, with accessory components and referred to on the Drawings as "ALUM-1 and ALUM-2".
 - .1 Pressure equalized rain screen (PERS) based system.

1.2 RELATED REQUIREMENTS

- .1 Section 05 41 00 - Structural Metal Stud Framing: Wall panel substrate sheathing.
- .2 Section 07 05 43 - Cladding Support System.
- .3 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .4 Section 07 21 00 - Thermal Insulation.
- .5 Section 07 25 00 - Weather Barriers: Air-water barrier behind wall panels.

1.3 REFERENCE STANDARDS

- .1 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- .2 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .3 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- .4 ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- .5 ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Preinstallation meeting: Convene one week before starting work related to installation of wall panel substrate.
 - .1 Require attendance of parties directly effecting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, review flashings, special cladding details, wall penetrations, openings; and review manufacturers' installation instructions.
 - .2 Require attendance by the City, Contract Administrator, Contractor, installer and relevant sub-contractors.
- .2 Coordination:
 - .1 Coordinate metal plate wall panel assemblies with rain drainage work, flashing, trim, and other adjoining work to provide leakproof, secure, and non-corrosive installation.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

- .2 Product data: Manufacturer's data sheets on each product to be used, including:
 - .1 Physical characteristics of components shown on Shop Drawings.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation instructions and recommendations.
- .3 Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
 - .1 Combine with Shop Drawings of cladding support system specified in Section 07 05 43.
 - .2 Indicate substrates and adjacent work with which the wall system must be coordinated.
 - .3 Include large-scale details of anchorages and connecting elements.
 - .4 Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing, drainage system, and rainscreen interface at a scale of not less than 1:10.
 - .5 Include design engineer's stamp or seal on Shop Drawings for attachments and anchors.
- .4 Samples: Submit two samples of wall panel, 300 mm by 300 mm in size illustrating finish colour, sheen, and texture, and including clips, anchors, and other panel accessories.
- .5 Design data: Submit structural calculations stamped by design engineer, for Contract Administrator's review and project record.
- .6 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .7 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Design engineer's qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
- .2 Installer qualifications: Company specializing in performing work of the type specified with minimum three years of documented experience.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.
- .2 Construct mock-up, 1 m long by 1 m wide; include aluminum plate wall panel at adhered masonry veneer and composite metal wall panel transition, with an L-shape corner, attachments to building frame, associated air/water barrier materials, weep drainage system, sealants and seals, and related wall insulation in mock-up.
- .3 Locate where directed.
- .4 Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- .2 Store prefinished material off ground and protected from weather; prevent twisting, bending, or abrasion, and provide ventilation to stored materials; slope metal sheets to ensure drainage.
- .3 Prevent contact with materials that may cause discolouration or staining of products.

1.9 PROJECT CONDITIONS

- .1 Field measurements: Verify actual dimensions by site measurement before fabrication; show recorded measurements on Shop Drawings.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design: Aluminum plate wall panels.
 - .1 SL5000-P manufactured by Sobotec Ltd..
 - .2 Substitutions: See Part B - Bidding Procedures.

2.2 DESIGN CRITERIA

- .1 Metal plate wall panels system: Factory fabricated prefinished metal panel system, site assembled.

2.3 MANUFACTURED METAL PANELS - TYPE ALUM-1 AND ALUM-2

- .1 Metal plate wall panel system: Solid aluminum plate panels, extruded aluminum sub-framing, clips, fasteners, anchors and cladding support system. Provide installed panel system capable of maintaining specified performance without defects, damage or failure.
 - .1 Assume overall responsibility for metal plate wall panel system and cladding support system engineering, including but not limited to:
 - .1 Determining sizes of thermally-broken cladding support clips, and sub-girts.
 - .2 Determining fastening details to framing, sub-framing and panels.
 - .2 Provide structural design by or under direct supervision of a Structural Engineer licensed in the Province in which the Project is located.
 - .3 Anchor panels to supporting framing without exposed fasteners.
- .2 Performance requirements:
 - .1 Pressure-equalized rain screen design: To accommodate movement of air into the rain screen cavity and move water vapour out.
 - .2 Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and adjacent components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - .3 Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.

- .4 Design pressure: In accordance with applicable codes, and as indicated on Drawings.
- .5 Wind load testing: In compliance with ASTM E330/E330M to obtain the following results:
 - .1 Maximum allowable deflection of panels: $L/120$ for length(L) of span.
- .6 Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths. Provide angled (mitred) corners where indicated.
- .3 Metal plate wall panels:
 - .1 Orientation: Vertical; style as indicated.
 - .2 Joint layout: As indicated on Drawings.
 - .3 Material: Aluminum, 5 mm nominal thickness.
 - .4 Panel width: As indicated.
- .4 Panel frame: Extruded aluminum full length perimeter frame stud welded to back of panel.
- .5 Panel clips: As recommended by manufacturer.
- .6 Subgirt framing assembly: Wall panel manufacturer's standard profile; to attach wall panel system to thermal clips, or building framing.
 - .1 1.52 mm thick formed Z275 galvanized steel sheet in accordance with ASTM A653/A653M.
- .7 Fasteners: Provide of aluminum or stainless steel material.

2.4 MATERIALS

- .1 General: Provide products containing recycled content.
- .2 Aluminum plate: ASTM B209 (ASTM B209M), 3003 alloy, H14 temper.
 - .1 Surface texture: Smooth.
- .3 Cladding support system: See Section 07 05 43.

2.5 FINISHES

- .1 Superior performing organic top coating: Complying with AAMA 2605 for testing, performance, and application procedures, and consisting of two-coat, thermally cured polyvinylidene fluoride (PVDF) system.
 - .1 Chemically etch metal panels using appropriate cleaner in accordance with manufacturer's written instructions.
 - .2 Primer: Apply acid resistant primer to cleaned aluminum metal plate; thickness range of 0.005 mm to 0.0076 mm.
 - .3 PVDF resin colour coating: At least 70 percent polyvinylidene fluoride (PVDF) based; thickness range of 0.023 mm to 0.033 mm and applied by metal finisher certified by coating manufacturer.
 - .1 Fluoropon Classic II.
 - .4 Colours:
 - .1 ALUM-1: Custom colour to match thin brick (adhered masonry veneer).
 - .2 ALUM-2: Custom colour to match standing seam metal wall panels.
- .2 Back side coating: Panel manufacturer's standard wash coat.
- .3 Panel edges: Matching exposed face.

2.6 ACCESSORIES

- .1 Site touch-up paint: As recommended by panel manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate framing members are ready to receive panels.
- .2 Verify that weather barriers have been properly installed over substrate.
- .3 Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.
- .4 Notify Contract Administrator in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Install cladding support system where indicated, as specified in Section 07 05 43.
- .2 Install subgirts perpendicular to panel length, securely fastened to substrates, shimmed and leveled to uniform plane, and spaced at intervals indicated on reviewed Shop Drawings.

3.3 INSTALLATION

- .1 Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- .2 Install panels on walls in accordance with manufacturer's instructions and reviewed Shop Drawings.
- .3 Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- .4 Protect surfaces in contact with dissimilar metals with bituminous paint; allow time to properly dry prior to wall panel installation.
- .5 Fasten panels to substrate structural supports; aligned, level, and plumb.
- .6 Use concealed fasteners unless otherwise indicated and approved by Contract Administrator.
- .7 Replace damaged products.

3.4 TOLERANCES

- .1 Maximum offset from true alignment between adjacent members butting or in line: 1.6 mm.

3.5 CLEANING

- .1 Remove protective material from wall panel surfaces.

3.6 PROTECTION

- .1 Protect installed products from damage until Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Exterior cladding consisting of formed metal composite material (referred to on the Drawings as "CMP") sheet, secondary supports, thermal clip cladding support system, anchors to structure, attached to solid backup.
- .2 Matching flashing and trim.
- .3 Supply of metal composite (CMP) sheet materials for decorative formed metal fabrications.

1.2 RELATED REQUIREMENTS

- .1 Section 05 41 00 - Structural Metal Stud Framing: Panel support framing.
- .2 Section 05 75 00 - Decorative Formed Metal: CMP-sheet decorative formed metal fabrications.
- .3 Section 07 05 43 - Cladding Support System.
- .4 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .5 Section 07 21 00 - Thermal Insulation.
- .6 Section 07 25 00 - Weather Barriers: Weather barrier behind wall panel system.
- .7 Section 07 62 00 - Sheet Metal Flashing and Trim: Fabrication requirements for metal flashing and trim components integrated with this wall system.
- .8 Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- .9 Section 09 21 16 - Gypsum Board Assemblies: Wall panel substrate.

1.3 REFERENCE STANDARDS

- .1 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- .2 ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- .3 ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- .4 ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip 2022.
- .5 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .6 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- .7 ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.
- .8 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

- .9 ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- .10 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- .11 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- .12 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .13 ASTM D523 - Standard Test Method for Specular Gloss 2014 (Reapproved 2018).
- .14 ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives 1998 (Reapproved 2021).
- .15 ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics 2020.
- .16 ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet 2010 (Reapproved 2018).
- .17 ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films 2007 (Reapproved 2015).
- .18 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Convene one week before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate; review flashings, special cladding details, wall penetrations, openings; and review manufacturers' installation instructions and warranty requirements.
 - .1 Require attendance by the installer and relevant sub-contractors.
 - .2 Include CMP sheet manufacturer's representative and wall system manufacturer's representative to review storage and handling procedures.
 - .3 Review procedures for protection of work and other construction.
- .2 Coordination:
 - .1 Coordinate CMP wall panel assemblies with rain drainage work, flashing, trim, and other adjoining work to provide leakproof, secure, and non-corrosive installation.
 - .2 Coordinate supply of CMP wall panel materials required for fabrication of CMP-sheet decorative formed metal fabrications specified in Section 05 75 00.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data - CMP sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
 - .1 Finish manufacturer's data sheet showing physical and performance characteristics.
 - .2 Storage and handling requirements and recommendations.
 - .3 Fabrication instructions and recommendations.
 - .4 Specimen warranty for finish, as specified herein.

-
- .3 Product data - Wall system: Manufacturer's data sheets on each product to be used, including:
 - .1 Physical characteristics of components shown on Shop Drawings.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation instructions and recommendations.
 - .4 Shop Drawings: Show panel layout and elevations, dimensions and thickness of panels, connections, edge conditions, details and location of joints, support clips, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - .1 Combine with Shop Drawings of cladding support system specified in Section 07 05 43.
 - .2 Indicate panel numbering system.
 - .3 Differentiate between shop- and site-fabrication.
 - .4 Differentiate between dry-joint and wet sealant-sealed systems.
 - .5 Indicate substrates and adjacent work with which the wall system must be coordinated.
 - .6 Include large-scale details of anchorages and connecting elements.
 - .7 Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing and drainage system at a scale of not less than 1:10.
 - .8 Include design engineer's stamp or seal on Shop Drawings for attachments and anchors.
 - .5 Samples: For each finish product specified, submit at least two samples, including clips, anchors, supports, fasteners, and other panel accessories; minimum size 305 mm square, showing 4-way joint, and representing actual product in colour.
 - .6 Certificate: Certify that the work results of this section meet or exceed specified requirements.
 - .7 Design data: Submit structural calculations stamped by design engineer, for Contract Administrator's review and project record.
 - .8 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
 - .9 Installer's qualification statement.
 - .10 Maintenance data: Care of finishes and warranty requirements.
 - .11 Executed warranty: Submit warranty and ensure that forms have been completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Design engineer's qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
- .2 Installer qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience and approved by manufacturer.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements,
- .2 Construct mock-up of each type of joint system.
 - .1 Construct rain screen dry-joint system mock-up 2 m long by 2 m wide. Include panel system, glazed window opening, attachments to building frame, associated air/water barrier materials, weep drainage system, sealants and seals, and related wall insulation in mock-up.
 - .2 Construct "wet" sealant-sealed joint system mock-up at canopy and above apparatus bay doors. Include panel system, folded edge, attachments to building frame, associated air/water barrier materials, sealants and seals, and related wall insulation in mock-up.
- .3 Locate where directed.
- .4 Mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - .1 Protect finishes by applying heavy duty removable plastic film during production.
 - .2 Package for protection against transportation damage.
 - .3 Provide markings to identify components consistently with Drawings.
 - .4 Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- .2 Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - .1 Store in well ventilated space out of direct sunlight.
 - .2 Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
 - .3 Store at a slope to ensure positive drainage of any accumulated water.
 - .4 Do not store in any enclosed space where ambient temperature can exceed 49 degrees C.
 - .5 Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.9 PROJECT CONDITIONS

- .1 Field measurements: Verify actual dimensions by site measurement before fabrication; show recorded measurements on Shop Drawings.

1.10 WARRANTY

- .1 CMP sheet manufacturer's finish warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 20 years:
 - .1 Chalking: No more than that represented by a No. 8 rating based on ASTM D4214.
 - .2 Colour retention: No fading or colour change in excess of 5 Hunter colour difference units, calculated in accordance with ASTM D4214.

- .3 Gloss retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of design metal composite material (CMP) sheet manufacturer:
 - .1 Alpolic.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Wall panel system manufacturers:
 - .1 Alumax.
 - .2 Northern Facades; ACCUMET - Preformed Composite Wall Panels.
 - .3 Vicwest.
 - .4 Flynn Canada.

2.2 WALL PANEL SYSTEM

- .1 Wall panel system: Metal composite material (CMP) panels, clips, fasteners, anchors and cladding support system supported by metal framing. Provide installed panel system capable of maintaining specified performance without defects, damage or failure.
 - .1 Assume overall responsibility for metal wall panel system and cladding support system engineering, including but not limited to:
 - .1 Determining sizes of thermally-broken cladding support clips, and sub-girts.
 - .2 Determining fastening details to framing, sub-framing and panels.
 - .2 Provide structural design by or under direct supervision of a Structural Engineer licensed in the Province in which the Project is located.
 - .3 Provide panel jointing using rain screen system dry joint with CMP spline, except as follows:
 - .1 Provide panel jointing using a "wet", sealant-sealed system where indicated.
 - .4 Anchor panels to supporting framing without exposed fasteners.
- .2 Performance requirements:
 - .1 Pressure-equalized rain screen design: To accommodate movement of air into the rain screen cavity and move water vapour out, except for areas using "wet" sealant-sealed system.
 - .2 Thermal movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 40 degrees C to 82 degrees C without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
 - .1 Wind performance: Provide system that will perform without permanent deformation or failures of structural members under the following conditions:
 - .2 Design wind pressure: As indicated on Drawings.
 - .3 Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.

- .4 Maximum anchor deflection in any direction of 1.6 mm at connection points of framing members to anchors.
- .3 Building envelope performance: Complies with ASHRAE Std 90.1 I-P when tested as part of a building envelope assembly.
- .3 Panels: 25 mm deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
 - .1 Reinforce corners with riveted aluminum angles.
 - .2 Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
 - .3 Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
 - .4 Reinforce panels as required with metal angle braces 610 mm on centre in short direction.
 - .1 Secure reinforcing members to back face of panels using structural silicone sealant approved by CMP sheet manufacturer.
 - .5 Metallic finished panels: Maintain consistent grain of CMP sheet; specifically, do not rotate sheet purely to avoid waste.
 - .6 Fabricate panels under controlled shop conditions.
 - .7 Where final dimensions cannot be established by site measurement before commencement of manufacturing, make allowance for site adjustments without requiring site fabrication of panels.
 - .8 Fabricate as indicated on Drawings and as recommended by MCM sheet manufacturer.
 - .1 Make panel lines, breaks, curves and angles sharp and true.
 - .2 Keep plane surfaces free from warp or buckle.
 - .3 Keep panel surfaces free of scratches or marks caused during fabrication.
 - .9 For "wet" sealant-sealed system, provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
 - .10 For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

2.3 MATERIALS

- .1 Metal composite material (CMP) sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content. Provide products containing recycled content.
 - .1 Overall sheet thickness: 4 mm, minimum.
 - .2 Face sheet thickness: 0.50 mm, minimum.
 - .3 Alloy: Manufacturer's standard, selected for best appearance and finish durability.
 - .4 Bond and peel strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 100 N-mm/mm with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 21 degrees C.

-
- .5 Surface burning characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with CAN/ULC S102.
 - .6 Flammability: Self-ignition temperature of 343 degrees C or greater, when tested in accordance with ASTM D1929.
 - .7 Factory finish: Two coat fluoropolymer resin coating, to AAMA 2605 approved by the coating manufacturer for the length of warranty specified for the project, and applied by coil manufacturing facility that specializes in coil applied finishes.
 - .1 Basis of Design: Lumiflon FEVE fluoropolymer resin coating as manufactured by AGC.
 - .2 Coating flexibility: Pass ASTM D4145 minimum 1T-bend, at time of manufacturing.
 - .3 Long-term performance: Not less than that specified under WARRANTY in PART 1.
 - .4 Colours:
 - .1 CMP1: White, selected by Contract Administrator from manufacturer's stock solid colours.
 - .2 CMP2: Mica MFS Grey.
 - .2 Metal framing members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation. Provide products containing recycled content.
 - .1 Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
 - .2 Sheet steel components: ASTM A653/A653M galvanized to Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
 - .3 Stainless steel sheet components: ASTM A480/A480M.
 - .4 Aluminum components: ASTM B209 (ASTM B209M); or ASTM B221 (ASTM B221M).
 - .3 Flashing: Sheet aluminum; 1.2 mm thick, minimum; finish and colour to match CMP sheet; refer to Section 07 62 00 for additional requirements.
 - .4 Anchors, clips and accessories: Use one of the following:
 - .1 Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
 - .5 Fasteners:
 - .1 Exposed fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Contract Administrator.
 - .2 Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
 - .3 Bolts: Stainless steel.
 - .4 Fasteners for flashing and trim: Blind fasteners of high-strength aluminum or stainless steel.
 - .6 Joint sealer and backer rod for wet sealant-sealed system: Provide colour to match wall panels non-sagging, non-staining, non-bleeding silicone sealant of type approved by MCM sheet manufacturer, with reduced dirt pick-up, and in compliance with ASTM C920.

- .7 Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.
- .8 Cladding support system: See Section 07 05 43.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine dimensions, tolerances, and interfaces with other work.
- .2 Verify that air/vapour barrier has been installed over substrate.
- .3 Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.
- .4 If substrate preparation is the responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.
- .5 Notify Contract Administrator in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Install cladding support system as specified in Section 07 05 43.

3.3 INSTALLATION

- .1 Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- .2 Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with reviewed Shop Drawings.
- .3 Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- .4 Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- .5 Do not form panels on site unless required by wall system manufacturer and approved by the Contract Administrator; comply with MCM sheet manufacturer's instructions and recommendations for site forming.
- .6 Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- .7 Where joints are designed for site-applied sealant, seal joints completely with specified sealant.
- .8 Install flashings as indicated on Shop Drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
- .9 Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
 - .1 Variation from plane or location: 10 mm in 10 m of length and up to 20 mm in 100 m, maximum.

- .2 Deviation of vertical member from true line: 3 mm in 9 m run, maximum.
 - .3 Deviation of horizontal member from true line: 3 mm in 9 m run, maximum.
 - .4 Offset from true alignment between two adjacent members abutting end-to-end, in line: 0.75 mm, maximum.
- .10 Replace damaged products.

3.4 CLEANING

- .1 Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- .2 Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- .3 Remove temporary coverings and protection of adjacent work areas.
- .4 Clean installed products in accordance with manufacturer's instructions.

3.5 PROTECTION

- .1 Protect installed panel system from damage until Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Modified bituminous roofing membrane, conventional application.
- .2 Insulation, flat and tapered.
- .3 Vapour retarders.
- .4 Deck sheathing.
- .5 Base flashings.

1.2 RELATED REQUIREMENTS

- .1 Section 05 31 00 - Steel Decking : Product requirements for acoustical insulation for deck flutes, for placement by this section.
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings.
- .4 Section 08 62 00 - Unit Skylights: Skylight frame, integral curb, and counterflashing.

1.3 REFERENCE STANDARDS

- .1 ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- .2 ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces 2011 (Reapproved 2019).
- .3 CAN/CSA A123.21 - Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems 2020.
- .4 CAN/ULC S704 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced 2017.
- .5 CCOHS - Canadian Centre for Occupational Health and Safety - Fire Extinguisher Fact Sheet Current Edition.
- .6 CRCA Roofing Specifications Manual - Roofing Specifications Manual Current Edition.
- .7 CSA A123.23 - Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced 2015 (Reaffirmed 2020).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with installation of associated flashings and counterflashing installed by other sections.
 - .2 Coordinate with installation of roof-mounted equipment, hatches, and skylights.
- .2 Preinstallation meeting: Convene one week before starting work of this section.
 - .1 Review preparation and installation procedures and coordinating and scheduling required with related work.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

- .2 Product data: Provide manufacturer's catalogue data for membrane and bitumen materials, base flashing materials, insulation, vapour retarder, and deck sheathing, and base sheet panel.
 - .1 Sustainable design submittal: Include testing documentation of solar reflectance index.
- .3 Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
- .4 Samples: Submit two samples 300 by 300 mm in size illustrating granule surfaced sheet.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; evidence of heat island effect mitigation; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .7 Manufacturer's certificate: Certify that products meet or exceed specified requirements.
- .8 Manufacturer's site reports: Indicate procedures followed, ambient temperatures, humidity, and wind velocity during application.
- .9 Installer's qualification statement.
- .10 Warranty: Submit manufacturer warranty and ensure forms have been completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Use an installation company that is a member in good standing of the Canadian Roofing Contractors Association (CRCA) with a minimum three years documented experience.
- .2 Manufacturer's representative (company providing written guarantee) shall:
 - .1 Perform a technical review of the specified roofing system and details.
 - .2 Attend site at regular intervals including not less than one visit at each of the following construction stages: pre-construction, 25%, 60%, and completion.
 - .3 Report in writing to Contractor, Contract Administrator, and City conditions deemed detrimental to roofing system.
 - .4 Advise membrane manufacturer of such inspection.
 - .5 Ensure system placed in accordance with manufacturer's recommendations.
 - .6 Certify through manufacturer's letters of assurance that roofing system is designed in accordance with specified performance requirements and installed in compliance with manufacturer's instructions.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.

1.8 FIRE PROTECTION

- .1 Protect roof junctions at parapets, roof curbs and upstands with a fire-resistant tape or barrier to prevent combustible materials within assemblies from ignition arising from the use of torches. Install prior to installation of base sheets.
- .2 Use a heat detector gun to spot any smouldering or concealed fire at the end of each work day. Establish a minimum one-hour fire watch after torch application.
- .3 Do not apply torch directly to dry or unprotected wood surfaces.
- .4 Maintain a clean site and have one approved ABC fire extinguisher in compliance with CCOHS within 6 metres of each roofing torch. Respect all safety measures described in manufacturer's technical data sheets. Do not place torches near combustible or flammable products.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- .2 Store materials in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.
- .3 Place plywood runways over the Work to enable the movement of materials and other traffic during construction of roofing.
- .4 Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- .5 Protect foam insulation from direct exposure to sunlight.
- .6 In the event of materials damage by the elements, improper handling or other causes, such materials will be rejected and will be replaced at no extra cost to the City. Remove rejected materials promptly from the site.

1.10 SITE CONDITIONS

- .1 Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.
- .2 Do not apply roofing membrane during unsuitable weather.
- .3 Do not apply roofing membrane when ambient temperature is below negative 23 degrees C.
- .4 Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- .5 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- .6 Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.11 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals for additional warranty requirements.

- .2 Provide 10-year system warranty:
 - .1 Installer's warranty: Correct defective Work within a two year period after Date of Substantial Performance. Installer is responsible for repair of leaks pertaining to faulty materials and workmanship, and repair of installer related roofing defects.
 - .2 Manufacturer's guarantee (manufacturer means single company providing modified bituminous membrane roofing): Covers years 3 through 8 of warranty period.
 - .1 Manufacturer's written warranty against failure of roofing system, leakage for a period of 10 years from the date of completion of installation. Including labour and material for repair, replacement of roofing components from the structural deck up.
 - .3 Name of Warrantee: Warrantor shall issue a written and signed warranty identifying the City's name as the warrantee and stating that executed work will remain in place and be free of any defects in materials and workmanship for the stated warranty period.

Part 2 Products

2.1 MANUFACTURERS

- .1 Membrane materials:
 - .1 Soprema.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.2 PERFORMANCE REQUIREMENTS

- .1 General performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- .2 Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- .3 Slope: Ensure finished roof surfaces slope to drains; minimum 2%.
- .4 Wind uplift performance:
 - .1 Provide tested roofing systems that meet wind uplift performance requirements for conventional roofing assemblies in accordance with CAN/CSA A123.21 as follows:
 - .2 Wind loads: Based on 1/50 year occurrence as follows:
 - .1 Building geometry: Low rise, based on building height, width and length indicated on Drawings, and having parapets of height indicated.
 - .2 Building exposure: Rough terrain.
 - .3 Building openings: Category 2.
 - .4 Building importance: High.
 - .3 For purposes of wind uplift assessment, designate roof membrane as plane of air tightness.
 - .4 Indicate necessary modifications to roofing system assembly to ensure system resistance to wind uplift forces. Address fastener distribution and adhesive application.

2.3 ROOFING - CONVENTIONAL APPLICATION

- .1 Modified bituminous roofing: Two-ply membrane, with vapour retarder and insulation.
- .2 Roofing assembly requirements:
 - .1 Solar Reflectance Index (SRI): 78, minimum initial, calculated in accordance with ASTM E1980, or a three-year aged SRI of 60 or greater.
 - .1 Site applied coating may not be used to achieve specified SRI.
 - .2 Surfacing: Mineral granules.
- .3 Acceptable insulation types:
 - .1 Uniform thickness polyisocyanurate board covered with tapered polyisocyanurate board.

2.4 MEMBRANE AND SHEET MATERIALS

- .1 Base sheet panel: Base sheet membrane factory-laminated to high-density polyisocyanurate insulation support panel and as follows:
 - .1 Roofing membrane with non-woven polyester reinforcement and elastomeric bitumen, top side covered with thermofusible plastic film on the top surface.
 - .2 Components:
 - .1 Reinforcement: Non-woven polyester.
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
 - .3 Support panel: High-density polyisocyanurate insulation.
 - .4 Mark top face with lines to ensure proper roll alignment.
 - .3 Characteristics:
 - .1 Membrane thickness: Minimum 2.2 mm.
 - .2 Support panel thickness: 12.7 mm.
 - .4 Products:
 - .1 Soprema; 2-1 Soprasmart ISO HD.
- .2 Membrane base sheet flashing (stripping):
 - .1 Primer: Manufacturer's recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of self-adhesive membranes suitable for application temperatures.
 - .2 Roofing membrane with non-woven polyester reinforcement and glass grid and elastomeric bitumen. Top face covered with thermofusible plastic film, underside self-adhesive and protected by silicone release paper in accordance with CSA A123.23 type C, grade 3.
 - .3 Characteristics:
 - .1 Cold bending at minimum negative 25 degrees C: No cracking.
 - .2 Membrane thickness: Minimum 2.5 mm.
 - .4 Products:
 - .1 Soprema; Sopraply Flam Stick.

- .3 Roof membrane cap sheets
 - .1 Field area and flashing cap sheets:
 - .1 Roofing membrane with composite reinforcement and elastomeric bitumen with flame-retarding agent. Top face protected by coloured granules, underside covered with a thermofusible plastic film, in accordance with CSA A123.23 type C, grade 1.
 - .1 Components:
 - .1 Reinforcement: Composite
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
 - .3 Protection: Coloured granules - Highly reflective white, and contrasting colour selected by Contract Administrator for walkways.
 - .2 Characteristics:
 - .1 Cold bending at minimum negative 25 degrees C: No cracking.
 - .2 Softening point: Greater than or equal to 110 degrees C.
 - .3 Membrane thickness: Minimum 4.3 mm.
 - .3 Products:
 - .1 Soprema; Soprastar Flam FR GR.
 - .4 Self-adhesive vapour retarder (referred to on the Drawings as "self-adhesive air/vapour barrier membrane": Self-adhering rubberized asphalt sheet, comprised of SBS modified bitumen adhesive, factory-laminated to woven, high-density slip resistant polyethylene top surface, and release liner on bottom surface.
 - .1 Products:
 - .1 Soprema; Sopravap'r.
 - .5 Flexible flashing material: Same material as membrane.

2.5 DECK SHEATHING AND COVER BOARDS

- .1 Deck sheathing: Gypsum-fibre sheathing, ASTM C1278/C1278M, Type X where indicated, thickness indicated.

2.6 INSULATION

- .1 Polyisocyanurate (ISO) board insulation: Rigid cellular foam, complying with CAN/ULC S704.
 - .1 Classifications:
 - .1 Type 2, Class 3: Inorganic glass mat facer on both major surfaces of core foam.
 - .1 Thermal resistance, RSI-value: 0.99 at 25 mm thick at 24 degrees C.
 - .2 Board size: 1220 by 1220 mm.
 - .3 Board thickness: As indicated, applied in two layers.
 - .4 Tapered board: Slope as indicated; minimum thickness 25.4 mm; fabricate of fewest layers possible.
 - .5 Board edges: Square.

2.7 ACCESSORIES

- .1 Deck sheathing fasteners: #12 flat counter-sunk head, self-tapping, cadmium plated, length for minimum 19 mm penetration through steel deck.
- .2 Insulation and base sheet panel adhesive: Bead-applied, low-rise, one-component or multicomponent urethane as recommended by roofing manufacturer, compatible with roofing materials.
- .3 Insulation fasteners (at perimeter): Appropriate for purpose intended and approved by roofing manufacturer.
 - .1 Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- .4 Base sheet panel joint tape: As recommended by membrane manufacturer.
- .5 Sealants: As recommended by membrane manufacturer.
- .6 Rigid conduit penetrations: Mill finish aluminum flashing sleeve with integral deck flange, removable cap, EPDM base seal, and EPDM grommet seal. Diameter to suit conduit size.
- .7 Vent stack flashing: Vandal-proof, 1.6 mm mill finish 1100-OT alloy aluminum, diameter to suit vents, aluminum hood and perforated collar, premoulded urethane insulation liner, bituminous painted deck flange.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces and site conditions are ready to receive work.
- .2 Verify deck is supported and secure.
- .3 Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- .4 Verify deck surfaces are dry and free of snow or ice.
- .5 Verify that roof openings, curbs, and penetrations through roof are solidly set, and nailing strips are in place.

3.2 METAL DECK PREPARATION

- .1 Install preformed acoustical glass fibre insulation strips in roof deck flutes; see Section 05 31 00. Install in accordance with manufacturer's instructions.
- .2 Install deck sheathing on metal deck:
 - .1 Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - .2 Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
 - .3 Mechanically fasten sheathing to roof deck, in accordance with roofing manufacturer's instructions, and to meet specified wind uplift requirements.

3.3 VAPOUR RETARDER INSTALLATION - CONVENTIONAL APPLICATION

- .1 Self-adhesive vapour retarder: Apply to deck surface in accordance with roofing and vapour retarder manufacturers' instructions.

- .2 Extend vapour retarder under cant strips and blocking.
- .3 Install flexible flashing from vapour retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

3.4 INSULATION INSTALLATION - CONVENTIONAL APPLICATION

- .1 Ensure vapour retarder is clean and dry, continuous, and ready for application of roofing system.
- .2 Attachment of insulation:
 - .1 Adhere first layer of insulation to vapour retarder in accordance with roofing manufacturer's instructions and to meet wind uplift requirements.
 - .2 Provide mechanical fastener for first layer at perimeter of roof and around roof openings. Use fastener type and fastening pattern as required to meet wind uplift requirements.
 - .3 Lay subsequent layers of insulation with joints staggered minimum 150 mm from joints of preceding layer.
- .3 Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- .4 Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- .5 At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 450 mm.
- .6 Do not apply more insulation than can be covered with membrane in same day.

3.5 MEMBRANE APPLICATION

- .1 Apply modified bituminous membrane roofing system in accordance with manufacturer's recommendations and CRCA Roofing Specifications Manual applicable requirements.
- .2 Base sheet panel: Adhere base sheet panel in accordance with roofing manufacturer's instructions and to meet wind uplift requirements.
 - .1 Install over insulation with long joints in continuous straight lines with end joints staggered between rows.
 - .2 Offset joints between base sheet panel and insulation minimum 150 mm in each direction. Tape joints if required by roofing system manufacturer.
 - .3 Provide supplementary fasteners if required to resist uplift pressure at roof openings, corners, and perimeter of roof.
- .3 Apply membrane; lap and seal edges and ends permanently waterproof.
- .4 Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.
- .5 At end of day's operation, install waterproof cut-off. Remove cut-off before resuming roofing.
- .6 At intersections with vertical surfaces:
 - .1 Extend membrane up a minimum of 200 mm onto vertical surfaces.
 - .2 Apply flexible flashing over membrane.
 - .3 Secure flashing to nailing strips at 100 mm on centre.
- .7 Around roof penetrations, seal flanges and flashings with flexible flashing.

- .8 Coordinate installation of roof drains and related flashings.
 - .1 Carry roofing membranes down into sump to edge of drain fitting.
 - .2 Embed flashing flange into 3 mm thickness of sealing compound on top of roofing membrane.
 - .3 Embed membrane flashing into sealant. Extend plies onto roof beyond outer edge of flange in accordance with manufacturer's instructions.
- .9 Install additional strip of cap sheet membrane, in accordance with manufacturer's written instructions, to create roof walkway as indicated on Drawings.

3.6 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control for general requirements for site quality control and inspection.
- .2 Require site attendance of roofing material manufacturers daily during installation of the Work.

3.7 CLEANING

- .1 Remove bituminous markings from finished surfaces.
- .2 In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- .3 Repair or replace defaced or damaged finishes caused by work of this section.

3.8 PROTECTION

- .1 Protect installed roofing and flashings from construction operations.
- .2 Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Fabricated sheet metal items, including flashings, counterflashing, gutters, and scuppers.
- .2 Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 18 00 - Traffic Coatings: Sealing built-in gutters into liquid applied roofing.
- .3 Section 07 64 13 - Standing Seam Metal Wall Cladding: Flashing, trim, and closures associated with metal wall cladding.
- .4 Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.3 REFERENCE STANDARDS

- .1 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- .2 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .3 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .4 ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- .5 SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate built-in gutters with liquid applied roofing specified in Section 07 18 00.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. Include the following:
 - .1 Identification of material, thickness, weight, and finish for each item and location in Project.
 - .2 Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - .3 Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - .4 Details of special conditions.
 - .5 Indicate materials and methods used to isolate and protect incompatible materials.
- .3 Samples: Submit two samples 75 by 75 mm in size illustrating metal finish colour.

- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Fabricator's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- .2 Fabricator qualifications: Company specializing in sheet metal work with five years of documented experience.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- .2 Prevent contact with materials that could cause discolouration or staining.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- .2 Completed sheet metal flashing and trim shall not rattle, leak or loosen, and shall remain watertight, and provided finished appearance.

2.2 SHEET MATERIALS

- .1 General: Provide products containing recycled content.
- .2 Galvanized steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.61 mm thick base metal.
- .3 Pre-finished galvanized steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.76 mm thick base metal, coil-coated with PVDF coating.
 - .1 PVDF (polyvinylidene fluoride) coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - .2 Colours: As indicated on Drawings.

2.3 FABRICATION

- .1 General: Custom fabricate sheet metal flashing and trim to comply with recommendations SMACNA (ASMM) that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

- .2 Form sections true to shape, accurate in size, square, and free from distortion or defects.
- .3 Fabricate continuous cleats of same material as sheet, interlocking with sheet.
- .4 Form coping pieces in minimum 2400 mm lengths, but not exceeding 3000 mm lengths.
- .5 Hem exposed edges on underside 13 mm; mitre and seam corners.
- .6 Form material with flat lock seams, except where otherwise indicated.
- .7 Fabricate corners from one piece with minimum 450 mm long legs; seam for rigidity, seal with sealant.
- .8 Fabricate vertical faces with bottom edge formed outward 13 mm and hemmed to form drip, unless otherwise indicated.
- .9 Fabricate flashings to allow toe to extend minimum 50 mm. Return and brake edges.
- .10 Fabrication tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 6 mm in 6 m on slope and location lines as indicated and within 3-mm offset of adjoining faces and of alignment of matching profiles.

2.4 SCUPPERS AND GUTTER FABRICATION

- .1 Fabricate scuppers with spillout to details indicated and with base extending minimum 100 mm beyond inside face of parapet into field of roof.
- .2 Gutters: Size and shape indicated.
- .3 Seal metal joints.

2.5 ACCESSORIES

- .1 Fasteners: Galvanized steel, with soft neoprene washers, including wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
- .2 Primer: Zinc chromate type.
- .3 Concealed sealants: Non-curing butyl sealant.
- .4 Exposed sealants: ASTM C920; elastomeric sealant, with minimum movement capability as colour to match adjacent material recommended by manufacturer for substrates to be sealed; colour to match adjacent material.
- .5 Plastic cement: ASTM D4586/D4586M, Type I.
- .6 Touch-up paint: as recommended by prefinished material manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- .2 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- .1 Install starter and edge strips, and cleats before starting installation.
- .2 Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 0.4 mm.

3.3 INSTALLATION

- .1 Install sheet metal work in accordance with SMACNA (ASMM), and as detailed.
- .2 Anchor sheet metal flashing and trim and other components of the work securely in place, with provisions for thermal and structural movement. Use fasteners, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
- .3 Comply with drawing details.
 - .1 Coping: SMACNA (ASMM), Detail 3-4A, fabricate back-up plate of same material thickness and finish as copings.
- .4 Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- .5 Apply plastic cement compound between metal flashings and felt flashings.
- .6 Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- .7 Seal metal joints watertight.
- .8 Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA (ASMM), and as indicated.
 - .1 Interlock bottom edge of coping with continuous cleat anchored to substrate at 300-mm centres. Place fasteners maximum 25 mm above kick-out at bottom of cleat
 - .2 Fully engage copings with continuous cleat.
- .9 Roof edge flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA (ASMM), and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 75-mm centres.
- .10 Secure built-in gutters in place with concealed fasteners.
- .11 Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - .1 Seal joints watertight.
 - .2 Waterproof scupper opening.
- .12 Slope gutters 2.1 mm per m, minimum.
- .13 Expansion provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3 m with no joints allowed within of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with sealant concealed within joints.

3.4 CLEANING

- .1 Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- .2 Clean and neutralize flux materials.
- .3 Clean off excess sealants.
- .4 Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

3.5 SCHEDULE

- .1 Coping, cap, parapet flashings, gutters, scuppers: Prefinished sheet steel, minimum 0.91 mm base steel thickness
- .2 Counterflashings at roofing terminations (over roofing base flashings): Galvanized sheet steel, minimum 0.61 mm base steel thickness
- .3 Roofing penetration flashings, for pipes, structural steel, and equipment supports: Galvanized sheet steel, minimum 0.61 mm base steel thickness

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Manufactured standing seam metal panels (referred to on the Drawing elevations as "MWP") for exterior wall panels, subgirt framing assembly, and thermal clip cladding support system, with related flashings and accessory components.

1.2 RELATED REQUIREMENTS

- .1 Section 05 41 00 - Structural Metal Stud Framing: Panel support framing.
- .2 Section 07 05 43 - Cladding Support System.
- .3 Section 07 08 00 - Commissioning of Thermal and Moisture Protection.
- .4 Section 07 21 00 - Thermal Insulation.
- .5 Section 07 25 00 - Weather Barriers: Weather barrier under wall panels.
- .6 Section 07 62 00 - Sheet Metal Flashing and Trim: Fabrication requirements for metal flashing and trim.
- .7 Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- .8 Section 09 21 16 - Gypsum Board Assemblies: Wall panel substrate.

1.3 REFERENCE STANDARDS

- .1 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- .2 ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- .3 ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Convene one week before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, review flashings, special cladding details, wall penetrations, openings; and review manufacturers' installation instructions and warranty requirements.
 - .1 Require attendance by the installer and relevant sub-contractors.
- .2 Coordination:
 - .1 Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and other adjoining work to provide leakproof, secure, and non-corrosive installation.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

-
- .2 Product data - wall system: Manufacturer's data sheets on each product to be used, including:
 - .1 Physical characteristics of components shown on Shop Drawings.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation instructions and recommendations.
 - .4 Specimen warranty for finish, as specified herein.
 - .3 Shop Drawings: Show panel layout and elevations, dimensions and thickness of panels, connections, edge and corner conditions, details and locations of joints, construction details, support clips, sub-girts, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - .1 Combine with Shop Drawings of cladding support system specified in Section 07 05 43.
 - .2 Differentiate between shop- and site-fabrication.
 - .3 Indicate substrates and adjacent work with which the wall system must be coordinated.
 - .4 Include large-scale details of anchorages and connecting elements.
 - .5 Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing, drainage system, and rainscreen interface at a scale of not less than 1:10.
 - .6 Include design engineer's stamp or seal on Shop Drawings for attachments and anchors.
 - .4 Samples: Submit two samples of wall panel, 305 mm by 610 mm in size representing actual product in finish colour, sheen, and texture specified, and illustrating finished joint in centre of sample.
 - .5 Design data: Submit structural calculations stamped by design engineer, for Contract Administrator's review and project record.
 - .6 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
 - .7 Installer's qualification statement.
 - .8 Executed warranty: Submit warranty and ensure that forms have been completed in the City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Design engineer's qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
- .2 Installer qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.

- .2 Construct mock-up, 2 m long by 2 m wide; include panel system, head, sill, and jamb flashing at glazed window opening, attachments to building frame, associated air/vapour barrier materials, weep drainage system, sealants and seals, related insulation, and separate mock-up of parapet cap in mock-ups.
- .3 Locate where directed by Contract Administrator.
- .4 Mock-ups may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- .2 Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- .3 Prevent contact with materials that may cause discolouration or staining of products.

1.9 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals for additional warranty requirements.
- .2 Manufacturer's standard 35 year warranty against chalk, fade, and film integrity caused by exposure to weather.

Part 2 Products

2.1 MANUFACTURERS

- .1 Standing seam metal wall panels - Type MWP:
 - .1 Morin; SLR-12-0 (50 mm deep profile).

2.2 MANUFACTURED METAL PANELS

- .1 Wall panel system: Factory prefinished metal panel system, site assembled.
 - .1 Assume overall responsibility for metal wall panel system cladding support system engineering, including, but not limited to:
 - .1 Determining sizes and spacing of thermally-broken cladding support clips, and sub-girts.
 - .2 Determining fastening details to framing, sub-framing and panels.
 - .2 Provide structural design by or under direct supervision of a Structural Engineer licensed in the Province in which the Project is located.
 - .3 Provide exterior wall panels, subgirt framing assembly, and panel clips, cladding support system.
- .2 Performance requirements:
 - .1 Pressure-equalized rain screen design: To accommodate movement of air into the rain screen cavity and move water vapour out.
 - .2 Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - .3 Design pressure: In accordance with applicable codes, and as indicated on Drawings.
 - .4 Maximum allowable deflection of panel: L/180 for length(L) of span.

- .5 Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - .6 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - .7 Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - .8 Corners: As detailed.
 - .9 Provide continuity of air barrier and vapour retarder seal at building enclosure elements in accordance with materials specified in Section 07 25 00.
 - .10 Building envelope performance: Complies with ASHRAE Std 90.1 I-P when tested as part of a building envelope assembly.
- .3 Exterior wall panels - Type MWP:
- .1 Profile: Vertical; smooth panel without ribs between standing seams.
 - .2 Side seams: Single-lock standing seam, integral, continuous overlapping suitable for continuous zipping or crimping by mechanical means.
- A technical diagram showing a cross-section of a single-lock standing seam. It consists of two vertical panels with a central locking mechanism. The locking mechanism is a single, continuous piece that fits into a groove on the top of one panel and the bottom of the other, creating a tight seal. The word "SINGLELOCK" is written in white capital letters on a dark blue rectangular background below the diagram.
- .3 Material: Precoated steel sheet, 0.76 mm minimum base steel thickness.
 - .4 Panel depth: 50 mm.
 - .5 Panel width: 305 mm coverage.
 - .6 Panel height: Full height of wall.
 - .7 Fabricate panels with hemmed top and bottom edges, and hemmed edges at openings, and penetrations through panels.
 - .8 Colour: SR-Pewter 439ZZ099M.
- .4 Panel clips: Manufacturer's one- or two-piece reinforced polyamide, thermally-broken. Include both fixed clips, and clips allowing for movement.
- .5 Subgirt framing assembly:
- .1 1.52 mm minimum thick formed zinc-coated steel sheet, Z275 galvanized coating complying with ASTM A653/A653M.
 - .2 Profile as indicated; to attach panel system to thermal clips. Perforated where indicated.
- .6 Internal and external corners: Same material, thickness, and finish as exterior sheets; profile to suit system and as indicated on Drawings; brake formed to required angles and profiles.
- .7 Expansion joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile as detailed.
- .8 Trim, closure pieces, caps, flashings, infills, and sills: Same material, and finish as exterior sheets; brake formed and hemmed to required profiles, and as shown on Drawings.
- .1 Base metal thickness:

- .1 Head and jamb flashing, closure pieces, caps, and trim: 0.91 mm, minimum.
- .2 Sill and base flashings: 1.519 mm, minimum.
- .2 Form top of wall cladding to overlap roof edge flashing as indicated
- .3 Refer to Section 07 62 00 for additional requirements.
- .9 Anchors: Galvanized steel.

2.3 MATERIALS

- .1 General: Provide products containing recycled content.
- .2 Precoated steel sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating, and on panel back with specified panel back coating.
- .3 Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.

2.4 FINISHES

- .1 Exposed surface finish: Polyvinylidene fluoride (PVDF) coating, coloured top coat over manufacturer's standard primer.
- .2 Panel backside finish: Panel manufacturer's standard backer coat.
- .3 Fluoropolymer coil coating system: Polyvinylidene fluoride (PVDF) two-coat steel coil coating system complying with AAMA 2605, including at least 70 percent PVDF resin by weight in colour coat, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.023 to 0.028 mm.
 - .1 Sherwin Williams; Fluropon Continuum Coil Coating, Colour 439Q0172.

2.5 ACCESSORIES

- .1 Cladding support system: See Section 07 05 43.
- .2 Exposed sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane. Colour selected by Contract Administrator.
- .3 Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized.
 - .1 Metal-to-metal fasteners: Self-drilling, self-tapping screws.
- .4 Site touch-up paint: As recommended by panel manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that building framing members are ready to receive panels.
- .2 Verify that air/vapour barrier has been installed over substrate.

3.2 PREPARATION

- .1 Install cladding support system as specified in Section 07 05 43.

3.3 INSTALLATION

- .1 Install panels on walls in accordance with manufacturer's instructions.
- .2 Fasten panels to supplementary framing attached to thermal clips; aligned, level, and plumb.
- .3 Use concealed fasteners unless otherwise approved by Contract Administrator.
- .4 Provide trim, closure pieces and flashing to prevent water penetration and direct moisture to exterior.
- .5 Seal and place closures to prevent weather penetration. Maintain neat appearance.

3.4 TOLERANCES

- .1 Maximum offset from true alignment between adjacent members butting or in line: 1.6 mm.

3.5 CLEANING

- .1 Remove site cuttings from finish surfaces.
- .2 Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Roof hatches.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate installation of roof hatches with roofing specified in Section 07 52 00.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's data sheets on each product to be used.
 - .1 Preparation instructions and recommendations.
 - .2 Installation methods.
 - .3 Maintenance requirements.
- .3 Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Store products in manufacturer's unopened packaging until ready for installation.
- .2 Store products under cover and elevated above grade.

Part 2 Products

2.1 ROOF HATCHES AND VENTS

- .1 Roof hatches:
 - .1 Acudor Products Inc; RHATB.
 - .2 Babcock-Davis; ThermalMAX.
 - .3 Bilco; S-50TB.
- .2 Roof hatches: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
 - .1 Style: Provide flat metal covers unless otherwise indicated.
 - .2 Mounting: Provide frames and curbs suitable for mounting conditions as indicated on Drawings.
 - .3 Thermally broken hatches: Added insulation to frame and cover; available in each manufacturer's standard, single leaf sizes; special sizes available upon request
 - .4 For ladder access: Single leaf; 760 by 915 mm.

-
- .3 Frames and curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 - .1 Material: Mill finished aluminum, 2.3 mm thick.
 - .2 Insulation: Manufacturer's standard; 76 mm rigid polyisocyanurate, located on outside face of curb.
 - .3 Curb height: As indicated on Drawings.
 - .4 Metal covers: Flush, insulated, hollow metal construction.
 - .1 Capable of supporting 1.90 kPa external load, and 0.9 kPa internal load, accounting for regional snow load requirements and a temperature range of 80 deg C without damage to unit or permanent deformation to seals.
 - .2 Material: Mill finished aluminum; outer cover 2.3 mm thick, liner 1.0 mm thick.
 - .3 Insulation: Manufacturer's standard 75 mm rigid polyisocyanurate.
 - .4 Gasket: Neoprene, continuous around cover perimeter.
 - .5 Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
 - .1 Hinges: Stainless steel, heavy duty pintle type.
 - .2 Hold open arm with vinyl-coated handle for manual release.
 - .3 Latch: Upon closing, engage latch automatically and reset manual release.
 - .4 Manual release: Pull handle on interior.
 - .5 Locking: Padlock hasp on interior.
 - .6 Ladder-assist post: Roof-hatch manufacturer's standard device for attachment to roof hatch access ladder:
 - .1 Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 - .2 Extended height: 1070 mm above finished roof deck.
 - .3 Material: Steel tube.
 - .4 Post: Square tubing.
 - .5 Finish: Manufacturer's standard, factory applied finish; colour safety yellow.

Part 3 Execution

3.1 EXAMINATION

- .1 Do not begin installation until substrates have been properly prepared.
- .2 If substrate preparation is the responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

- .1 Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4 CLEANING

- .1 Clean installed work to like-new condition.

3.5 PROTECTION

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Fireproofing (Sprayed Fire-Resistive Material - SFRM) of interior structural steel not exposed to damage or moisture, referred to on the Drawings as "spray-applied cementitious coating".

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 05 12 00 - Structural Steel Framing.
- .3 Section 07 81 23 - Intumescent Fire Protection.
- .4 Section 07 84 00 - Firestopping.

1.3 REFERENCE STANDARDS

- .1 ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 2019.
- .2 ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members 2019.
- .3 ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members 1992 (Reapproved 2020).
- .4 ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 1993 (Reapproved 2020).
- .5 ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 1993 (Reapproved 2020).
- .6 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- .7 AWCI 12-A - Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials 2017.
- .8 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials 2014.
- .9 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with placement of ceiling hanger tabs, mechanical component hangers, electrical components, and other construction to minimize need to repair, cut or remove fireproofing.
- .2 Preinstallation meeting: Convene one week before starting work of this section, to review products, design ratings, densities, thickness, bond strength, and other performance requirements.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittals Procedures.
- .2 Product data: Provide data indicating product characteristics, performance criteria, and limitations of use.

- .3 Sustainable design submittals: Submit evidence of life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Manufacturer's certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.
 - .1 Submit test results in accordance with CAN/ULC S101 for fire endurance, and CAN/ULC S102 for surface burning characteristics.
- .5 Test reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
 - .1 Bond strength.
 - .2 Bond impact.
 - .3 Compressive strength.
 - .4 Fire tests using substrate materials similar those on project.
- .6 Manufacturer's installation instructions: Indicate special procedures and conditions requiring special attention.
- .7 Site quality control submittals: Submit site test report.
- .8 Manufacturer reports: Indicate environmental conditions that applied fireproofing materials were installed.
- .9 Installer's qualification statement.
- .10 Inspection agency's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer
- .2 Inspection agency qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

1.7 SITE CONDITIONS

- .1 Do not apply fireproofing when temperature of substrate material and surrounding air is below 4 degrees C or when temperature is predicted to be below said temperature for 24 hours after application.
- .2 Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- .3 Provide temporary enclosure to prevent spray from contaminating air.

Part 2 Products

2.1 FIREPROOFING ASSEMBLIES

- .1 Provide assemblies as indicated on Drawings.
- .2 Provide ULC fire-rated assemblies to hourly ratings as follows:

- .1 Interior beams, columns and cross bracing supporting the second floor: 45-minutes.

2.2 MATERIALS

- .1 Applied fireproofing material for interior applications, concealed and exposed to view not subject to damage: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
 - .1 Composition: Gypsum-based; not mineral-fibre-based; containing no asbestos fibre.
 - .2 Bond strength: 7.2 kPa, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
 - .3 Dry density: Minimum average density of 240 kg/cu m, with minimum individual density of any test sample of 224 kg/cu m, when tested in accordance with ASTM E605/E605M.
 - .4 Compressive strength: 57.4 kPa, minimum.
 - .5 Effect of impact on bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
 - .6 Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
 - .7 Air erosion resistance: Weight loss of 0.27 g/sq m, maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
 - .8 Surface burning characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with CAN/ULC S102.
 - .9 Fungal resistance: No growth after 28 days when tested according to ASTM G21.
 - .10 VOC content and emission restrictions: in accordance with Section 01 61 16.
 - .11 Products:
 - .1 GCP Applied Technologies; Monokote MK-6.
 - .2 Carbolite AD Southwest Fireproofing; Type 5GP.
 - .3 Isolatak; Cafco 300.
 - .4 Substitutions: See Part B - Bidding Procedures.

2.3 ACCESSORIES

- .1 Primer adhesive: Of type recommended by applied fireproofing manufacturer.
 - .1 VOC content and emission restrictions: in accordance with Section 01 61 16.
- .2 Water: Clean, potable.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces are ready to receive fireproofing.
- .2 Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- .3 Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- .4 Verify that voids and cracks in substrate have been filled.

- .5 Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.2 PREPARATION

- .1 Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
- .2 Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
- .3 Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- .4 Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- .5 Close off and seal duct work in areas where fireproofing is being applied.

3.3 APPLICATION

- .1 Mix and apply fireproofing in accordance with manufacturer's instructions.
- .2 Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.
- .3 In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.

3.4 SITE QUALITY CONTROL

- .1 Engage a qualified inspection and testing agency to perform site inspection and testing in accordance with Section 01 45 00 - Quality Control, to perform the following:
 - .1 Test and inspect in accordance with AWCI 12-A.
- .2 Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
 - .1 Submit site test reports promptly to Contractor and Contract Administrator.
- .3 Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).
- .4 Repair or replace applied fireproofing at locations where test results indicate fireproofing does not meet specified requirements.
- .5 Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.5 CLEANING

- .1 Remove excess material, overspray, droppings, and debris.
- .2 Remove fireproofing from materials and surfaces not required to be fireproofed.
- .3 At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Thin-film intumescent mastic fire protection for exposed structural steel.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 05 12 00 - Structural Steel Framing.
- .3 Section 09 91 00 - Painting: Site-applied paints compatible with intumescent fireproofing.

1.3 REFERENCE STANDARDS

- .1 ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness 2015 (Reapproved 2021).
- .2 AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide 2014.
- .3 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials 2014.
- .4 ULC (FRD) - Fire Resistance Directory Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate work schedule with testing and reviewing activities.
 - .2 Coordinate application field condition requirements with construction schedule.
 - .3 Coordinate and allow for proposed extent of building envelope completion for application.
 - .4 Coordinate with steel fabrication, shop preparation, and shop-applied primer to ensure steel is ready to receive fireproofing after erection.
- .2 Pre-Installation meetings: convene pre-installation meeting minimum two weeks prior to beginning work of this Section, with Contractor's representative, intumescent fireproofing subcontractor, City, and Contract Administrator to review:
 - .1 Products and design ratings.
 - .2 Restrained and unrestrained conditions.
 - .3 Thicknesses, bond strengths.
 - .4 Standard construction project intumescent coating guidelines.
 - .5 Shop drawing and system requirements.
 - .6 Coordination with other building systems.
 - .7 Marriage details and tie-ins to other rated assemblies and non-rated assemblies.
- .3 Sequencing: Schedule application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - .1 Do not begin applying intumescent fireproofing until clips, hangers, supports, and other welded connections have been installed. Obtain intumescent fireproofing manufacturer's written approval for clips, hangers, supports or connections that may be installed after coating application due to exposure to unfavourable environmental conditions.

- .2 Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittals Procedures.
- .2 Product data: Manufacturer's data sheets on each product to be used, including:
 - .1 Performance characteristics and test results.
 - .2 Preparation instructions and recommendations.
 - .3 Storage and handling requirements and recommendations.
 - .4 Installation methods.
- .3 Verification samples: or each exposed product, colour, and texture specified:
 - .1 Submit stepped sample including approved primer, thin film intumescent coating, and approved top coating. Apply sample to 600 mm long section of same shape of structural steel as specified. Approved sample will form standard of acceptance for site-applied coating.
- .4 Sustainable design submittals: Submit evidence of life cycle assessment; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements and is acceptable to authorities having jurisdiction (AHJ).
- .6 Test reports: Published fire resistive designs for structural elements of types required for project, indicating hourly ratings of each assembly.
- .7 Site quality control submittals: Submit site test report.
- .8 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Regulatory requirements: Products supplied and installed under this section to be manufactured under testing requirements acceptable to authorities having jurisdiction (AHJ), and packaged in containers indicating ULC (FRD) compliance label.
- .2 Installer qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience and approved by manufacturer.
- .3 Certifications: Provide the following during course of the Work:
 - .1 Compliance certification: Provide certificates from manufacturer indicating tested performance requirements required by authorities having jurisdiction (AHJ) for required fire resistance rating.

1.7 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control, for additional requirements.
- .2 Provide a mock-up for evaluation of surface preparation techniques and application workmanship; approved mock-up will serve as a standard of comparison for subsequent work of this section.
- .3 Finish at least one column in areas designated by Contract Administrator.

- .4 Evaluate mock-up for compliance with specified requirements, including thickness and finish texture.
- .5 Do not proceed with remaining work until workmanship, colour, and sheen are approved by Contract Administrator.
- .6 Refinish mock-up area as required to produce acceptable work.
- .7 Approved mock-up may remain as part of the project.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.
- .2 Store products in manufacturer's unopened packaging until ready for installation.
 - .1 Store at temperatures not less than 10 degrees C in dry, protected area.
 - .2 Protect from freezing, and do not store in direct sunlight.
 - .3 Dispose of any materials that have come into contact with contaminants of any kind prior to application.
- .3 Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 SITE CONDITIONS

- .1 Protect areas of application from windblown dust and rain.
- .2 Maintain ambient site conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
 - .1 Provide temporary enclosures as required to control ambient conditions.
 - .2 Maintain ventilation in enclosed spaces during application and for not less than 72 hours afterward.

Part 2 Products

2.1 SYSTEM REQUIREMENTS

- .1 Fireproofing: Provide intumescent thin-film fire resistive coating systems tested by an independent testing agency in accordance with CAN/ULC S101 and acceptable to authorities having jurisdiction (AHJ).
 - .1 Provide assemblies listed by ULC and bearing listing agency label or mark.
- .2 Structural steel columns: Fire resistance rating as indicated; Design Number Y633.
- .3 Structural steel beams: Fire resistance rating as indicated; Design Number [___].

2.2 MATERIALS

- .1 Fire resistive coating system: Thin-film intumescent mastic fire protection system for structural steel.
 - .1 For interior use:
 - .1 Use only water-based products.
 - .2 VOC content and emission restrictions: In accordance with Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

- .3 Durometer hardness, Type D: 65, minimum, in accordance with ASTM D2240.
- .4 Finish: "Highly Decorative Finish" based on International Coatings "Coatings Application Guidelines - Finish Standard No. 3", to provide good general standard of cosmetic finish when viewed from a distance of not less than 3 m at normal viewing angles.
 - .1 Typical application method: Spray, backroll and sand with orbital sander. (Actual methods may vary depending on material used.)
- .5 Products:
 - .1 Hilti, Inc; Fire Finish CFP-SP WB.
 - .2 Cafco; SprayFilm WB 5.
 - .3 A/D Fire Protection; Fire-Film III..
 - .4 Substitutions: See Part B - Bidding Procedures.
- .2 Primer: As required by tested and listed assemblies, and as recommended by fireproofing manufacturer to suit specific substrate conditions.
 - .1 VOC content and emission restrictions: In accordance with Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection. Verify that:
 - .1 Substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.
 - .2 Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - .3 Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
 - .4 Weld flashes are ground smooth.
 - .5 Shop primer is compatible with intumescent coating and properly applied to maintain conformance to performance requirements.
 - .6 That ambient temperature, steel temperature, and humidity range requirements have been met based on manufacturer's written instructions and recommendations.
- .2 Do not begin installation until substrates have been properly prepared.
- .3 If substrate preparation is responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- .1 Thoroughly clean surfaces to receive fireproofing.
- .2 Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.
- .3 Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient site conditions.

3.3 INSTALLATION

- .1 Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.
- .2 Apply manufacturer's recommended primer to required coating thickness.
- .3 Apply fireproofing to full thickness over entire area of each substrate to be protected.
 - .1 When sanding is required to achieve scheduled finish, add additional material prior to sanding to maintain minimum thickness required for design assembly.
- .4 Apply coats at manufacturer's recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.
- .5 Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.
- .6 Achieve uniform finished appearance complying with accepted mock-up.

3.4 SITE QUALITY CONTROL

- .1 Perform site inspection and testing in accordance with Section 01 45 00 - Quality Control.
 - .1 Arrange for visual inspection of structural steel substrate condition before application, including interference by other building disciplines materials or equipment.
 - .2 Arrange for visual assessment during installation and at completion indicating acceptable finishes and noting deficiencies.
 - .3 Arrange for thickness and adhesion testing of installed thin-film intumescent fireproofing by an independent testing laboratory in accordance with AWCI 117, and ensure it meets requirements of authorities having jurisdiction (AHJ).
 - .4 Submit site test reports promptly to Contractor and Contract Administrator.
- .2 Repair or replace intumescent fireproofing at locations where test results indicate fireproofing does not meet specified requirements.
- .3 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.
 - .2 Provide report summarizing recommendations, site visits and observations.

3.5 CLEANING

- .1 Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.6 PROTECTION

- .1 Protect installed intumescent mastic fireproofing from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Performance.
- .2 Touch-up, repair or replace damaged products before Date of Substantial Performance.

3.7 SCHEDULE

- .1 Exposed steel columns at west side of Training Classroom 102.

- .2 Steel beam supporting hollowcore floor at Hose Wash 123.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated or not, and other openings indicated.
- .2 Firestop devices.
- .3 Fill, void, and cavity materials.
- .4 Wall opening protective materials.
- .5 Packing materials.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 04 22 00 - Concrete Unit Masonry: Coordination with installation of components that penetrate masonry assemblies, firestop components at top and perimeter of assemblies between fire compartments, and other gaps or joints within fire-resistance-rated assemblies.
- .3 Section 09 21 16 - Gypsum Board Assemblies: Coordination of components that penetrate gypsum board assemblies, firestop components at top, bottom and perimeter of assemblies between fire compartments, and other gaps or joints within fire-resistance-rated assemblies.

1.3 REFERENCE STANDARDS

- .1 ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops 2020a.
- .2 ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus 2015b, with Editorial Revision (2016)2020.
- .3 ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.
- .4 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials 2014.
- .5 CAN/ULC S115 - Standard Method of Fire Tests of Firestop Systems 2018.
- .6 CAN/ULC S702.1 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification 2021.
- .7 FCIA - Firestop Contractors International Association Current Edition.
- .8 IFC EJ Guidelines - Recommended International Firestop Council (IFC) Guidelines for Evaluating Firestop System Engineering Judgments Current Edition.
- .9 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meetings: Convene pre-installation meeting minimum two weeks prior to beginning work of this Section, with Contractor's representative, firestopping subcontractor, City, and Contract Administrator to review:
 - .1 Project requirements.
 - .2 Installation and substrate conditions.

- .3 Coordination with other building subtrades.
- .4 Manufacturer's installation instructions.
- .5 Project sequencing.
- .6 Environmental conditions.
- .7 Marriage details.
- .8 Top-of-wall joints (shrinkage, expansion, contraction requirements).
- .9 Perimeter joints.
- .10 Tagging and fire barrier markings.
- .11 Close-out submittals
- .12 Inspection guidelines.
- .2 Coordination:
 - .1 Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
 - .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
 - .3 Coordinate and sequence firestopping installation with affected trades.
- .3 Sequencing: Do not cover up firestopping installations until Contract Administrator or Authorities Having Jurisdiction have examined installation.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Firestopping schedule:
 - .1 List each type of penetration, each joint condition, fire rating of the assembly, and firestop system design number.
 - .2 Include floor plan drawings showing locations of firestopping assemblies.
 - .3 Include certified UL/ULC system designs, or approved substitute systems, for each condition.
- .3 Product data: Provide data on product characteristics, performance ratings, and limitations.
- .4 Certificate: Certify that products of this section meet or exceed specified requirements.
- .5 Manufacturer's installation instructions: Indicate preparation and installation instructions.
- .6 Sustainable design submittals: Submit evidence of life cycle assessment; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .7 Installer's qualification statement.
- .8 Inspection agency's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Fire testing: Provide firestopping System Design Listing by a testing agency to CAN/ULC S101, or determined by testing of materials meeting requirements of CAN/ULC S115, or a manufacturer's substitute system acceptable to the Authority Having Jurisdiction (AHJ).

- .2 Substitute systems:
 - .1 If a firestop system design is not available for project-specific configuration from any manufacturer, the firestopping installer is required to obtain an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) from a firestopping manufacturer.
 - .2 EJ and EFRRA to be prepared to IFC EJ Guidelines.
- .3 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- .4 Installer qualifications: Company specializing in performing the work of this section and:
 - .1 ULC (DIR) Qualified Firestop Contractor.
 - .2 FCIA Contractor Member in good standing.
- .5 Inspection agency qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver firestopping products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer.
- .2 Store and handle firestopping materials in accordance with manufacturer's instructions.

1.8 SITE CONDITIONS

- .1 Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- .2 Provide ventilation in areas where solvent-cured materials are being installed.

Part 2 Products

2.1 MANUFACTURERS

- .1 Firestopping manufacturers:
 - .1 3M Fire Protection Products.
 - .2 HILTI, Inc..
 - .3 Specified Technologies, Inc.
 - .4 Tremco Firestop Systems
 - .5 Substitutions: See Part B - Bidding Procedures.

2.2 DESIGN CRITERIA

- .1 Penetrations: Provide firestop systems that resist the spread of fire and the passage of smoke and other gases according to requirements indicated including, but not limited to the following:
 - .1 Firestop penetrations passing through fire-resistance-rated wall and floor assemblies and other locations as indicated on Drawings.
 - .2 Provide and install complete penetration firestopping systems that have been tested and approved by a nationally recognized third-party testing agency.
- .2 Perimeter fire containment systems: Provide interior perimeter fire containment systems with fire-resistance ratings indicated, when tested in accordance with ASTM E2307, but not less than the fire-resistance rating of the floor construction.

- .3 Fire-resistive joints: Provide joint systems with fire-resistance ratings indicated, in accordance with CAN/ULC S115, but not less than the fire-resistance rating of the construction in which the joint occurs.
- .4 For firestopping exposed to view, traffic, moisture, and physical damage, provide firestop system designs for these conditions with Flame Spread Rating (FSR) of less than 25 and Smoke Developed Classification (SDC) of less than 50 in accordance with CAN/ULC S102.
- .5 VOC content and emission restrictions: Use products in accordance with Section 01 61 16.

2.3 FIRESTOP DEVICES

- .1 Cast-in-place devices: Prefabricated flanged sleeves with intumescent liners, for use in cast-in-place concrete floors.
- .2 Pathway devices: Pass-through sleeve for cabling, designed for re-entry.
- .3 Pipe collars: Prefabricated metal collar with integral intumescent lining.
- .4 Pipe sleeves: Prefabricated metal sleeve with integral intumescent lining.

2.4 FILL, VOID AND CAVITY MATERIALS

- .1 Mortar: Cementitious compound, non-shrinking, for mixing with water at project site.
- .2 Pillows: Reusable, intumescent, compressible pillow-shaped devices.
- .3 Putty: Intumescent, non-hardening, mouldable compound.
- .4 Sealant:
 - .1 Silicone sealant: Silicone-based, intumescent sealant.

2.5 WALL OPENING PROTECTIVE MATERIAL

- .1 Outlet box firestopping: Intumescent, mouldable putty pads, precut liners or gaskets designed to protect UL-listed outlet boxes.

2.6 PACKING MATERIALS

- .1 Safing insulation: Mineral wool insulation to CAN/ULC S702.1 Type 1; preformed mineral fibre, compression fit.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify openings are ready to receive the work of this section.
- .2 Verify that site dimensions are as shown on the Drawings, system designs including EJs and EFRRAs, and the manufacturer's recommendations.

3.2 PREPARATION

- .1 Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- .2 Remove incompatible materials that could adversely affect bond.

3.3 INSTALLATION - GENERAL

- .1 Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- .2 Do not cover installed firestopping until inspected by authorities having jurisdiction.
- .3 Install labelling.

3.4 INSTALLING PENETRATION FIRESTOPS

- .1 Comply with through-penetration firestop manufacturer's installation instructions and system design.
- .2 Coordinate with other trades to ensure that penetrating items have been permanently installed.
- .3 Coordinate the work to ensure that partitions and other construction that conceal penetrations are not erected prior to installation of firestop systems.
- .4 Install packing materials and other accessories in accordance with manufacturer's installation instructions and system design.
- .5 Install fill, void, and cavity materials for through-penetration firestop systems as recommended by the manufacturer and system design:
 - .1 Clean surfaces as recommended by manufacturers' written instructions.
 - .2 Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - .3 Install materials to contact and adhere to substrates formed by openings and penetrating items.
 - .4 Finish to produce smooth, uniform surfaces.

3.5 INSTALLING FIRESTOP JOINT SYSTEMS

- .1 Comply with joint system firestop manufacturer's installation instructions and system design.
 - .1 Install joint forming materials to support firestop materials during application. Position to produce cross-sectional shapes and depths of installed firestop material relative to joint widths, permit mechanical joint movement capability, and develop fire-resistance rating required.
- .2 Install system designs that result in firestop materials:
 - .1 Directly contacting and fully wetting joint substrates.
 - .2 Completely filling recesses provided for each joint configuration,
- .3 Tool or smooth non-sag firestop materials to manufacturer's installation instructions. Form smooth, uniform beads, and to:
 - .1 produce fire-resistance-rating.
 - .2 eliminate air pockets.
 - .3 ensure contact and adhesion with sides of joint.

3.6 INSTALLING PERIMETER FIRE BARRIER SYSTEMS

- .1 Comply with firestop manufacturer's installation instructions and system design.
- .2 Install metal framing, curtainwall insulation, mechanical attachments, safing materials and other firestop system components as shown on system design.

3.7 SITE QUALITY CONTROL

- .1 Inspection: Independent inspection agency employed and paid by City, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- .2 Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.8 CLEANING

- .1 Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION

- .1 Protect adjacent surfaces from damage by material installation.
- .2 Protect firestopping during and after curing period from damage during construction.
 - .1 If damage is caused by others, City and Contractor will instruct firestop installer to make appropriate repairs and charge costs to appropriate trades.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Non-sag gunnable joint sealants.
- .2 Self-levelling pourable joint sealants.
- .3 Joint backings and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .3 Section 07 25 00 - Weather Barriers: Sealants required in conjunction with weather barriers.
- .4 Section 07 84 00 - Firestopping: Firestopping sealants.
- .5 Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.3 REFERENCE STANDARDS

- .1 ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- .2 ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).
- .3 ASTM C834 - Standard Specification for Latex Sealants 2017.
- .4 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .5 ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.
- .6 ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- .7 ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- .8 ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.
- .9 ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness 2015 (Reapproved 2021).

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data for sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - .1 Physical characteristics, including movement capability, VOC content, hardness, cure time, and colour availability.
 - .2 List of backing materials approved for use with the specific product.
 - .3 Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - .4 Substrates the product should not be used on.

- .5 Substrates for which use of primer is required.
- .6 Substrates for which laboratory adhesion or compatibility testing is required.
- .7 Installation instructions, including precautions, limitations, and recommended backing materials and tools.
- .3 Product data for accessory products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- .4 Colour cards for selection: Where sealant colour is not specified, submit manufacturer's colour cards showing standard colours available for selection.
- .5 Sustainable design submittals: Submit evidence of life cycle assessment; compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Preconstruction laboratory test reports: Submit at least four weeks prior to start of installation.
- .7 Site quality control plan: Submit at least two weeks prior to start of installation.
- .8 Site quality control log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
- .9 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- .2 Testing agency qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- .3 Preconstruction laboratory testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - .1 Adhesion testing: In accordance with ASTM C794.
 - .2 Compatibility testing: In accordance with ASTM C1087.
 - .3 Stain testing: In accordance with ASTM C1248; required only for glazed adhered masonry veneer.
 - .4 Allow sufficient time for testing to avoid delaying the work.
 - .5 Deliver to manufacturer sufficient samples for testing.
 - .6 Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 - .7 Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- .4 Site quality control plan:
 - .1 Visual inspection of entire length of sealant joints.
 - .2 Site testing agency's qualifications.

- .3 Site quality control log form: Show data fields indicated below, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified site testing; allow for possibility that more tests than minimum specified may be necessary.
 - .1 Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
 - .2 Test date.
 - .3 Location on project.
 - .4 Sealant used.
 - .5 Stated movement capability of sealant.
 - .6 Test method used.
 - .7 Date of installation of site sample to be tested.
 - .8 Date of test.
 - .9 Copy of test method documents.
 - .10 Age of sealant upon date of testing.
 - .11 Test results, modeled after the sample form in the test method document.

1.6 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

Part 2 Products

2.1 JOINT SEALANT APPLICATIONS

- .1 Scope:
 - .1 Exterior joints: Seal open joints, whether or not the joint is indicated on Drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - .1 Wall expansion and control joints.
 - .2 Joints between door, window, and other frames and adjacent construction.
 - .3 Joints between different exposed materials.
 - .4 Openings below ledge angles in masonry.
 - .5 Other joints indicated below.
 - .2 Interior joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - .1 Joints between door, window, and other frames and adjacent construction.
 - .2 Other joints indicated below.
 - .3 Do not seal the following types of joints.
 - .1 Intentional weepholes in masonry.
 - .2 Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - .3 Joints where sealant is specified to be provided by manufacturer of product to be sealed.

- .4 Joints where installation of sealant is specified in another section.
- .5 Joints between suspended panel ceilings/grid and walls.
- .6 Joints in composite metal panel wall assemblies.
- .2 Exterior joints: Use non-sag hybrid sealant, unless otherwise indicated.
 - .1 Lap joints in sheet metal fabrications: Butyl rubber, non-curing.
 - .2 Control and expansion joints in concrete paving: Self-levelling polyurethane "traffic-grade" sealant.
- .3 Interior joints: Use non-sag siliconized acrylic latex sealant, unless otherwise indicated.
 - .1 Joints between fixtures in wet areas and floors, walls, and ceilings: Mildew-resistant silicone sealant; white.
 - .2 Narrow control joints in interior concrete slabs: Self-levelling polyurea sealant.
 - .3 Other floor joints: Self-levelling polyurethane "traffic-grade" sealant.
- .4 Interior wet areas: Shower rooms, kitchens, and washrooms; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.2 JOINT SEALANTS - GENERAL

- .1 Sealants and primers: Provide products with VOC content and VOC emission requirements as indicated in Section 01 61 16.
- .2 Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- .3 Where sealants are qualified with primers use only those primers.
- .4 Colours: As indicated as selected by Contract Administrator.

2.3 NON-SAG JOINT SEALANTS

- .1 High-performance hybrid sealant: ASTM C920, Grade NS, Uses T, NT, M, A and O; not expected to withstand continuous water immersion or traffic
 - .1 Movement capability: Plus and minus 50 percent, minimum.
 - .2 Cure type: Single-component, neutral moisture curing
 - .3 Service temperature range: Minus 40 to plus 85 degrees C.
 - .4 Products:
 - .1 Master Builders Solutions; MasterSeal NP 100.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Mildew-resistant silicone sealant: ASTM C920, Grade NS, Uses M and A; mildew resistant; not expected to withstand continuous water immersion or traffic.
 - .1 Colour: White.
 - .2 Cure type: Single-component, neutral moisture curing
 - .3 Products:
 - .1 Pecora; 898NST.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .3 Siliconized acrylic latex: Water-based; ASTM C834, single-component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

- .1 Products:
 - .1 Tremco Commercial Sealants & Waterproofing; Tremflex 834.
 - .2 Pecora; AC-20+Silicone.
 - .3 Master Builders Solutions; MasterSeal NP 520.
 - .4 Substitutions: See Part B - Bidding Procedures.
- .4 Non-curing butyl sealant: Solvent-based; ASTM C1311; single-component, non-sag, non-skinning, non-hardening, non-bleeding; vapour-impermeable; intended for fully concealed applications.

2.4 SELF-LEVELLING SEALANTS

- .1 Self-levelling polyurethane sealant: ASTM C920, Grade P, Uses T, NT, M, A and O; multi-component; explicitly approved by manufacturer for interior and exterior traffic exposure; not expected to withstand continuous water immersion .
 - .1 Movement Capability: Plus and minus 25 percent, minimum.
 - .2 Hardness range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 - .3 Service temperature range: Minus 40 to 82 degrees C.
- .2 Semi-rigid self-levelling polyurea joint filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - .1 Durometer Hardness, Type A: 80, minimum, after seven days when tested in accordance with ASTM D2240.
 - .2 Joint width, Minimum: 3 mm.
 - .3 Joint width, Maximum: 6 mm.
 - .4 Joint depth: Provide product suitable for joints from 3 mm to 51 mm, or in accordance with manufacturer's instructions.
 - .5 Products:
 - .1 Metzger/McGuire; Edge-Pro 80.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.5 ACCESSORIES

- .1 Backer rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
- .2 Backing tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- .3 Masking tape: Self-adhesive, non-absorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- .4 Joint cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- .5 Primers: Type recommended by sealant manufacturer to suit application; non-staining.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that joints are ready to receive work.
- .2 Verify that backing materials are compatible with sealants.

- .3 Verify that backer rods are of the correct size.

3.2 PREPARATION

- .1 Remove loose materials and foreign matter that could impair adhesion of sealant.
- .2 Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- .3 Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- .4 Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- .5 Concrete floor joints that will be exposed in completed work: Test joint filler in inconspicuous area to verify that it does not stain or discolour slab.

3.3 INSTALLATION

- .1 Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- .2 Perform installation in accordance with ASTM C1193.
- .3 Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- .4 Install bond breaker backing tape where backer rod cannot be used.
- .5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- .6 Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- .7 Non-sag sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- .8 Concrete floor joint filler: After full cure, shave joint filler flush with top of concrete slab.

3.4 SITE QUALITY CONTROL

- .1 Perform site quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- .2 Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

GENERAL NOTES:

- 1 REFER TO SECTION 08 06 71 FOR DOOR HARDWARE SCHEDULE
- 2 REFER TO DOOR & FRAME SCHEDULE 08 06 13 AND INTERIOR ELEVATIONS FOR FRAME & SIDELITE CONFIGURATION
- 3 REFER TO EXTERIOR ELEVATIONS FOR CONFIGURATION OF EXTERIOR DOOR FRAMES, TRANSOMS & SIDELITES
UNLESS OTHERWISE DETAILED
- 4 ALL PRESSED STEEL FRAMES IN GYPSUMBOARD FINISHED WALLS TO HAVE A FRAME PROFILE WITH A JAMB DEPTH TO MATCH AND ALIGN
WITH THE FINISHED WALL THICKNESS, UNLESS OTHERWISE DETAILED
- 5 ALL PRESSED STEEL FRAMES IN INTERIOR MASONRY WALLS TO HAVE A FRAME PROFILE WITH A JAMB DEPTH TO MATCH AND ALIGN
WITH THE FINISHED WALL THICKNESS, UNLESS OTHERWISE DETAILED
- 6 REFER TO SECTION 09 91 00 FOR DOOR AND FRAME PAINT COLOURS
- 6 COORDINATE DOOR UNDERCUTS TO SUIT FINISH FLOOR THICKNESS - REFER TO INTERIOR FINISH SCHEDULE
- 7 PROVIDE MINIMUM 3 MUTES PER SINGLE DOOR LEAF

KEYNOTES:

- 1 EMERGENCY CALL SWITCH
- 2 DOOR MOUNTED IN CONCRETE WALL
- 3 PROVIDE BARRIER-FREE DOOR OPERATOR MOUNTED ON WALL . COORDINATE WITH ELECTRICAL.
- 4 DOOR FRAMES TO BE INTEGRAL WITH CURTAIN WALL, PRESSED STEEL FRAME OR STOREFRONT GLAZING SYSTEM.
- 5 CARD ACCESS DOOR WITH CARD READER.
COORDINATE DOOR FRAME PREPARTION AND HARDWARE WITH ELECTRICAL.
- 6 PROTECTIVE FRAMED GLAZING ASSEMBLY - REFER TO SECTION 08 44 35
- 7 DOOR MOUNTED IN MASONRY WALL
- 8 T/O DOOR FRAME TO ALIGN WITH CMU COURSING. REFER TO DOOR AND FRAME TYPE SCHEDULE. MODIFY DOOR HEIGHT TO SUIT
- 9 INTERCOM AND REMOTE RELEASE THAT GOES BACK TO WATCH ROOM 108
- 10 VIDEO INTERCOM SYSTEM WHICH RELEASES DOOR D100A
- 11 DOOR INSTALLED IN ALUMINUM FRAMED ENTRANCE SYSTEM
- 12 SITE CONFIRM HEIGHT OF DOOR AND FRAME WITH U/S OF STAIR LANDING TO ENSURE CLEARANCE
- 13 CURB AT DOOR THRESHOLD . SITE CONFIRM HEIGHT OF DOOR PRIOR TO INSTALLATION
- 14 REFER TO DETAILS FOR FOLDING DOOR FRAMING
- 15 WIDTH OF DOOR C/W CURTAINWALL ASSEMBLY TO ALIGN WITH METAL WALL PANEL SEAMS. REFER TO PLAN DETAILS AND ELEVATIONS.

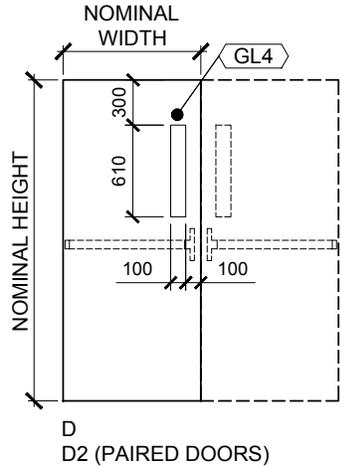
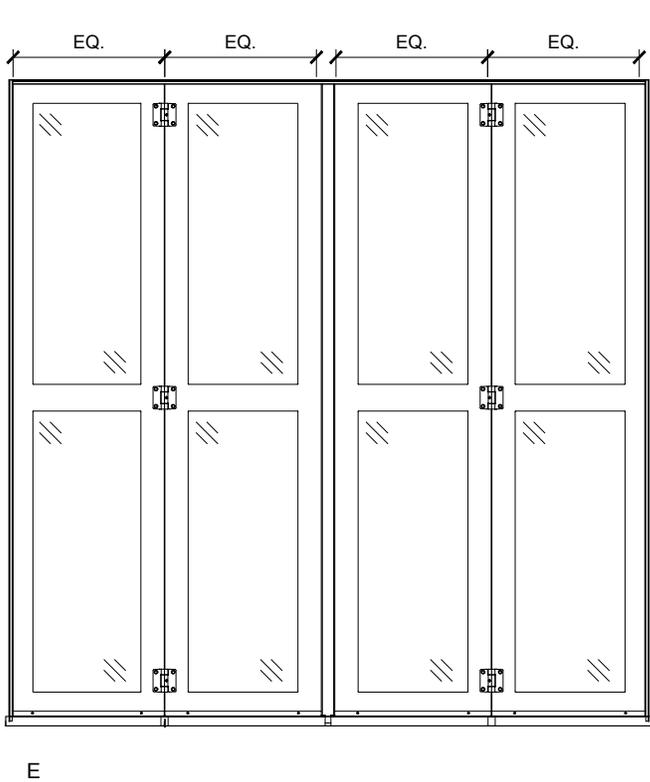
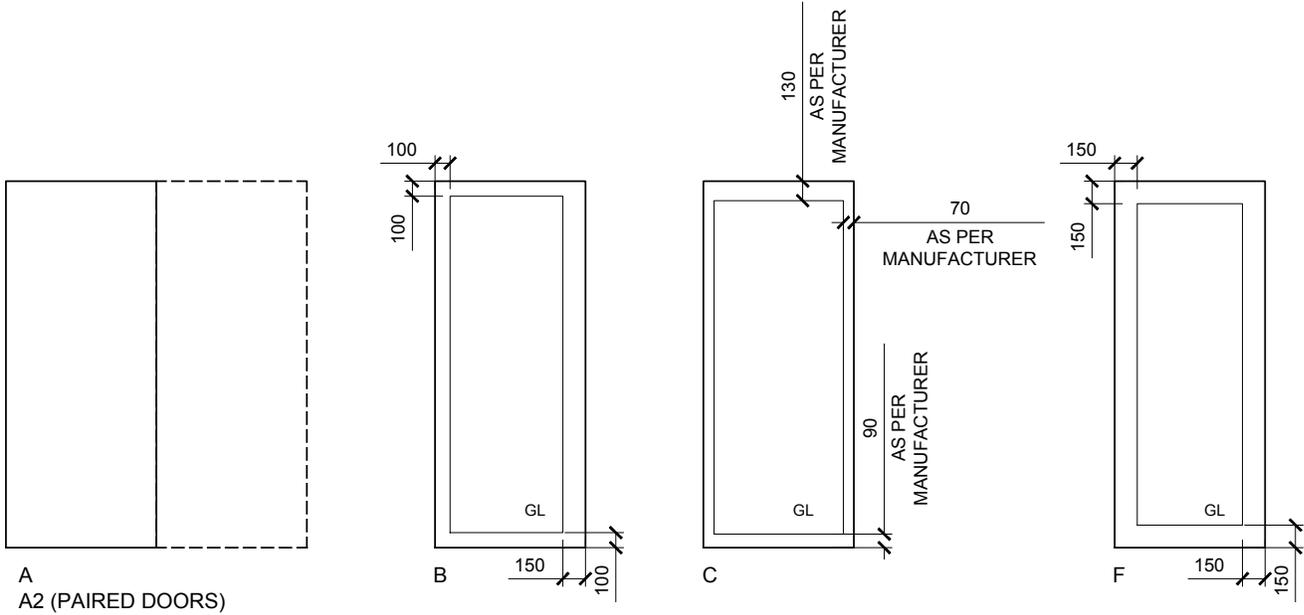
LEGEND

ALUM ALUMINUM
ANOD ANODIZED - CLEAR UNLESS NOTED OTHERWISE
CWS CURTAIN WALL SYSTEM
FR-LAM FIRE RATED - LAMINATED
HM HOLLOW METAL
HMI HOLLOW METAL, INSULATED
IGU INSULATED GLASS UNIT - REFER TO SECTION 08 80 50
INSUL INSULATED CORE
NR NON-RATED FIRE SEPARATION

PC POWDER COATED
PFGA PROTECTIVE FRAME GLAZING ASSEMBY
PREFIN PREFINISHED
PS PRESSED STEEL
PSI PRESSED STEEL, INSULATED
PST PRESSSED STEEL, THERMALLY BROKEN & INSULATED
PT PAINT - REFER TO SECTION 09 91 00
STI STEEL INSULATED
TG TEMPERED GLASS
WD WOOD

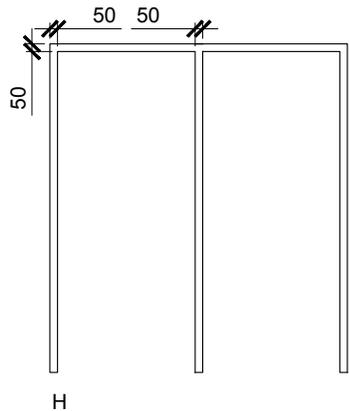
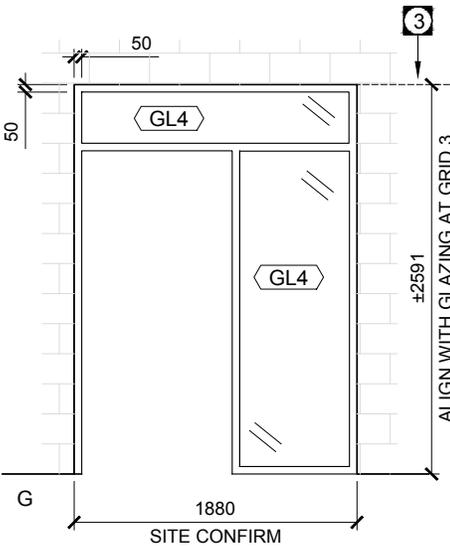
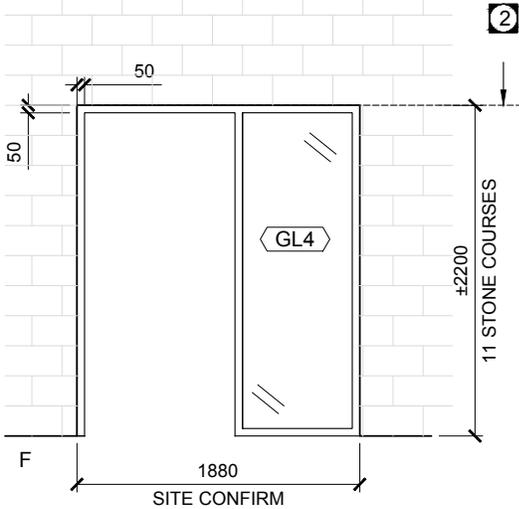
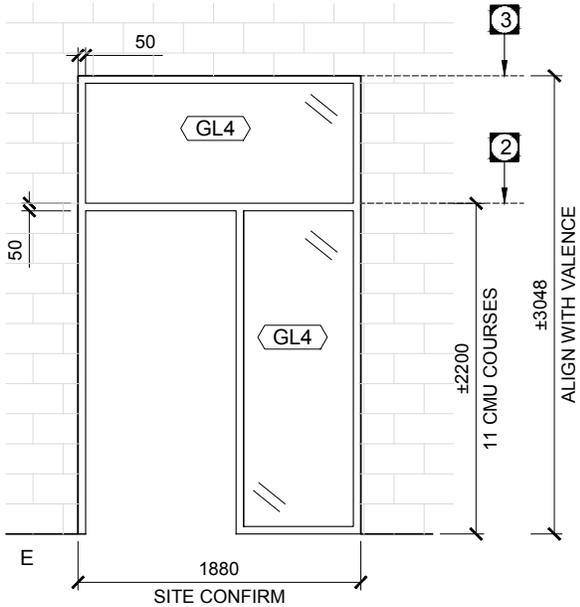
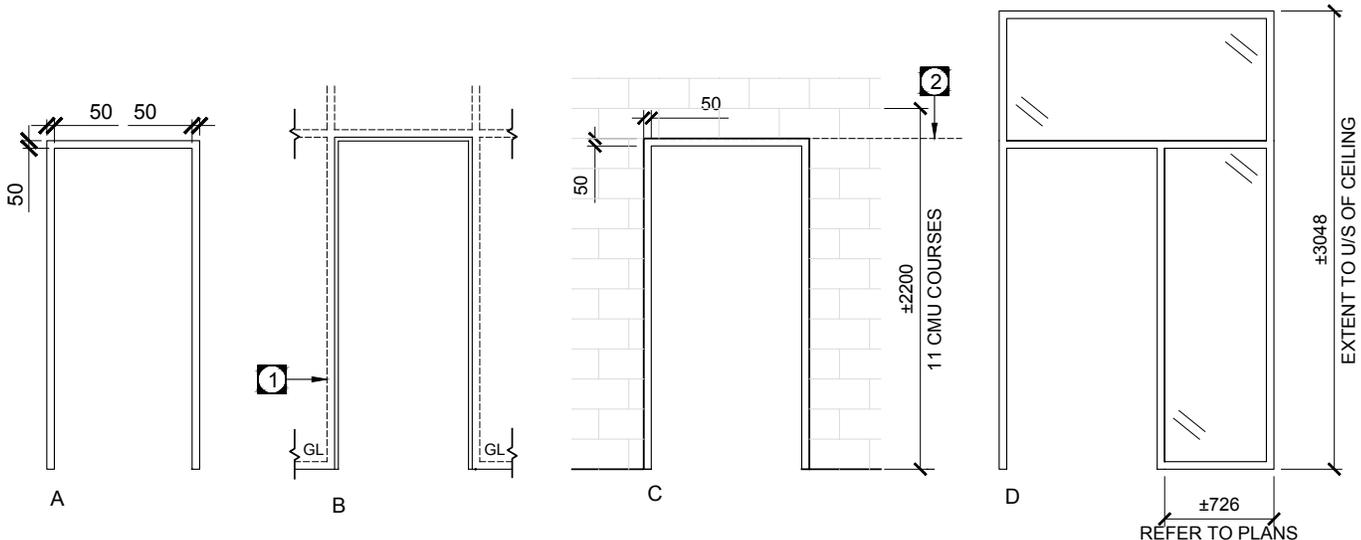
DOOR AND FRAME SCHEDULE																		
DOOR									FRAME				UL RATING	LOCK	ADO	CARD ACCESS	HARD-WARE	KEYNOTE
DOOR NUMBER	ROOM NAME	DESCRIPTION	NOMINAL SIZE (w x h)	TYPE	MAT.	CORE	FINISH	GLASS	TYP E	MAT.	FINISH	GLAS S						
MAIN FLOOR																		
D100A	VESTIBULE	BARRIER FREE EXTERIOR DOOR	1000 x 2135	B	ALUM	-	PREFIN	GL-5	B	ALUM	PREFIN	-	x	x	x	1	3,4,5	
D100B	VESTIBULE	BARRIER FREE DOOR	1000 x 2135	B	ALUM	-	PREFIN	GL-2	B	ALUM	PREFIN	-	x	x		3	3,4,5	
D102	TRAINING CLASSROOM	TRAINING ROOM DOOR	1830 x 2135	A2	WD	-	PT	-	A	PS	PT	-				5	10	
D102A	STORAGE	STORAGE ROOM DOOR	1830 x 2135	A2	WD	-	PT	-	A	PS	PT	-	x			6		
D102B	STORAGE	STORAGE ROOM DOOR	1830 x 2135	A2	WD	-	PT	-	A	PS	PT	-	x			6		
D103	UTR	UNIVERSAL TOILET DOOR	1000 x 2135	A	WD	-	PT	-	A	PS	PT	-	x	x		7	1,3	
D104	W/C	WASHROOM DOOR	1000 x 2135	A	WD	-	PT	-	A	PS	PT	-	x			8		
D105	IT	OFFICE DOOR	1000 x 2135	A	WD	-	PT	-	A	PS	PT	-			x	11	5	
D106	LOBBY	CORRIDOR DOOR	1000 x 2135	B	ALUM		PREFIN	GL-2	B	ALUM	PREFIN	-	x	x		12	3,4,5	
D107A	VESTIBULE	BARRIER FREE EXTERIOR DOOR	1000 x 2135	B	ALUM		PREFIN	GL-5	B	ALUM	PREFIN	-	x	x		2	3,4,5	
D107B	VESTIBULE	BARRIER FREE DOOR	1000 x 2135	B	ALUM		PREFIN	GL-2	B	ALUM	PREFIN	-	x			4	4,3	
D107.1	STORAGE	STORAGE ROOM EXTERIOR DOOR	1000 x 2135	A	HM	INSUL	PT	-	A	PST	PT	-			x	36	5	
D108	FLOOR WATCH	OFFICE DOOR	915 x 2135	A	WD	-	PT	-	B	ALUM	PREFIN	-				13	4	
D109	CORRIDOR	CORRIDOR DOOR	1000 x 2135	C	PFGA		PREFIN	FR-LAM	D	PFGA	PREFIN	FR-LAM	90			15	6	
D110	JANITOR	SERVICE DOOR	1830 x 2135	A2	HM	-	PT	-	A	PS	PT	-	90			16	2	
D111	CAPT/LIEUT OFFICE	OFFICE DOOR	915 x 2135	A	HM	-	PT	-	A	PS	PT	-	90			26		
D111A	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	HM	-	PT	-	A	PS	PT	-	20			20		
D112	STORAGE	SERVICE DOOR	915 x 2135	A	HM	-	PT	-	A	PS	PT	-	90			24	7,12	
D113	SHOWER	WASHROOM DOOR	915 x 2135	A	HM	-	PT	-	A	PS	PT	-	90	x		9		
D114	INVESTIGATORS OFFICE	OFFICE DOOR	915 x 2135	A	HM	-	PT	-	A	PS	PT	-	90		x	19	5	
D114A	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	HM	-	PT	-	A	PS	PT	-	20			20		
D115	HAZMAT EQUIP. STOR	STORAGE ROOM DOOR	1830 x 2135	A	HM	-	PT	-	A	PS	PT	-	90			17		
D116A	VESTIBULE	BARRIER FREE EXTERIOR DOOR	1000 x 2135	B	ALUM		PREFIN	GL-5	B	ALUM	PREFIN	-	x	x		2	3,4,5	
D116B	VESTIBULE	BARRIER FREE DOOR	1000 x 2135	B	ALUM		PREFIN	GL-2	B	ALUM	PREFIN	-	x			4	3	
D117	APPARATUS BAY	SERVICE DOOR	1830 x 2135	A2	HM		PT	-	A	PS	PT	-				18		
D17-A	APPARATUS BAY	FOLDING BAY DOOR	4267 x ±4267	E	STI	-	PREFIN	GL-5	N/A	STI	PREFIN	-	x			37	5,14	
D17-B	APPARATUS BAY	FOLDING BAY DOOR	4267 x ±4267	E	STI	-	PREFIN	GL-5	N/A	STI	PREFIN	-	x			37	5,14	
D17-C	APPARATUS BAY	FOLDING BAY DOOR	4267 x ±4267	E	STI	-	PREFIN	GL-5	N/A	STI	PREFIN	-	x			37	5,14	
D17-D	APPARATUS BAY	FOLDING BAY DOOR	4267 x ±4267	E	STI	-	PREFIN	GL-5	N/A	STI	PREFIN	-	x			37	5,14	
D17-E	APPARATUS BAY	FOLDING BAY DOOR	4267 x ±4267	E	STI	-	PREFIN	GL-5	N/A	STI	PREFIN	-	x			37	5,14	
D118	AMB RESTOCK	STORAGE ROOM DOOR	1000 x ±2200	A	HM	-	PT	-	C	PS	PT	-	90			23	7,8	
D119	JANITOR	SERVICE DOOR	1000 x ±2200	A	HM	-	PT	-	C	PS	PT	-	90			23	7,8	
D120	W/R	WASHROOM DOOR	1000 x ±2200	A	HM	-	PT	-	C	PS	PT	-	90	x		10	7,8	
D121	EVIDENCE	INTERIOR DOOR	1000 x ±2200	A	HM	-	PT	-	C	PS	PT	-	90		x	25	5,7,8	
D122	TOOL REPAIR	INTERIOR DOOR	1000 x 2135	A	HM	-	PT	-	A	PS	PT	-	90			26		
D123	HOSE WASH	EXTERIOR DOOR	1000 x 2135	A	HM	INSUL	PT	-	A	PST	PT	-	x			28		
D124	SCBA	INTERIOR DOOR	1000 x ±2200	A	HM	-	PT	-	C	PS	PT	-	90			27	7,8	
D125	PPE STORAGE	STORAGE ROOM DOOR	1000 x ±2200	A	HM	-	PT	-	C	PS	PT	-	90			26	7,8	
D126	SPRINKLER ROOM	SERVICE DOOR	1000 x ±1985	A	HM	-	PT	-	A	PS	PT	-	90			27	13	
DSTR1A	STAIR 1	EGRESS DOOR	1830 x 2135	D2	HM	-	PT	GL-4	H	PS	PT	-	90			35		
DSTR1B	STAIR 1	EGRESS DOOR	1000 x ±2200	A	HM	-	PT	-	E	PS	PT	GL-4	90			34	7,8	
DSTR2A	STAIR 2	EGRESS DOOR	1000 x ±2200	C	PFGA		PREFIN	FR-LAM	D	PFGA	PREFIN	FR-LAM	90			15	6	

DOOR									FRAME				UL RATING	LOCK	ADO	CARD ACCESS	HARD-WARE	KEYNOTE
DOOR NUMBER	ROOM NAME	DESCRIPTION	NOMINAL SIZE (w x h)	TYPE	MAT.	CORE	FINISH	GLASS	TYP E	MAT.	FINISH	GLASS						
DSTR2B	STAIR 2	EGRESS DOOR	1000 x 2135	A	HM	-	PT		E	PS	PT	GL-4	90			14	7,8	
SECOND FLOOR																		
D200	FITNESS AREA	INTERIOR DOOR	915 x 2135	B	ALUM	INSUL	PREFIN	GL-2	B	ALUM	PREFIN	-				29	4	
D201	OUTDOOR AREA	EXTERIOR DOOR	±1100 X 2135	B	ALUM	INSUL	PREFIN	GL-5	B	ALUM	PREFIN	-		x		30	4,15	
D202	KITCHEN	EXTERIOR DOOR	915 x 2135	B	ALUM	INSUL	PREFIN	GL-5	B	ALUM	PREFIN	-		x		30	4	
D205	SUPPORT SERVICES	INTERIOR DOOR	762 X 2135	A	WD	-	PT	-	A	PS	PT	-	20			21		
D206	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D207	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D208	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D208	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D209	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D210	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D211	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D212	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D213	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			22		
D214	SLEEPING QUARTERS	INTERIOR DOOR	762 x 2135	A	WD	-	PT	-	A	PS	PT	-	20			21		
D215	OFFICE	OFFICE DOOR	864 x 2135	B	ALUM	INSUL	PREFIN	GL-2	B	ALUM	PREFIN	-				29	4	
D216A	JANITOR	STORAGE DOOR	864 X 2135	A	HM	-	PT	-	A	PS	PT	-	NR			27		
D216B	LAUNDRY RM	STORAGE DOOR	864 X 2135	F	HM	-	PT	GL-2	A	PS	PT	-				27		
D217	SHOWER	WASHROOM DOOR	864 x 2135	A	HM	-	PT	-	A	PS	PT	-		x		32		
D218	SHOWER	WASHROOM DOOR	864 x 2135	A	HM	-	PT	-	A	PS	PT	-		x		32		
D219	SHOWER	WASHROOM DOOR	864 x 2135	A	HM	-	PT	-	A	PS	PT	-		x		32		
D221	MECHANICAL / ELEC.	SERVICE DOOR	1830 x 2135	A2	HM	-	PT	-	A	PS	PT	-	90			18		
DSTR1C	STAIR 1	EGRESS DOOR	1000 x ±2240	A	HM	-	PT		F	PS	PT	GL-4	20			34	7,8	
DSTR1D	STAIR 1	EGRESS DOOR	1000 x ±2240	A	HM	-	PT		G	PS	PT	GL-4	90			33	7,8	
DSTR2C	STAIR 2	EGRESS DOOR	1000 x ±2240	A	HM	-	PT		F	PS	PT	GL-4	20			34	7,8	
DSTR2D	STAIR 2	EGRESS DOOR	1000 x ±2240	A	HM	-	PT		G	PS	PT	GL-4	90			33	7,8	



GENERAL NOTES

1. REFER TO SPEC. SECTION 08 80 00 FOR GLAZING (GL) TYPE.
2. REFER TO EXTERIOR AND INTERIOR ELEVATIONS FOR CONFIGURATION OF ADJACENT FRAMING.
3. ALL DIMENSIONS TO BE VERIFIED ON SITE.
4. REFER TO SPEC. SECTION 08 71 00 FOR MOUNTING HEIGHTS OF DOOR HARDWARE.



1

FRAME TYPES

KEYED NOTES

- 1 ADJACENT CURTAINWALL SYSTEM.
- 2 ALIGN T.O. FRAME WITH CMU COURSING.
- 3 ALIGN T.O. FRAME WITH U/S OF GLAZING AT GRID 3. REFER TO DETAILS.

Hardware Group No. 01

For use on Door #(s):
D100A

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	112XY	628	IVE
1 EA	PUSH/PULL BAR	9190HD-255MM-NS	630	IVE
1 EA	OH STOP	100S ADJ	630	GLY
1 EA	AUTO OPERATOR	HORTON 4100LE	AN	HOR
2 EA	ACTUATOR WALL MOUNT	S I36-5 INGREESS R'	630	WIK
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME MFR		
1 EA	DOOR SWEEP	8198AA X DR W	AA	ZER
1 EA	THRESHOLD	CT-410 TO SUIT OPENING WIDTH	627	KNC

FREE EGRESS AT ALL TIMES,
AUTOMATIC DOOR OPERATOR BY ACTUATOR EITHER SIDE

Hardware Group No. 02

For use on Door #(s):

D107A D116A

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	112XY TWP CON	628	IVE
1 EA	ELEC PANIC HARDWARE	LX-RX-QEL-35A-NL-OP-388-CON 24 VDC	626	VON
1 EA	RIM CYLINDER	1E72	626	BES
1 EA	90 DEG OFFSET PULL	8190HD 255MM STD	630	IVE
1 EA	OH STOP	100S ADJ	630	GLY
1 EA	AUTO OPERATOR	HORTON 4100LE	AN	HOR
1 EA	BOLLARD	B-6TR-FT-32D-BP-2	630	WIK
2 EA	ACTUATOR WALL MOUNT	S I36-5 INGREESS R'	630	WIK
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME MFR		
1 EA	DOOR SWEEP	8198AA X DR W	AA	ZER
1 EA	THRESHOLD	CT-410 TO SUIT OPENING WIDTH	627	KNC
1 EA	WIRE HARNESS	CON-6		SCH
1 EA	WIRE HARNESS	CON-6W		SCH
1 EA	CARD READER	BY SECURITY CONTRACTOR		
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1 EA	POWER SUPPLY	SHARED WITH OTHER OPENING(S)	GRY	SCE
1 EA	DOOR GUARD	CE-803 MANITOBA HOR. BAR GUIDE RAIL 42"H x 36"L. Recessed installation.	C	CUR

FREE EGRESS AT ALL TIMES, ELECTRONIC LATCH RETRACTION WHEN ENGAGED HOLDS LATCH BOLT IN RETRACTED POSITION FOR MOMENTARY OR MAINTAINED PERIOD OF TIME.
KEY RETRACTS LATCH BOLT FOR MECHANICAL OVERRIDE
VALID CREDENTIAL AT CARD READER OR REMOTE RELEASE PROVIDES MANUAL OR AUTOMATIC DOOR OPERATION
AUTOMATIC DOOR OPERATOR BY ACTUATOR EITHER SIDE, EXTERIOR ACTUATOR DISABLED WHEN LATCH BOLT IS ENGAGED IN STRIKE. (LX)
REQUEST TO EXIT SIGNAL TO ACCESS CONTROL BY INTERNAL SWITCH IN EXIT HARDWARE (RX)
POWER SUPPLY LOCATED CENTRALLY.

Hardware Group No. 03

For use on Door #(s):
D100B

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	112XY TWP CON	628	IVE
1 EA	ELEC PANIC HARDWARE	LX-RX-QEL-35A-NL-OP-388-CON 24 VDC	626	VON
1 EA	RIM CYLINDER	1E72	626	BES
1 EA	90 DEG OFFSET PULL	8190HD 255MM STD	630	IVE
1 EA	OH STOP	100S ADJ	630	GLY
1 EA	AUTO OPERATOR	HORTON 4100LE	AN	HOR
2 EA	ACTUATOR WALL MOUNT	S I36-5 INGRESS R'	630	WIK
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME MFR		
1 EA	WIRE HARNESS	CON-6		SCH
1 EA	WIRE HARNESS	CON-6W		SCH
1 EA	CARD READER/INTERCOM	BY SECURITY CONTRACTOR		
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1 EA	PUSH BUTTON	CM400/8 "PUSH TO LOCK"	630	CAM
1 EA	POWER SUPPLY	SHARED WITH OTHER OPENING(S)	GRY	SCE

FREE EGRESS AT ALL TIMES, ELECTRONIC LATCH RETRACTION WHEN ENGAGED HOLDS LATCH BOLT IN RETRACTED POSITION FOR MOMENTARY OR MAINTAINED PERIOD OF TIME. KEY RETRACTS LATCH BOLT FOR MECHANICAL OVERRIDE
VALID CREDENTIAL AT CARD READER OR REMOTE RELEASE PROVIDES MANUAL OR AUTOMATIC DOOR OPERATION
AUTOMATIC DOOR OPERATOR BY ACTUATOR EITHER SIDE, EXTERIOR ACTUATOR DISABLED WHEN LATCH BOLT IS ENGAGED IN STRIKE. (LX)
REQUEST TO EXIT SIGNAL TO ACCESS CONTROL BY INTERNAL SWITCH IN EXIT HARDWARE (RX)
CONNECTED TO SECURITY/FIRE/SMOKE ALARM AND PUSH TO LOCK BUTTON FOR IMMEDIATE RELEASE OF LATCH RETRACTION AS REQUIRED.
POWER SUPPLY LOCATED CENTRALLY, REMOTE RELEASE BY INTERCOM

Hardware Group No. 04

For use on Door #(s):

D107B D116B

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1 EA	CONT. HINGE	112XY		628	IVE
1 EA	PUSH/PULL BAR	9190HD-255MM-NS		630	IVE
1 EA	OH STOP	100S ADJ		630	GLY
1 EA	AUTO OPERATOR	HORTON 4100LE		⚡ AN	HOR
2 EA	ACTUATOR WALL MOUNT	S I36-5 INGRESS R'		⚡ 630	WIK
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME MFR			

FREE EGRESS / ACCESS AT ALL TIMES

Hardware Group No. 05

For use on Door #(s):

D102

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6 EA	HINGE	3CB1HW 114X114MM		652	IVE
2 EA	SINGLE DUMMY TRIM	ND170 RHO		626	SCH
2 EA	OH STOP	100S ADJ		630	GLY
1 EA	SURFACE CLOSER	4040XP HEDA		689	LCN
2 EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1 EA	GASKETING	8144S-BK (1X DR W, 2X DR H)		BK	ZER
2 EA	MEETING STILE	8879AA X DR HEIGHT		AA	ZER
2 EA	DOOR BOTTOM	3552AA X DR WIDTH		AA	ZER

Mount kickplate to the interior side of door only.

Hardware Group No. 06

For use on Door #(s):

D102A D102B

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6 EA	HINGE	3CB1 114X102MM	652	IVE
1 EA	MANUAL FLUSH BOLT	FB458 TOP	626	IVE
1 EA	CYL X TURN DEAD LOCK	L460L 626	626	SCH
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	MORTISE CYLINDER	1E74	626	BES
2 EA	OH STOP	450S	630	GLY
2 EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 07

For use on Door #(s):

D103

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 127X114MM	652	IVE
1 EA	CYL X TURN DEAD LOCK	L9460L 06A L583-363 L283-722 XL11-886	626	SCH
1 EA	MORTISE CYLINDER	1E74	626	BES
1 EA	MONITOR STRIKE	LML-1	626	SEC
1 EA	AUTO OPERATOR	HORTON 4100LE	AN	HOR
2 EA	ACTUATOR WALL MOUNT	S I36-5 INGREESS R'	630	WIK
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
3 EA	SILENCER	SR64	GRY	IVE
1 EA	EMERGENCY CALL KIT	CX-WEC-11		CAM
1 EA	POWER SUPPLY	PS902 120/240 VAC	LGR	SCE

FREE EGRESS AT ALL TIMES

DEADBOLT LATCH THROWN / RETRACTED BY KEY OUTSIDE OR THUMBTURN INSIDE

INSIDE LEVER RETRACTS DEADBOLT LATCH, OUTSIDE LEVER RIGID.

INDICATOR PROVIDES OCCUPIED STATUS WHEN DEADBOLT THROWN

AUTO OPERATOR BY ACTUATOR EITHER SIDE, ACTUATOR DISABLED WHEN DEADBOLT ENGAGED IN STRIKE (LML).

EMERGENCY CALL KIT PROVIDES AUDIBLE AND VISUAL SIGNAL FOR ASSISTANCE

Hardware Group No. 08

For use on Door #(s):
D104

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 127X114MM	652	IVE
1 EA	CYL X TURN DEAD LOCK	L9460L 06A L583-363 L283-722 XL11-886	626	SCH
1 EA	MORTISE CYLINDER	1E74	626	BES
1 EA	SURFACE CLOSER	1461 REG FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

FREE EGRESS AT ALL TIMES
DEADBOLT LATCH THROWN / RETRACTED BY KEY OUTSIDE OR THUMBTURN INSIDE
INSIDE LEVER RETRACTS DEADBOLT LATCH, OUTSIDE LEVER RIGID.
INDICATOR PROVIDES OCCUPIED STATUS WHEN DEADBOLT THROWN

Hardware Group No. 09

For use on Door #(s):
D113

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 127X114MM	652	IVE
1 EA	PRIVACY LOCK	L9040 06A L583-363 L283-722	626	SCH
1 EA	SURFACE CLOSER	1461 REG FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

FREE EGRESS AT ALL TIMES
INDICATOR PROVIDES OCCUPIED STATUS

Hardware Group No. 10

For use on Door #(s):

D120

Provide each SGL door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	3CB1 127X114MM	652	IVE
1	EA	PRIVACY LOCK	L9040 06A L583-363 L283-722	626	SCH
1	EA	SURFACE CLOSER	1461 CUSH STD	689	LCN
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1	EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

FREE EGRESS AT ALL TIMES
INDICATOR PROVIDES OCCUPIED STATUS

Hardware Group No. 11

For use on Door #(s):

D105

Provide each SGL door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	3CB1 127X114MM	652	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	SFIC CYLINDER	1C72	619	BES
1	EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
1	EA	SURFACE CLOSER	1461 REG FC	689	LCN
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436/438	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		

Hardware Group No. 12

For use on Door #(s):

D106

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 127X114MM	652	IVE
1 EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1 EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
1 EA	OH STOP	100S ADJ	630	GLY
1 EA	AUTO OPERATOR	HORTON 4100LE	AN	HOR
2 EA	ACTUATOR WALL MOUNT	S I36-5 INGRESS R'	630	WIK
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME		MFR
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR		

RESTRICTED ACCESS FROM LOBBY 101 SIDE, FREE ACCESS FROM LOBBY 106

KEY RETRACTS LATCH BOLT FOR MECHANICAL OVERRIDE

VALID CREDENTIAL AT CARD READER PROVIDES MANUAL OR AUTOMATIC DOOR OPERATION

AUTOMATIC DOOR OPERATOR BY ACTUATOR EITHER SIDE, EXTERIOR ACTUATOR ENABLED

WITH VALID CREDENTIAL AT READER.

REQUEST TO EXIT SIGNAL TO ACCESS CONTROL BY DOOR CONTACT

Hardware Group No. 13

For use on Door #(s):

D108

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	SURFACE CLOSER	1461 REG FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 14

For use on Door #(s):

DSTR2B

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	SURFACE CLOSER	4040XP REG	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 15

For use on Door #(s):

D109 DSTR2A

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	PROPRIETARY SYSTEM	HARDWARE BY DOOR SUPPLIER		TGP

FREE EGRESS/ENTRY AT ALL TIMES

PROPRIETARY HARDWARE BY DOOR SUPPLIER. REFER TO PROTECTIVE FRAMED GLAZING ASSEMBLY – SECTION 08 44 35.

Hardware Group No. 16

For use on Door #(s):

D110

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6 EA	HINGE	3CB1 114X102MM	652	IVE
1 SET	CONST LATCHING BOLT	FB51P	630	IVE
1 EA	DUST PROOF STRIKE	DP1	626	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	COORDINATOR	COR X FL	628	IVE
2 EA	MOUNTING BRACKET	MB	689	IVE
2 EA	SURFACE CLOSER	4040XP CUSH ST-2648	689	LCN
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER
1 EA	MEETING STILE	155AA	AA	ZER
1 EA	MEETING STILE	55AA	AA	ZER

Hardware Group No. 17

For use on Door #(s):

D115

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6 EA	HINGE	3CB1HW 114X114MM	652	IVE
1 SET	CONST LATCHING BOLT	FB51P	630	IVE
1 EA	DUST PROOF STRIKE	DP1	626	IVE
1 EA	ENTRANCE LOCK	ND53BDC RHO	626	SCH
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	OH STOP	100S	630	GLY
2 EA	SURFACE CLOSER	4040XP REG	689	LCN
2 EA	KICK PLATE	8400 305MM X 25MM LDW B-CS	630	IVE
1 EA	FLOOR STOP	FS436/438	626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER
1 EA	MEETING STILE	155AA	AA	ZER
1 EA	MEETING STILE	55AA	AA	ZER

Hardware Group No. 18

For use on Door #(s):

D117 D221

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6 EA	HINGE	3CB1HW 114X114MM	652	IVE
1 SET	CONST LATCHING BOLT	FB51P	630	IVE
1 EA	DUST PROOF STRIKE	DP1	626	IVE
1 EA	PASSAGE SET	ND10S RHO 14-042	626	SCH
1 EA	COORDINATOR	COR X FL	628	IVE
1 EA	OH STOP	100S	630	GLY
2 EA	SURFACE CLOSER	4040XP REG	689	LCN
2 EA	KICK PLATE	8400 305MM X 25MM LDW B-CS	630	IVE
1 EA	FLOOR STOP	FS436/438	626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER
1 EA	MEETING STILE	155AA	AA	ZER
1 EA	MEETING STILE	55AA	AA	ZER

Hardware Group No. 19

For use on Door #(s):

D114

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3 EA	HINGE	3CB1 127X114MM		652	IVE
1 EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1 EA	SFIC CYLINDER	1C72		619	BES
1 EA	ELECTRIC STRIKE	6211 FSE CON		630	VON
1 EA	SURFACE CLOSER	1461 REG FC		689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1 EA	WALL STOP	WS401/402CCV		626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)		BK	ZER
1 EA	WIRE HARNESS	CON-6W			SCH
1 EA	CARD READER	BY SECURITY CONTRACTOR			
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR			

FREE EGRESS AT ALL TIMES

VALID CREDENTIAL AT READER RELEASES ELECTRIC STRIKE

REQUEST TO EXIT SIGNAL TO ACCESS CONTROL BY DOOR CONTACT

Hardware Group No. 20

For use on Door #(s):

D111A D114A

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3 EA	HINGE	3CB1 114X102MM		652	IVE
1 EA	PASSAGE SET	ND10S RHO		626	SCH
1 EA	OH STOP	450S		630	GLY
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1 EA	GASKETING	8144S-BK (1X DR W, 2X DR H)		BK	ZER
1 EA	DOOR BOTTOM	321AA X DR WIDTH		AA	ZER

Hardware Group No. 21

For use on Door #(s):
D205

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	OH STOP	410S	630	GLY
1 EA	SURFACE CLOSER	1461T FC ST-3259	689	LCN
1 EA	MOUNTING PLATE	1460-18	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	GASKETING	8144S-BK (1X DR W, 2X DR H)	BK	ZER
1 EA	DOOR BOTTOM	321AA X DR WIDTH	AA	ZER

Hardware Group No. 22

For use on Door #(s):
D206 D207 D208 D208 D209 D210
D211 D212 D213 D214 D205

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	SURFACE CLOSER	1461T FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
1 EA	GASKETING	8144S-BK (1X DR W, 2X DR H)	BK	ZER
1 EA	DOOR BOTTOM	321AA X DR WIDTH	AA	ZER

Hardware Group No. 23

For use on Door #(s):
D118 D119

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	SURFACE CLOSER	1461 CUSH STD	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 24

For use on Door #(s):

D112

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	SURFACE CLOSER	1461 CUSH STD	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 25

For use on Door #(s):

D121

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM NRP	652	IVE
1 EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1 EA	SFIC CYLINDER	1C72	619	BES
1 EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
1 EA	SURFACE CLOSER	1461 CUSH STD	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER
1 EA	WIRE HARNESS	CON-6W		SCH
1 EA	CARD READER	BY SECURITY CONTRACTOR		
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR		

Hardware Group No. 26

For use on Door #(s):

D111 D122 D125

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	SURFACE CLOSER	1461 REG FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 27

For use on Door #(s):

D124 D126 D216A D216B

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	PASSAGE SET	ND10S RHO	626	SCH
1 EA	OH STOP	90S	630	GLY
1 EA	SURFACE CLOSER	1461 REG FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 28

For use on Door #(s):

D123

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	700CS X DR HT	441	IVE
1 EA	PANIC HARDWARE	LD-98-EO	626	VON
1 EA	OH STOP	90S	630	GLY
1 EA	SURFACE CLOSER	TJ4040XP LONG	693	LCN
1 EA	FLUSH CEILNG MTG PLT	4040XP-18G	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 SET	WEATHERSTRIP	328AA (2X DR H X 1X DR W)	AA	ZER
1 EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1 EA	THRESHOLD	CT-410 TO SUIT OPENING WIDTH	627	KNC
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR		

Hardware Group No. 29 - WIDE STILE ALUMINUM DOOR

For use on Door #(s):

D200 D215

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1 EA	CONT. HINGE	112XY		628	IVE
1 EA	PASSAGE SET	ND10S RHO		626	SCH
1 EA	SURFACE CLOSER	4021		693	LCN
1 EA	MOUNTING PLATE	4020-18		689	LCN
1 EA	FLOOR STOP	FS436/438		626	IVE
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME MFR			

FREE EGRESS / ACCESS AT ALL TIMES

Hardware Group No. 30 - MORTISE CYLINDER INTERIOR SIDE - NO CYLINDER EXTERIOR

For use on Door #(s):

D201 D202

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1 EA	CONT. HINGE	112XY		628	IVE
1 EA	MAX SECURITY DEADBOLT	MS1850SW		628	ADA
1 EA	MORTISE CYLINDER	1E74		626	BES
1 EA	PUSH/PULL BAR	9190HD-255MM-NS		630	IVE
1 EA	OH STOP	100S		630	GLY
1 EA	SURFACE CLOSER	4021		693	LCN
1 EA	MOUNTING PLATE	4020-18		689	LCN
1 EA	WEATHER STRIPPING	BY ALUMINUM DOOR / FRAME MFR			
1 EA	DOOR SWEEP	8198AA X DR W		AA	ZER
1 EA	THRESHOLD	CT-410 TO SUIT OPENING WIDTH		627	KNC

RESTRICTED EGRESS/ACCESS

Hardware Group No. 31

For use on Door #(s):

D217

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM	630	IVE
1 EA	PRIVACY LOCK	L9040 06A L583-363 L283-722	626	SCH
1 EA	OH STOP	410S	630	GLY
1 EA	SURFACE CLOSER	1461T FC ST-3259	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
3 EA	SILENCER	SR64	GRY	IVE

FREE EGRESS AT ALL TIMES

DEADBOLT LATCH THROWN / RETRACTED BY KEY OUTSIDE OR THUMBTURN INSIDE

INSIDE LEVER RETRACTS DEADBOLT LATCH, OUTSIDE LEVER RIGID.

INDICATOR PROVIDES OCCUPIED STATUS WHEN DEADBOLT THROWN

Hardware Group No. 32

For use on Door #(s):

D218 D219

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 114X114MM	652	IVE
1 EA	PRIVACY LOCK	L9040 06A L583-363 L283-722	626	SCH
1 EA	OH STOP	410S	630	GLY
1 EA	SURFACE CLOSER	1461T FC ST-3259	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
3 EA	SILENCER	SR64	GRY	IVE

FREE EGRESS AT ALL TIMES

DEADBOLT LATCH THROWN / RETRACTED BY KEY OUTSIDE OR THUMBTURN INSIDE

INSIDE LEVER RETRACTS DEADBOLT LATCH, OUTSIDE LEVER RIGID.

INDICATOR PROVIDES OCCUPIED STATUS WHEN DEADBOLT THROWN

Hardware Group No. 33

For use on Door #(s):

DSTR1D DSTR2D

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	FIRE EXIT HARDWARE	9875-L-BE-F-4'-06	626	VON
1 EA	OH STOP	90S	630	GLY
1 EA	SURFACE CLOSER	1461 REG FC	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

FREE EGRESS AT ALL TIMES, LEVERS ON PULL SIDE RETRACT LATCHBOLT
PASSAGE FUNCTION AT ALL TIMES, MAINTAINS LATCHING FOR FIRE RATING

Hardware Group No. 34

For use on Door #(s):

DSTR1B DSTR1C DSTR2C

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4 EA	HINGE	3CB1HW 127X114MM	652	IVE
1 EA	FIRE EXIT HARDWARE	9875-L-BE-F-4'-06	626	VON
1 EA	SURFACE CLOSER	4040XP REG	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	WALL STOP	WS401/402CVX	626	IVE
1 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 35

For use on Door #(s):

DSTR1A

Provide each DE door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6 EA	HINGE	3CB1HW 114X114MM	652	IVE
1 EA	FIXED MULLION	BY FRAME SUPPLIER		
2 EA	FIRE EXIT HARDWARE	9875-L-BE-F-4'-06	626	VON
1 EA	OH STOP	100S	630	GLY
2 EA	SURFACE CLOSER	4040XP EDA	689	LCN
2 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
2 EA	GASKETING	188S-BK (2 X DR W, 2X DR H)	BK	ZER

Hardware Group No. 36

For use on Door #(s):
D107.1

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1HW 127X114MM NRP	652	IVE
1 EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1 EA	SFIC CYLINDER	1C72	619	BES
1 EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
1 EA	SURFACE CLOSER	4040XP CUSH ST-1595	689	LCN
1 EA	KICK PLATE	8400 305MM X 40MM LDW B-CS	630	IVE
1 EA	HEAD SEAL	429AA TO SUIT OPENING WIDTH	AA	ZER
2 EA	JAMB SEAL	328AA TO SUIT OPENING HEIGHT	AA	ZER
1 EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1 EA	THRESHOLD	CT-410 TO SUIT OPENING WIDTH	627	KNC
1 EA	MOUNTING BRACKET	328SPB		ZER
1 EA	WIRE HARNESS	CON-6W		SCH
1 EA	CARD READER	BY SECURITY CONTRACTOR		
1 EA	DOOR CONTACT	BY SECURITY CONTRACTOR		

Hardware Group No. 37

For use on Door #(s):
D117-A D117-B D117-C D117-D D117-E

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER
1 EA	PROPRIETARY SYSTEM	HARDWARE BY DOOR SUPPLIER
2 EA	CARD READER	BY SECURITY CONTRACTOR

PROPRIETARY HARDWARE BY DOOR SUPPLIER. REFER TO 08 36 27 FOLDING BAY DOORS.

1 General

1.1 SECTION INCLUDES

- .1 This section includes labour and materials required to complete conformance testing and reporting of openings.

1.2 RELATED SECTIONS

- .1 Section 08 11 13 – Hollow Metal Doors and Frames
- .2 Section 08 36 27 – Folding Bay Doors
- .3 Section 08 44 13 – Glazed Aluminum Curtain Wall
- .4 Section 08 62 00 – Unit Skylights
- .5 Section 08 71 00 – Door Hardware
- .6 Section 08 80 00 – Glazing

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Mock-up installation field testing:
 - .1 Building Envelope Commissioning Authority to conduct testing.
 - .2 Co-ordinate testing frequency and locations with Building Envelope Commissioning Authority.
 - .3 Costs to co-ordinate, supervise, assist, and provide access for testing to be allocated to the fixed price component.
- .3 Additional field testing of installations:
 - .1 Building Envelope Commissioning Authority to conduct testing.
 - .2 Co-ordinate testing frequency and locations with Building Envelope Commissioning Authority.
 - .3 Costs to co-ordinate supervise, assist, and provide access for testing to be allocated to the fixed price component.
- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Architectural Manufacturers Association
 - .1 AAMA 501.1-17 Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure.
 - .2 AAMA 501.2-15 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

- .2 ASTM E1105-15 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
- .3 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
- .3 Canadian Standards Association (CSA International):
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
 - .2 CSA A440SI-09 - Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.5 PRE-INSTALLATION CONFERENCE

- .1 Pre-work Conference in accordance with Section 01 31 19 Project Meetings.
- .2 Convene pre-work conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Contractor, Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test, maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all doors, windows, louvres and associated adjacent wall assembly components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.
- .4 Product Data
 - .1 Provide product data for:
 - .1 Section 08 11 13 – Hollow Metal Doors and Frames
 - .2 Section 08 36 27 – Folding Bay Doors
 - .3 Section 08 44 13 – Glazed Aluminum Curtain Wall
 - .4 Section 08 62 00 – Unit Skylights
 - .5 Section 08 71 00 – Door Hardware
 - .6 Section 08 80 00 – Glazing

.5 Shop Drawings

- .1 Provide shop drawings for:
 - .1 Section 08 11 13 – Hollow Metal Doors and Frames
 - .2 Section 08 36 27 – Folding Bay Doors
 - .3 Section 08 44 13 – Glazed Aluminum Curtain Wall
 - .4 Section 08 62 00 – Unit Skylights

1.7 TESTING AGENCY

- .1 Testing agency to be a third-party accredited test lab approved by the Building Envelope Commissioning Authority.

1.8 QUALITY ASSURANCE

- .1 Notify the Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and the testing agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the testing agency identified by the Building Envelope Commissioning Authority.
 - .1 Provide a minimum seventy-two (72) hours notice for openings to be reviewed by Building Envelope Commissioning Authority.

2 Products

2.1 NOT USED

3 Execution

3.1 HOLLOW METAL DOORS AND FRAMES

- .1 Provide a mock-up of hollow metal doors and frames at location identified by the Building Envelope Commissioning Authority prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.2 FOLDING BAY DOORS

- .1 Provide a mock-up of folding bay doors at location identified by the Building Envelope Commissioning Authority prior to full system installation.

- .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.3 GLAZED ALUMINUM CURTAIN WALL

- .1 Provide mock-ups of glazed aluminum curtain wall at location identified by the Commissioning Authority prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Testing: Mock-Up for continuous openings:
 - .1 Continuous openings include Curtain Wall Type CW1.
 - .2 Mock-up to be at least two (2) bays wide, full-height, and capturing both vertical and horizontal mullions, jambs, head, and sill conditions.
 - .3 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform or cyclic static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 AAMA 501.1.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.
 - .4 Quantitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:

- .1 ASTM E783.
- .2 AAMA/WDMA/CSA 101/I.S.2/A440.
- .3 CSA A440S1.
- .5 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .6 Test pressure in accordance with:
 - .1 Section 08 44 13.
 - .7 Frequency of Testing:
 - .1 Once during Mock-up.
- .4 Testing: Functional Performance for continuous openings:
 - .1 Continuous openings include Curtain Wall Type CW1.
 - .2 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform or cyclic static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 ASTM E1105 and AAMA 501.2.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.
 - .3 Quantitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E783.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .4 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .5 Test pressure in accordance with:
 - .1 Section 08 44 13.
 - .6 Frequency of Testing:

- .1 One full day, covering as much area as possible.
- .5 Testing: Mock-Up and Functional Performance for punched openings:
 - .1 Punched openings include Curtain Wall Types W1, W2,
 - .2 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform or cyclic static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 ASTM E1105.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.
 - .3 Quantitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E783.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .4 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .5 Test pressure in accordance with:
 - .1 Section 08 44 13.
 - .6 Frequency of Testing:
 - .1 Once during Mock-up.
 - .2 Once randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.4 UNIT SKYLIGHTS

- .1 Provide a mock-up of unit skylights at location identified by the Building Envelope Commissioning Authority prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:

- .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Testing: Mock-Up and Functional Performance:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Diagnostic field water penetration check:
 - .1 Conduct water penetration testing in accordance with:
 - .1 AAMA 501.2.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.

3.5 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.
- .2 Remediate non-conforming work identified during visual reviews and testing.
- .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
- .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.
- .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the City for repairs or testing.

3.6 REPORTING

- .1 Testing agency to prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Non-fire-rated hollow metal doors and frames.
- .2 Hollow metal frames for wood doors.
- .3 Fire-rated hollow metal doors and frames.
- .4 Thermally insulated hollow metal doors with frames.
- .5 Accessories, including glazing.

1.2 RELATED REQUIREMENTS

- .1 Section 08 08 00 - Commissioning of Openings
- .2 Section 08 44 35 - Protective Framed Glazing Assemblies.
- .3 Section 08 71 00 - Door Hardware.
- .4 Section 08 80 00 - Glazing: Glass for doors, sidelites and transoms.
- .5 Section 09 91 00 - Painting: Site painting.

1.3 ABBREVIATIONS AND ACRONYMS

- .1 CSDMA - Canadian Steel Door Manufacturers Association
- .2 NFPA - National Fire Protection Association.
- .3 ULC - Underwriters Laboratories of Canada.

1.4 REFERENCE STANDARDS

- .1 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .2 ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2021a.
- .3 ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- .4 ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- .5 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies 2010.
- .6 CSDMA Commercial Steel Doors and Frames - Canadian Steel Door Manufacturers Association Commercial Steel Doors and Frames Recommended Specification 2009.
- .7 CSDMA Storage and Installation Guide - Guide Specification for Installation and Storage of Hollow Metal Doors and Frames 2012.
- .8 ITS (DIR) - Intertek Testing Services, Directory of Listed Products current edition.
- .9 NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- .10 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- .3 Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- .4 Sustainable design submittals: Submit evidence of compliance of product life cycle, sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, re-used steel content, and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Manufacturer's qualification statement.
- .6 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Manufacturer: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer, and as follows:
 - .1 Fabricate work of this Section to meet the requirements of CSDMA Commercial Steel Doors and Frames as a minimum and as further modified in this section.
- .2 Installer qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- .3 Testing agencies: Provide doors produced under label service program of a testing agency acceptable to Authorities Having Jurisdiction, and as follows:
 - .1 Steel fire rated doors and frames: Labelled and listed by an organization accredited by Standards Council of Canada for ratings specified or indicated.
 - .2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:
 - .1 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.
 - .2 Fabricate all rated doors, frames and screens to labelling authority standard.
 - .3 Affix appropriate label to each opening requiring indicating a labelling requirement listed in door schedule on Drawings, and as follows:
 - .1 At standard size openings: Fire endurance rating.
- .4 Maintain at project site copies of reference standards relating to installation of products specified.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for additional requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Requirements for hollow metal doors and frames:
 - .1 Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, Commercial Steel (CS) Type B for each. Provide products containing recycled content.
 - .2 Typical door face sheets: Flush.
 - .3 Glazed lights: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings. Style: Manufacturers standard.
 - .4 Zinc coating for typical interior and exterior locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - .1 Exterior doors and frames and interior high humidity areas (including janitor/laundry, shower rooms, hose wash, and door openings in perimeter walls of Apparatus Bay 117): ZF120, stretcher levelled standard of flatness when used for face sheets.
 - .2 Combined requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.2 HOLLOW METAL DOORS

- .1 Door finish: Galvannealed, site painted.
- .2 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; of types and sizes indicated in Section 08 06 10 - Door and Frame Schedule, and as follows:
 - .1 Fabricate door faces of steel doors without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .2 Form edges true and straight with minimum radius suitable for thickness of steel used.
 - .3 Bevel lock and hinge edges 3 mm in 50 mm; confirm requirement with builder's hardware or door swing that could dictate a different bevel.
 - .4 Provide top and bottom of doors with inverted, recessed, nominal 1.60 mm steel end channels, welded to each face sheet at 150 mm on centre.
 - .5 Reinforce doors where required, for surface mounted hardware, and around perimeter of cut-outs for glazing and louvres. Provide full height hinge reinforcement where continuous hinges are scheduled.

- .3 Exterior doors: Thermally insulated.
 - .1 Face thickness: Minimum 1.60 mm.
 - .2 Insulation stiffened core: Insulated and sound deadened with injected polyisocyanurate core laminated under pressure to each face sheet.
 - .3 Longitudinal edges: Mechanically interlocked and adhesive assisted.
 - .4 Door thermal resistance: RSI-value of 1.94 when tested to ASTM C518
 - .5 Door thickness: 44.5 mm, nominal.
 - .6 Top closures for outswinging doors: PVC, flush with top of faces and edges.
 - .7 Provide weep-hole openings in bottom channel of exterior doors to permit moisture to escape.
 - .8 Product:
 - .1 Fleming; Trio E.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .4 Interior doors, non-fire rated:
 - .1 Flush, lock seam construction, hollow steel doors fabricated in accordance with CSDMA Commercial Steel Doors and Frames Manufacturing Specifications for Doors and Frames, and as follows:
 - .1 Face sheets: Minimum 1.30 mm base steel sheet thickness.
 - .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.
 - .3 Longitudinal edges: Mechanically interlocked, edge seams spot welded, filled with automotive body filler and sanded flush.
 - .2 Door thickness: 44.5 mm, nominal.
- .5 Fire-rated doors: Flush, lock seam construction, hollow steel doors fabricated in compliance with CAN/ULC S104 and NFPA 80, and as follows:
 - .1 Face sheets: Minimum nominal 1.60 mm base steel sheet thickness.
 - .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.
 - .3 Longitudinal edges: Mechanically interlocked, edge seams spot welded, filled with automotive body filler and sanded flush.
 - .4 Fire rating: As indicated on Door Schedule, tested in accordance with CAN/ULC S104.
 - .5 Provide units listed and labeled by ULC (DIR) or ITS (DIR).
 - .1 Attach fire rating label to each fire rated unit.
 - .6 Door thickness: 44.5 mm, nominal.

2.3 HOLLOW METAL FRAMES

- .1 Comply with standards or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- .2 Frame profile:
 - .1 Gypsum board partitions: Double rabbet with backbend.
 - .2 Masonry partitions: Butt-type (not wrap-around), double rabbet, jamb depth to match partition thickness.
- .3 Frame finish: Same as hollow metal door.

-
- .4 Exterior door frames: Face welded type, thermally-broken.
 - .1 Frame metal thickness: 1.7 mm, minimum.
 - .2 Weatherstripping: Separate, see Section 08 71 00.
 - .5 Interior door frames, non-fire rated: Face welded type.
 - .1 Frame metal thickness: 1.7 mm, minimum.
 - .6 Door frames, fire-rated: Face welded type.
 - .1 Fire rating: Same as door, labeled.
 - .2 Frame metal thickness: 1.7 mm, minimum.
 - .7 Frames for wood doors: Comply with frame requirements in accordance with corresponding door.
 - .8 Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
 - .9 Frames in masonry walls: Size to suit masonry coursing with head member 50 mm high to fill opening without cutting masonry units.
 - .10 Frames wider than 1220 mm: Reinforce with steel channel fitted tightly into frame head, flush with top.
 - .11 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.
 - .1 Provide full height hinge reinforcement where continuous hinges are scheduled.
 - .2 For electronic door hardware and controls provide hinge junction box and outlet junction box at hardware mounting locations as required and cut-outs for hardware items.

2.4 REINFORCEMENT

- .1 Hardware reinforcement: Cold or hot rolled steel, galvanneal coated. Minimum base steel thickness in accordance with CSDMA Recommended Specifications for Commercial Steel Door and Frame Products, Table 1 – Minimum Steel Gauges for Component Parts, unless indicated otherwise.
 - .1 Hinge reinforcement: minimum 5 mm thick.
 - .2 Surface mounted hardware reinforcement: minimum 2.5 mm thick.
 - .3 Flush bolt reinforcement: minimum 5 mm thick.

2.5 FINISHES

- .1 Remove weld slag and splatter from exposed surfaces.
- .2 Fill and sand smooth tool marks, abrasions, and surface blemishes to present smooth uniform surfaces.
- .3 Primer: Shop apply zinc rich primer to repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site; include compatible primer for site finishing and correction of surface abrasions to zinc coatings and factory applied primer.
- .4 Bituminous coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.6 ACCESSORIES

- .1 Glazing: As specified in Section 08 80 00, factory installed.

- .2 Removable stops: Formed sheet steel, mitred or butted corners; prepared for countersunk style tamper proof screws.
- .3 Mechanical fasteners for concealed metal-to-metal connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- .4 Grout for frames: Portland cement grout with maximum 100 mm slump for hand troweling; thinner pumpable grout is prohibited.
- .5 Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on centre mullion of pairs, and two on head of pairs without centre mullions.
- .6 Frame anchors: Commercial steel (CS), 40Z coating designation; mill phosphatized. Minimum base steel thickness in accordance with CSDMA Recommended Specifications for Commercial Steel Door and Frame Products, Table 1 – Minimum Steel Gauges for Component Parts.
 - .1 For anchors built into exterior walls, steel sheet complying with ASTM A1008M or ASTM A1011M, hot-dip galvanized according to ASTM A153M, Class B.
 - .2 Provide appropriate anchorage to floor and wall construction.
 - .3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
 - .4 Provide number and spacing of anchors in accordance with CSDMA “Installation and Storage of Hollow Metal Doors and Frames”.
 - .5 Securely attach floor anchors to inside of each jamb profile.
- .7 Temporary frame spreaders: Provide for factory- or shop-assembled frames.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that opening sizes and tolerances are acceptable.
- .3 Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

- .1 Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

- .1 Install doors and frames in accordance with reviewed Shop Drawings, CSDMA Storage and Installation Guide, manufacturer's instructions, and related requirements of specified door and frame standards.
- .2 Install fire rated units in accordance with NFPA 80.
- .3 Coordinate frame anchor placement with wall construction.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- .6 Install door hardware as specified in Section 08 71 00.
- .7 Coordinate installation of electrical connections to electrical hardware items.

- .8 Touch up damaged factory coatings.

3.4 TOLERANCES

- .1 Clearances between door and frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with CSDMA Storage and Installation Guide.
- .2 Maximum diagonal distortion: 1.6 mm measured with straight edge, corner to corner.

3.5 ADJUSTING

- .1 Adjust for smooth and balanced door movement.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Flush wood doors; flush configuration; fire-rated and non-rated.

1.2 RELATED REQUIREMENTS

- .1 Section 08 11 13 - Hollow Metal Doors and Frames.
- .2 Section 08 71 00 - Door Hardware.

1.3 REFERENCE STANDARDS

- .1 AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, Canada Version 4.0 2021.
- .2 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies 2010.
- .3 NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- .4 WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2013.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Indicate door core materials and construction; veneer species, type and characteristics.
- .3 Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, and factory machining.
 - .1 Include certification program label.
- .4 Selection samples: For factory finished doors, submit two sets of 200 by 250 mm selected veneer samples with the standard finish colours representing manufacturer's full range of available colours and finishes.
- .5 Verification samples: Submit two samples of door construction, 300 by 300 mm in size illustrating door core, selected veneer, wood grain, veneer matching, and sheen.
- .6 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to sustainably harvested wood; product labels; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .7 Manufacturer's qualification statement.
- .8 Installer's qualification statement.
- .9 Specimen warranty.
- .10 Warranty, executed in City's name.

1.5 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

- .2 Installer qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Package, deliver and store doors in accordance with manufacturer's instructions and specified quality standard.
- .2 Accept doors on site in manufacturer's packaging. Inspect for damage.
- .3 Do not store in damp or wet areas; or in areas where sunlight might bleach veneer.

1.7 AMBIENT CONDITIONS

- .1 Environmental limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 16 and 32 deg C and relative humidity between 17 and 50 percent during the remainder of the construction period.
- .2 Acclimatize doors on site before hanging.

1.8 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Interior doors: Provide manufacturer's warranty for the life of the installation.
- .3 Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

Part 2 Products

2.1 MANUFACTURERS

- .1 Wood veneer faced doors:
 - .1 Baillargeon Doors.
 - .2 Lynden Doors.
 - .3 Dormond Industries.
 - .4 Substitutions: See Part B - Bidding Procedures.

2.2 DOORS

- .1 Doors: Refer to Drawings for locations and additional requirements.
 - .1 Quality standard: Custom Grade, Extra Heavy-Duty performance, in accordance with AWMAC/WI (NAAWS) or WDMA I.S. 1A.
 - .2 Wood veneer faced doors: 5-ply.
- .2 Interior doors: 44 mm thick unless otherwise indicated; flush construction.
 - .1 Provide solid core doors at each location.
 - .2 Fire rated doors: Tested to ratings indicated on Drawings in accordance with CAN/ULC S104; ULC (DIR) labeled without any visible seals when door is open.
 - .3 Wood veneer facing with factory finish.

2.3 DOOR CORES

- .1 General:
 - .1 Provide wood products and laminating adhesives containing no added urea-formaldehyde or resins containing urea-formaldehyde.
 - .2 Provide sustainably harvested wood, certified or labeled as specified in Section 01 61 00.
- .2 Non-rated solid core and 20-minute rated doors: LVL (laminated veneer lumber) or LSL (laminated strand lumber) core with top and bottom rails and stiles bonded to core, plies and faces as indicated.

2.4 DOOR FACINGS

- .1 Veneer facing for transparent finish: Hard (white) Maple, HPVA Grade A, quarter cut, with slip match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
 - .1 Vertical edges: Any option allowed by quality standard for grade.
- .2 Facing adhesive: Type I - waterproof, and containing no added urea-formaldehyde or resins containing urea-formaldehyde.

2.5 DOOR CONSTRUCTION

- .1 Fabricate doors in accordance with door quality standard specified.
- .2 Cores constructed with stiles, and top and bottom meeting performance requirements.
- .3 Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- .4 Factory fit doors for frame opening dimensions identified on Shop Drawings, with edge clearances in accordance with specified quality standard.
- .5 Provide edge clearances in accordance with the quality standard specified.

2.6 FACTORY FINISHING - WOOD VENEER DOORS

- .1 Finish work in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - .1 Transparent:
 - .1 System - 11, Polyurethane, Catalyzed.
 - .2 Sheen: Low.
- .2 Factory finish doors in accordance with approved sample.

2.7 ACCESSORIES

- .1 Hollow metal door frames: As specified in Section 08 11 13.
- .2 Door hardware: As specified in Section 08 71 00.

Part 3 Execut

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that opening sizes and tolerances are acceptable.

- .3 Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- .1 Install doors in accordance with manufacturer's instructions and specified quality standard.
 - .1 Install fire-rated doors in accordance with NFPA 80 requirements.
- .2 Factory-finished doors: Do not site cut or trim; if fit or clearance is not correct, replace door.
- .3 Use machine tools to cut or drill for hardware.
- .4 Coordinate installation of doors with installation of frames and hardware.

3.3 TOLERANCES

- .1 Comply with specified quality standard for fit and clearance tolerances.
- .2 Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

- .1 Adjust doors for smooth and balanced door movement.
- .2 Door hardware: As specified in Section 08 71 00.

3.5 CLEANING

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Wall and ceiling access door and frame units.

1.2 RELATED REQUIREMENTS

- .1 Section 04 22 00 - Concrete Unit Masonry: Openings in masonry.
- .2 Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions
- .3 Section 09 91 00 - Painting: Site paint finish.

1.3 REFERENCE STANDARDS

- .1 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies 2010.
- .2 ITS (DIR) - Intertek Testing Services, Directory of Listed Products current edition.
- .3 NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- .4 ULC (FRD) - Fire Resistance Directory Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- .3 Shop Drawings: Indicate exact position of each access door or panel unit.
- .4 Sustainable design submittals: Submit evidence of compliance of product life cycle, sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, re-used steel content, and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Manufacturer's installation instructions: Indicate installation requirements and rough-in dimensions.

1.5 QUALITY ASSURANCE

- .1 Regulatory requirements: Provide fire rated access doors and frames in accordance with NFPA 80 or CAN/ULC S104 and labelled and listed by ULC (FRD), or ITS (DIR), or another testing and inspecting agency acceptable to the Authority Having Jurisdiction.

Part 2 Products

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

- .1 Fire-rated wall-mounted units:
 - .1 Wall fire-rating: As indicated on Drawings.

2.2 WALL AND CEILING MOUNTED UNITS

- .1 Wall and ceiling mounted units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - .1 Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated. Provide products containing recycled content.
 - .2 Style: Flush.
 - .1 Gypsum board mounting criteria: Use drywall bead type frame.
 - .2 Masonry partitions: Exposed frame with door surface flush with frame surface.
 - .3 Door style: Single thickness with rolled or turned in edges.
 - .4 Frames: 1.6 mm, minimum thickness.
 - .5 Single steel sheet door panels: 1.6 mm, minimum thickness.
 - .6 Units in fire-rated assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - .1 Provide products listed by ITS (DIR) or ULC (FRD) as suitable for purpose indicated.
 - .2 Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
 - .7 Steel finish: Primed.
 - .8 Door/panel nominal size: 915 by 915 mm where indicated; 600 by 600 mm elsewhere.
 - .9 Hardware:
 - .1 Hardware for fire-rated units: As required for listing.
 - .2 Hinges for non-fire-rated units: Concealed, constant force closure spring type.
 - .3 Handle: No handle.
 - .4 Latch/lock: Screw driver slot for quarter turn cam latch.
 - .5 Number of locks/latches required: As recommended by manufacturer for size of unit.
 - .10 Provide masonry anchors for access panels installed in masonry partitions.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

- .1 Install units in accordance with manufacturer's instructions.
- .2 Install frames plumb and level in openings, and secure units rigidly in place.
- .3 Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Folding door assemblies for apparatus vehicle bays, including doors, frames and operators.
- .2 Wiring from electric circuit disconnect to operators to control stations.

1.2 RELATED REQUIREMENTS

- .1 Section 08 08 00 - Commissioning of Openings
- .2 Section 05 12 23: Structural Steel for Buildings: Steel opening frame.
- .3 Division 26 - Electrical: Conduit and wiring from electrical circuit to operators, and from operators to control stations.
- .4 Section 28 10 00 - Access Control: Access control device service connection to door controller.

1.3 REFERENCE STANDARDS

- .1 ANSI/CAN/UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems 2017.
- .2 ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- .3 ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing 2020a.
- .4 ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2021a.
- .5 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations 2021.
- .6 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate installation of electrical services and connections with work of Division 26.
 - .2 Coordinate door controls with door access controls specified in Division 28.
- .2 Preinstallation meeting: Conduct a preinstallation meeting one week prior to start of this Work to review procedures, schedules, safety, and coordination with other elements of project; attendance required by the following:
 - .1 City's representative.
 - .2 Contract Administrator.
 - .3 Folding bay door manufacturer's representative.
 - .4 Other installers for systems that require an interface with this Work.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

- .2 Product data: Show component construction, anchorage method, hardware, and door operator information.
- .3 Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, installation details, and door operator mechanism, and wiring diagrams.
 - .1 Prepared by manufacturer of folding bay door assembly, and stamped and sealed by a professional structural engineer.
- .4 Samples: Two steel tube frames, 150 mm long and two steel panels 50 mm by 50 mm in size, indicating colour and finish.
- .5 Sustainable design submittals: Submit evidence of compliance of product life cycle, sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, re-used steel content, and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Design data: Include structural load calculations at points of attachment to building structure.
- .7 Manufacturer's installation instructions: Include any special procedures required by project conditions.
- .8 Designer's qualification statement.
- .9 Manufacturer's qualification statement.
- .10 Installer's qualification statement.
- .11 Maintenance contract.
- .12 Operation data: Include normal operation, troubleshooting, and adjusting.
- .13 Maintenance data: Indicate lubrication requirements and frequency, periodic adjustments required, and recommended maintenance schedule, and equipment interconnection diagrams.

1.6 QUALITY ASSURANCE

- .1 Designer qualifications: Perform design under direct supervision of Professional Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
- .2 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.
- .3 Installer qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.
- .4 Products requiring electrical connection: Electrical motors, components, devices, wiring and accessories as listed and labelled by Canadian Electrical Code CSA C22.1, or testing firm acceptable to Authorities Having Jurisdiction as suitable for purpose specified.
- .5 Source limitations: Furnish products produced by single manufacturer and obtained from single supplier.
 - .1 Obtain operators and controls from folding bay door manufacturer.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for additional requirements.

1.8 SITE CONDITIONS

- .1 Site measurements: Verify actual locations of openings and supports for folding bay doors by site measurements before fabrication, and indicate measurements on Shop Drawings.

Part 2 Products

2.1 MANUFACTURERS

- .1 Door Engineering and Manufacturing; Four-Fold Doors, Model FF300 series glazed.
- .2 Substitutions: See Part B - Bidding Procedures.

2.2 MATERIALS

- .1 Steel tube: ASTM A513/A513M and ASTM A500/A500M.
- .2 Steel sheet: Steel sheets of commercial quality, complying with ASTM A1008/A1008M cold-rolled steel sheet.
- .3 Hardware: Manufacturer's standard components.
- .4 Fasteners: Zinc-coated steel.

2.3 FOLDING BAY DOORS

- .1 Size: As indicated in Door and Frame Schedule.
- .2 Construction:
 - .1 Door framing: Minimum 3 mm thick structural steel tube, urethane foam filled, with 1.6 mm thick steel sheet on exterior and interior faces, formed on vertical edges with no visible welds on interior or exterior panel faces.
 - .2 Construct frames and framing members true to dimension and square in all directions. Fabrication tolerance: Maximum 3 mm in 6 m.
- .3 Surface mounted tube frame: Pre-hung tube frame system, minimum 150 by 100 by 3 mm thick designed to be welded to steel structure, urethane foam filled, and complete with factory-installed hinges, track supports and operator supports.
- .4 Hardware: Including guide tracks and brackets, trolleys, centre guides, minimum three pairs of jamb and fold hinges per opening, and bolts, nuts, fasteners, etc. necessary for complete installation and operation.
 - .1 Doors up to 4.876 m wide and under 200 kPa windload shall require no floor mounted supports, guides or tracks.
 - .2 Top tracks: Adjustable on end track hangers to allow for adjustment of door panels in the open position and replaceable without removal of door framing or operators.
- .5 Hinges:
 - .1 Jamb hinges: Dual shear with two thrust bearings and two needle bearings.

- .2 Panel (fold) hinges: Stainless steel, dual shear with two thrust bearings. Bearings completely concealed within hinge barrel and include grease zerks.
- .3 Hinge pins: Minimum 19 mm diameter hardened steel.
- .6 Hinge guards: Provide plastic guards at jamb hinges to prevent access through hinge space. Colour to match doors.
- .7 Weatherstripping: Adjustable and readily replaceable, substantially weather-tight installation.
 - .1 Centre weatherstripping: EPDM, with no exposed fasteners on exterior side of panel.
 - .2 Sill weatherstripping: Two 1.6 mm thick EPDM sweeps with aluminum retainer.
 - .3 Perimeter weatherstripping: Provide full perimeter jamb and head weatherstripping.
- .8 Vision panels: 25 mm thick double-glazed insulating unit; 6 mm thick clear tempered glass inner and outer pane. Vision panels of size, shape and location as indicated on the Drawings.
- .9 Factory finish: PPG Spectracron epoxy primer and polyurethane top coat. Custom colour to match metal composite material wall panel CMP-1.

2.4 OPERATOR

- .1 General: Operator, controls, actuators, and safeties shall comply with CSA C22.1; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
- .2 Overhead-mounted electro-mechanical drive unit designed for high cycle operation, consisting of an electric motor, gear reducer, and rotating drive arm. Door shall be operated with connecting rods attached to rotating drive arm on the operator and to control arms attached to jamb door section and to door lintel. Connecting rods shall be positive drive, keeping door under firm control at all times. Connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.
- .3 Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to manual operation.
- .4 Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. Motor shall be wound for three phase 208 VAC, 60 Hertz operation.
 - .1 Provide interlock switches on motor operated units.
- .5 Electric controls: Controls furnished by door manufacturer, complete for each door, and built in accordance with the latest NEMA standards. Electrical power supply: 208/230 VAC 3-phase.
 - .1 Control panel assemblies ULC listed per CSA C22.1.
 - .2 Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
 - .3 Controls shall include a variable frequency drive with independent adjustment of opening and closing speeds.
 - .4 Controller enclosures: NEMA 250 Type 4 with disconnect switch.

- .5 Control stations: Provide three button (Open-Close-Stop) momentary-contact control devices for each operator complying with ANSI/CAN/UL 325. Multiple grouped and individual locations: As indicated on Drawings.
- .6 Provide for connection of access control devices with door controls where indicated and as specified in Section 28 10 00.
- .7 Limit switches: To stop travel of door in its fully open or fully closed position.
- .6 Safety features:
 - .1 Safety edges: Monitored electric safety edges on leading edge of doors to stop and reverse door upon contact with obstruction.
 - .2 Photo eyes: Exterior, jamb mounted, light curtain type photo eyes, NEMA 4 rated. Photo eye shall cover from floor level to 1830 mm AFF. Door stops and reverses automatically if an object interferes with the beams.
 - .3 Presence sensor: Interior, overhead mounted, to sense objects approaching from interior.
 - .4 Warning horn/strobe: Include outputs PLC to allow for activation while door is in motion both opening and closing, along with activation before to closing. Include programmable "delay-to-close" timer that activates warning horn for a set time, prior to the door closing.
 - .5 Interior swing path safety edges: With wireless edge kit to sense objects in path of swinging panel.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- .2 Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's written instructions, and reviewed Shop Drawings.
- .2 Anchor assembly to wall construction and building framing without distortion or stress.
- .3 Set doors plumb, level, and square, and with all parts properly fastened and mounted.
- .4 Fit and align door assembly including hardware to provide smooth operation.
- .5 Complete power and control wiring from disconnect to unit components.

3.3 ADJUSTING

- .1 Adjust door assembly for smooth operation, and full contact of weatherstripping.
- .2 Have manufacturer's site representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.4 CLEANING

- .1 Clean doors, frames and glazing.
- .2 Remove temporary labels and visible markings.
- .3 Touch-up abraded or damaged finished surfaces to match factory-applied finish.

3.5 CLOSEOUT ACTIVITIES

- .1 Demonstrate proper operation of door assemblies to City's designated representative.
- .2 Training: Train City's personnel on operation and maintenance of system.
 - .1 Training reference: Operation and maintenance manual and additional training materials as required.
 - .2 Provide minimum of two hours of training.
 - .3 Location: Project site.

3.6 PROTECTION

- .1 Protect installed door assemblies from subsequent construction operations.
- .2 Do not permit construction traffic through door openings after adjustment and cleaning.

3.7 MAINTENANCE

- .1 Provide separate maintenance contract for service and maintenance of door assemblies for 12 months from Date of Substantial Performance.
 - .1 Provide full maintenance by skilled employees of folding bay door installer, including monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation at rated speed. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
 - .2 Provide emergency call back service at all hours for this maintenance period.
 - .3 Perform maintenance work using competent personnel, under supervision and in direct employ of door manufacturer.
 - .4 Do not assign or transfer maintenance service to any agent or subcontractor without prior written consent of the City.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Interior and exterior aluminum-framed curtain wall, with vision glazing and metal infill panels.
- .2 Associated glazed aluminum entrance doors.
- .3 Firestopping between curtain wall and edge of floor slab.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 05 12 00 - Structural Steel Framing: Steel attachment members.
- .3 Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- .4 Section 07 84 00 - Firestopping: Firestop at system junction with structure.
- .5 Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- .6 Section 08 08 00 - Commissioning of Openings
- .7 Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- .8 Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

- .1 AAMA 501 - Methods of Tests for Exterior Walls 2015.
- .2 AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure 2017.
- .3 AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- .4 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- .5 AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.
- .6 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- .7 ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- .8 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- .9 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- .10 ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- .11 ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants 2005 (Reapproved 2017).

- .12 ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).
- .13 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .14 ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.
- .15 ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants 2019.
- .16 ASTM C1184 - Standard Specification for Structural Silicone Sealants 2018, with Editorial REvision.
- .17 ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications 2018.
- .18 ASTM C1401 - Standard Guide for Structural Sealant Glazing 2014 (Reapproved 2022).
- .19 ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- .20 ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- .21 ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- .22 CSA S157/S157.1 - Strength Design in Aluminum Design / Commentary On CSA S157, Strength Design in Aluminum 2017.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with installation of other components that comprise the exterior enclosure.
- .2 Preinstallation meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers to:
 - .1 Verify project requirements, including mock-up requirements.
 - .2 Verify site conditions.
 - .3 Co-ordinate products, installation methods and techniques.
 - .4 Sequence work of related sections, including but not limited to structural-support framing, air/vapour barrier, exterior cladding, and glazing.
 - .5 Co-ordinate with other building subtrades.
 - .6 Review manufacturer's installation instructions.
 - .7 Review glazing procedure and schedule including methods of delivering and handling glass, and installing glazing materials.
 - .8 Verify compatibility of sealants, gaskets and glazing materials.
 - .9 Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - .10 Review firestopping, flashings, special curtain wall details, and condition of other construction that may affect curtain wall.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

- .2 Product data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, entrance doors and hardware, and metal infill panels.
- .3 Shop Drawings:
 - .1 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint location and details, and field welding required.
 - .2 Indicate materials and details in full size for head, jamb and sill, profiles of components, operable windows, junction between combination units, elevations of units, thermal break locations and details, glazing details and methods, anchorage details, location of isolation coating, description of related components; exposed finishes; hardware, fasteners and sealant locations.
 - .3 Indicate isometric views of joining and fastening where surfaces intersect or change plane.
 - .4 Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.
 - .5 Prepared by manufacturer of curtain wall system; and stamped and sealed by a professional structural engineer.
- .4 Hardware schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- .5 Samples: Submit two samples 100 by 100 mm in size of metal infill panels, and 100 mm long tubular framing section illustrating finished aluminum surfaces.
- .6 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and compliance with VOC-content and VOC-emission requirements for glazing sealants and primers.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .7 Manufacturer's certificate: Certify that the products supplied meet or exceed the specified requirements.
- .8 Design data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- .9 Structural sealant glazing (SSG): Submit product data and calculations showing compliance with performance requirements.
- .10 Test reports: Submit results of mock-up testing. Reports of tests previously performed on the same design are acceptable.
- .11 Site quality control submittals: Report of site testing for water penetration and air leakage.
- .12 Designer's qualification statement.
- .13 Installer's qualification statement.
- .14 Warranty: Submit manufacturer warranty and ensure forms have been completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Designer qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the Province in which the Project is located.
- .2 Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, self-life, storage conditions, and colour.
- .3 Installer qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- .4 Quality-control program for SSG system: Develop quality control program specifically for Project. Document quality-control procedures and verify results for SSG curtain wall systems. Comply with ASTM C1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.
- .5 Product options: Information in Contract Documents establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - .1 Do not modify intended aesthetic effects, as judged solely by Contract Administrator, except with Contract Administrator's approval. If revisions are proposed, submit comprehensive explanatory data to Contract Administrator for review.
- .6 Preconstruction sealant testing: For SSG curtain wall systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by curtain wall systems.
- .7 Structural-sealant glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed systems.
- .8 Structural-sealant joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for additional requirements.
- .2 Construct integrated exterior mock-ups of curtain wall assembly and adjacent metal wall panel assembly.
- .3 Locate on-site where directed by Contract Administrator; accepted mock-up may remain as part of the Work.
- .4 Mock-up will be tested by an independent testing agency in the presence of curtain wall sub-contractor, Contractor, and Contract Administrator.
- .5 Exact test procedures will be determined with testing agency, but will include air infiltration and exfiltration tests, and water penetration tests.
- .6 Costs for testing will be paid for by cash allowance.
- .7 Alterations, repairs, additions necessary to achieve acceptable performance at the test locations and similar adjustments to all completed work shall be at no additional cost to the Contract.
- .8 Include cost of re-testing to verify corrected work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Handle products of this section in accordance with AAMA CW-10.
- .2 Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.9 SITE CONDITIONS

- .1 Site measurements: Verify actual locations of structural supports for glazed aluminum curtain wall systems by site measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

Part 2 Products

2.1 MANUFACTURERS

- .1 Exterior glazed aluminum curtain walls - CW1: Thermally-broken, triple-glazed.
 - .1 Basis of Design Product: Alumicor; ThermaWall TW2200.
 - .2 Other manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - .1 Kawneer North America.
 - .2 Oldcastle Building Envelope.
- .2 Interior SSG aluminum curtain walls - CW2: Non-thermally broken, monolithic safety glazing, and double-glazing as indicated.
 - .1 Basis of Design Product: Alumicor; VersaWall MidLine 2200.
 - .2 Other manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - .1 Kawneer North America.
 - .2 Oldcastle Building Envelope.
- .3 Exterior entrance doors: Thermally-broken, insulating safety glazing.
 - .1 Basis of Design Product: Alumicor; ThermaPorte 7700 T400A.
 - .2 Other manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - .1 Kawneer North America.
 - .2 Oldcastle Building Envelope.
- .4 Interior entrance doors: Non-thermally broken, monolithic safety glazing.
 - .1 Basis of Design Product: Alumicor; Canadiana 400A.
 - .2 Other manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - .1 Kawneer North America.
 - .2 Oldcastle Building Envelope.
- .5 Substitutions: See Part B - Bidding Procedures.

2.2 CURTAIN WALL

- .1 Aluminum-framed curtain wall: Factory-fabricated, factory-finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - .1 Exterior curtain wall - Type CW1: Outside glazed, with pressure plate and mullion cover, triple-glazed.
 - .2 Interior curtain wall - Type CW2: Structural sealant glazing (SSG) adhesive on four-sides, monolithic and double-glazed.
 - .3 Fabrication method: Site fabricated stick system.
 - .4 Glazing method: Site glazed system.
 - .5 Vertical mullion face width: 50 mm.
 - .6 Vertical mullion depth of back section:
 - .1 CW1: 50 mm at punched windows, 100 mm elsewhere.
 - .2 CW2: 100 mm.
 - .7 Finish: Superior performing organic coatings.
 - .1 Factory finish surfaces that will be exposed in completed assemblies.
 - .2 Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - .8 Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - .9 Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - .10 System internal drainage - Exterior CW: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - .11 Air and vapour seal - Exterior CW: Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
 - .12 Perimeter clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - .13 Base exterior skin design on "Rain Screen", pressure-equalized system. Provide complete air/vapour seal within system grid, with gaskets, baffles, overlaps, seals, openings between cavities, sufficient cross section to provide pressure equalization. Baffle openings or guard to minimize direct water entry.
- .2 Structural performance requirements: Design and size components to withstand, as applicable to installation location, the following load requirements without damage or permanent set.
 - .1 Design structural support framing components to CSA S157/S157.1 under direct supervision of a professional structural engineer experienced in design of this Work and licensed in the Province in which the Project is located.
 - .2 Design wind loads: Comply with the following:
 - .1 Design wind load (Once In 50 Year Occurrence): As indicated on Drawings.
 - .2 Design in accordance with MBC wind load requirements.
 - .3 Member deflection: For spans less than 4100 mm, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 19 mm, whichever is less and with full recovery of glazing materials.

- .4 Member deflection: For spans over 4100 mm and less than 12.2 m, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 6 mm, with full recovery of glazing materials.
- .3 Movement: Accommodate the following movement without damage to components or deterioration of seals:
 - .1 Allow for thermal movements resulting from the following maximum change (range) in ambient temperatures, accounting for surface temperatures of materials due to both solar heat gain and night time sky heat loss:
 - .1 Exterior ambient: 35 degrees C to 30 degrees C.
 - .2 Adjust calculations to account for colour treatments or coatings on curtain wall framing members.
 - .2 Movement of curtain wall relative to perimeter framing.
 - .3 Deflection of structural support framing, under permanent and dynamic loads.
- .4 Structural sealant glazing (SSG) system: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with 19 mm maximum, and a deflection parallel to the wall of L/360 with 3 mm maximum, whichever is less.
- .3 Water penetration resistance (static) on manufactured assembly - CW1: No uncontrolled water on indoor face when tested as follows, and as defined in AAMA 501:
 - .1 Test pressure differential: 720 Pa.
 - .2 Test method: ASTM E331.
- .4 Water penetration resistance (dynamic) on manufactured assembly - CW1: No uncontrolled water on indoor face when tested as follows, and as defined in AAMA 501:
 - .1 Test pressure differential: 720 Pa.
 - .2 Test method: AAMA 501.1.
- .5 Air leakage laboratory test - CW1: Maximum of 0.3 L/sec sq m of wall area, when tested in accordance with ASTM E283 at 300 Pa pressure differential across assembly.
- .6 Thermal performance requirements - CW1:
 - .1 Overall USI-value including glazing: 1.9 W/(sq m K), maximum.

2.3 COMPONENTS

- .1 Aluminum framing members: Tubular aluminum sections using recycled aluminum, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - .1 Framing members for interior applications need not be thermally broken.
- .2 Entrance doors: Glazed aluminum.
 - .1 Thickness:
 - .1 Exterior: 57 mm.
 - .2 Interior: 44 mm.
 - .2 Stile and rail widths: As indicated in Section 08 06 13 - Door and Frame Type Schedule.
 - .3 Glazing stops: Manufacturer's standard shape.
 - .4 Finish: Same as curtain wall framing.

- .3 Glazing: As specified in Section 08 80 00.
 - .1 For exterior framing: Type GL1.
 - .2 For interior framing: Type GL2, and GL3.
- .4 Infill panels: Interior door actuator mounting panels.
 - .1 Minimum 1.0 mm thick aluminum sheet adhered to 19 mm thick plywood backing panel.
 - .2 Single piece per location, secured to mullions with concealed fasteners.
 - .3 Finish: Superior performing organic coatings to match framing.
- .5 Infill panels: Insulated spandrel panels.
 - .1 Overall panel thickness: Same depth as curtain wall mullion.
 - .2 Exterior skin: 1.0 mm thick aluminum sheet adhered to plywood backing. Exposed aluminum finish: Same as framing.
 - .3 Insulation: Semi-rigid mineral wool insulation.
 - .4 Inner skin: As specified for exterior skin.
 - .5 Back pan: Fabricate back pan from 0.91 mm thick zinc coated, sheet metal, to profiles indicated, with sealed corners. Size panels to provide maximum clearance 6 mm around perimeter, between pans, vertical, and horizontal aluminum framing members, and to allow installation of door activating devices.
 - .6 Install mineral wool board insulation in back pan.
 - .7 Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching exterior skin. Maintain cavity width of 25 mm unless otherwise indicated between insulation and exterior skin.
 - .8 Ventilate and pressure-equalize air space outside exterior surface of insulation, to the exterior.
 - .9 Arrange fasteners and attachments to ensure concealment from view.
- .6 Caps: Extruded aluminum, secured with concealed fasteners; square profile, 19 mm deep; finish to match curtain wall framing.
- .7 Trim:
 - .1 Minimum 3 mm thick extruded and sheet aluminum, except as specified or indicated otherwise. Fabricated for securement with concealed fasteners.
 - .2 Fabricate aluminum trim pieces, angles and closure pieces at head, sill and jambs, at stacked sills, at ends of partitions, as indicated and as required.
 - .3 Profiles indicated, and as required.
 - .4 Finish to match curtain wall mullion sections where exposed.

2.4 MATERIALS

- .1 Provide products containing recycled content.
- .2 Extruded aluminum: ASTM B221 (ASTM B221M).
- .3 Sheet aluminum: ASTM B209 (ASTM B209M).
- .4 Brackets and reinforcements: Manufacturer's standard high strength aluminum and non-staining, non-ferrous shims for aligning system components.
- .5 Structural supporting anchors attached to structural steel: Design for bolted attachment.

-
- .6 Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
 - .1 Use self locking devices where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration.
 - .2 Reinforce members as required to receive fastener threads.
 - .3 Use only concealed fasteners, unless use of exposed fasteners has been accepted in writing by the Contract Administrator.
 - .4 Finish: Match framing system.
 - .7 Exposed flashings: Aluminum sheet, 3 mm minimum thickness; finish to match framing members; fabricate in maximum lengths.
 - .8 Concealed flashings: Sheet aluminum, 0.43 mm minimum thickness.
 - .9 Firestopping: As specified in Section 07 84 00.
 - .10 Structural sealant glazing (SSG) adhesive: Neutral curing, silicone sealant formulated for SSG applications in compliance with ASTM C1184 and structural glazing industry guidelines, ASTM C1401.
 - .1 SSG adhesive in compliance with ASTM C920; Type S - Single-component, Grade NS, Class 50, Use NT, G, and A.
 - .2 Ultimate tensile strength: Minimum of 345 kPa as determined by test method ASTM C1135 under the following conditions.
 - .1 Exposure to air temperatures of 88 degrees C and minus 29 degrees C.
 - .2 Water immersion for seven days, minimum.
 - .3 Exposure to weathering for 5,000 hours, minimum.
 - .3 Sealant design tensile strength: 139 kPa, maximum.
 - .4 Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
 - .5 Colour: Black.
 - .6 VOC content and emission restrictions for sealants: in accordance with Section 01 61 16.
 - .7 SSG sealant tested for compatibility with glazing accessories in compliance with ASTM C1087, tested for accelerated weathering in compliance with ASTM C793, and in compliance with insulating glass secondary sealant design standards of ASTM C1249.
 - .11 Weatherseal sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.
 - .12 Glazing gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
 - .13 Glazing accessories: As specified in Section 08 80 00.
 - .14 Entrance door adapters: Extruded aluminum, prefinished to match curtain wall framing, manufacturer's standard profile to allow installation of entrance doors as specified in this Section.
 - .15 Anti-rotation channels: Manufacturer's recommended extruded aluminum anti-rotation channel or reinforced nylon anti-rotation channel designed to retain air seal membrane through pressure to the face of the tubular back section and prevent rotation of pressure cap.
 - .16 Isolation coating: Manufacturer's standard alkali-resistant coating.

2.5 FINISHES

- .1 Superior performing organic coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
 - .1 Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF colour topcoat and minimum total dry film thickness of 0.023 mm.
 - .2 Manufacturers:
 - .1 Sherwin-Williams Company; Fluoropon Classic II
- .2 Colour: Custom colour selected by Contract Administrator.
- .3 Touch-up materials: As recommended by coating manufacturer for site application.

2.6 HARDWARE

- .1 For each door, include weatherstripping and sill sweep strip.
- .2 Other door hardware: As specified in Section 08 71 00.
- .3 Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- .4 Sill sweep strips: Resilient seal type, of neoprene; provide on all doors.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify dimensions, tolerances, and method of attachment with other related work.
- .2 Verify that curtain wall openings and adjoining air and vapour seal materials are ready to receive work of this section.
- .3 Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

- .1 Install curtain wall system in accordance with manufacturer's instructions.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Provide alignment attachments and shims to permanently fasten system to building structure.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- .5 Provide thermal isolation where components penetrate or disrupt building insulation.
- .6 Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- .7 Coordinate installation of firestopping at each floor slab edge.
- .8 Apply insulating foam sealant in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .9 Entrances:
 - .1 Install entrance framing to produce smooth operation and tight fit at contact points.

- .2 Install exterior entrance framing to produce tight fit at weather stripping and weather tight closure.
- .3 Install site applied surface mounted hardware in accordance with hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- .10 Pressure plate framing - Exterior CW: Install glazing and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
- .11 Structural sealant glazing (SSG) adhesive - Interior CW: Install structural sealant glazing adhesive and weatherseal sealant in accordance with manufacturer's instructions.
- .12 Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

- .1 Maximum variation from plumb: 3 mm / 3m non-cumulative or 6 mm / 12 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Sealant space between curtain wall mullions and adjacent construction: Maximum of 12 mm and minimum of 6 mm.

3.4 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, for independent site testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- .2 Costs for testing and inspection will be paid for by cash allowance.
- .3 Testing and inspection of representative areas of glazed aluminum curtain walls shall take place as installation proceeds and before installation of interior finishes, to determine compliance of installed assemblies with specified requirements.
- .4 Testing and inspection will include:
 - .1 Periodic on-site testing.
 - .2 Verification of proper insulation, and air/vapour barrier installation.
 - .3 Review of panel-to-panel air seals.
 - .4 Review of panel fastening, exterior sealants, etc.
 - .5 Verification of flashing placement and continuity.
 - .6 Special review of interfaces between different elements to verify continuity of envelope performance.
 - .7 Review of exterior applied sealants and flashings.
 - .8 Review of drainage paths to confirm they are clear.
 - .9 Verification of glass type and position.
 - .10 Water penetration testing. Exact test procedures and number of tests will be determined with testing agency
 - .11 Air infiltration testing. Exact test procedures and number of tests will be determined with testing agency
 - .12 Structural sealant glazing inspection and evaluation to ASTM C1401.
- .5 Repair work if test results and inspections indicate that it does not comply with specified requirements. Once repairs are completed, re-test system by same standard. Failure of test will result in re-testing of the same location and the additional testing of another location within the same curtain wall system.

- .6 Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- .7 Curtain wall assemblies will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

- .1 Adjust entrance door and hardware for smooth operation.
- .2 Adjust closers designated as accessible for people with disabilities to provide a 3 second closer sweep period for doors to move from a 70 degree open position to 75 mm from latch measured to the leading door edge.

3.6 CLEANING

- .1 Remove protective material from pre-finished aluminum surfaces.
- .2 Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.7 PROTECTION

- .1 Protect installed products from damage until Date of Substantial Performance.
- .2 Protect aluminum finishes and glazing during erection against disfiguration, contamination or damage by abuse or harmful materials.
- .3 Mark each light with large cross or other symbol to make glass obvious and noticeable to other trades after glass is installed, using substance that will not stain, mark or shadow glass either by itself or by reaction with sunlight, moisture or the environment; masking tape is not considered as a suitable material; replace glass units marked with masking tape.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Interior protective framed glazing assembly, including doors and frames (referred to on the Door and Frame Schedule as "PFGA")

1.2 RELATED REQUIREMENTS

- .1 Section 07 84 00 - Firestopping: Firestop at exterior wall assembly junction with structure.
- .2 Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3 REFERENCE STANDARDS

- .1 16 CFR 1201 - Safety Standard for Architectural Glazing Materials current edition.
- .2 AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.
- .3 ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.
- .4 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- .5 CAN/CGSB 12.20 - Structural Design of Glass in Buildings 1989.
- .6 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials 2014.
- .7 CAN/ULC S106 - Standard Method for Fire Tests of Window and Glass Block Assemblies 2015.
- .8 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel 2013 (Reaffirmed 2018).
- .9 NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- .10 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide evidence of compliance with fire performance criteria and manufacturer's published product data on framing components, glazing, anchorage and fasteners, and doors, if any.
- .3 Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and site welding required.
- .4 Samples: Submit samples illustrating each exposed metal finish, and gloss.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, reused steel content, and compliance with VOC-content and VOC-emission requirements for glazing sealants and primers.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

-
- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
 - .6 Hardware schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
 - .7 Manufacturer's qualification statement.
 - .8 Installer's qualification statement.
- 1.5 QUALITY ASSURANCE**
- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience.
 - .2 Installer qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- 1.6 DELIVERY, STORAGE, AND HANDLING**
- .1 Handle products of this section in accordance with AAMA CW-10.
 - .2 Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.
- 1.7 SITE CONDITIONS**
- .1 Do not install sealants when ambient temperature is less than 5 degrees C, and maintain above this minimum temperature during and for 48 hours after installation.
- Part 2 Products**
- 2.1 INTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES**
- .1 Interior protective framed glazing assembly manufacturers:
 - .1 Technical Glass Products; Fireframe Designer Series doors and frames.
 - .2 Substitutions: See Part B - Bidding Procedures.
 - .2 Provide factory-fabricated, factory-finished framing members with glazing and related flashings, anchorage and attachment devices.
 - .1 Perimeter clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - .3 Structural performance: Design to support dead loads and applicable horizontal live loads; coordinate connection to main structural members.
 - .1 Comply with CAN/CGSB 12.20 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - .2 Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths or 19 mm, whichever is less.
 - .4 Fire performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with CAN/ULC S101, CAN/ULC S106 and requirements of local authorities having jurisdiction.
 - .1 Acceptable evidence of compliance includes listing by ULC (DIR) or testing agency acceptable to authorities having jurisdiction.

2.2 COMPONENTS

- .1 Framing members: Formed steel structural members without aluminum cladding and non-combustible thermally-resistive material as required for fire rating.
 - .1 Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - .2 Glazing stops: Flush.
 - .3 Cross section: 45 by 136 mm nominal dimension.
 - .4 Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2.3 MATERIALS

- .1 Extruded aluminum: ASTM B221M.
- .2 Structural steel sections: CSA G40.20/G40.21; shop primed.
- .3 Concealed fasteners: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
 - .1 Arrange fasteners and attachments to conceal from view, unless otherwise approved by Contract Administrator.
- .4 Exposed fasteners: Stainless steel.
- .5 Firestopping: As specified in Section 07 84 00.
- .6 Sealants within fire-rated assembly: As required by fire-rating and manufacturer's assembly.
 - .1 VOC content and emission restrictions for sealants: in accordance with Section 01 61 16.
- .7 Refer to Section 07 92 00 for additional information on sealant requirements.
- .8 Glass - Type FR-LAM: Composed of multiple sheets of low-iron high visible light transmission glass laminated with an intumescent interlayer.
 - .1 Thickness: 37 mm.
 - .2 Impact safety resistance: ANSI Z97.1 and 16 CFR 1201.
 - .3 Visible light transmittance: Minimum 84 percent.
 - .4 Product:
 - .1 Pilkington; Pyrostop 90-102.
- .9 Glazing gaskets: Type to suit application to achieve fire-rating, weather, moisture, and air infiltration requirements.
- .10 Glazing tape: Intumescent type provided by manufacturer.
- .11 Setting blocks: Calcium silicate.

2.4 DOORS AND HARDWARE

- .1 Doors: Glazed hollow steel.
 - .1 Thickness: 50 mm.
 - .2 Top rail: 90 mm wide.
 - .3 Vertical stiles: 90 mm wide.

- .4 Horizontal mid rail: 90 mm.
- .5 Bottom rail: 90 mm wide.
- .6 Glazing stops: Flush.
- .7 Finish: Same as framing.
- .2 Interior door hardware:
 - .1 Pivots: Manufacturer's standard weld-on pivot type, three per door.
 - .2 Closers: LCN 4040XP surface-mounted, pull side.
 - .3 Exit device and latching: Von Duprin rim exit device.
 - .4 Door bottom seal: Pemko, automatically seals to floor when door is closed.
 - .5 Perimeter gaskets: Manufacturer's standard double overlapping smoke and weather seal system.

2.5 FINISHES

- .1 Finishing: Apply factory finish to surfaces that will be exposed in completed assemblies.
 - .1 Touch-up surfaces cut during fabrication so that no natural metal surfaces are visible in completed assemblies, including joint edges.
- .2 Aluminum finish: High performance organic coatings.
 - .1 Apply factory finish to surfaces that will be exposed in completed assemblies.
 - .2 Touch-up surfaces cut during fabrication so that no natural aluminum metal surfaces are visible in completed assemblies, including joint edges.
 - .3 Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - .4 Colour: To be selected by Contract Administrator from manufacturer's custom range.
- .3 Touch-up materials: As recommended by coating manufacturer for site application.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify dimensions, tolerances, and method of attachment with other work.
- .2 Verify that wall openings and adjoining air and vapour seal materials are ready to receive work of this section.
- .3 Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

- .1 Install wall system in accordance with limitations of fire rating and with manufacturer's instructions.
- .2 Install framed glazing assemblies in accordance with NFPA 80 and requirements of local authorities having jurisdiction.
- .3 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .4 Provide alignment attachments and shims to permanently fasten system to building structure.

- .5 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- .6 Install door hardware using templates provided.
- .7 Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 ADJUSTING

- .1 Adjust doors for smooth operation.

3.4 CLEANING

- .1 Remove protective material from pre-finished surfaces.
- .2 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths; take care to remove dirt from corners, and wipe surfaces clean.

3.5 PROTECTION

- .1 Protect installed products from damage until Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Fixed sound-control window assembly with glazing.

1.2 REFERENCE STANDARDS

- .1 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- .2 ASTM E413 - Classification for Rating Sound Insulation 2022.
- .3 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's published data showing materials, construction details, dimensions of components, finishes, and acoustic performance.
- .3 Shop Drawings: Drawings prepared specifically for this project, showing plans, elevations, sections, details of construction, anchorage to other work, hardware, and glazing.
- .4 Samples for selection: Colour charts for factory-applied finishes.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, reused aluminum content, and compliance with VOC-content and VOC-emission requirements for glazing sealants and primers.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Firm with at least 5 years experience in the manufacture of windows of the type specified.

1.6 STORAGE, DELIVERY AND HANDLING

- .1 Label units to indicate which side is which, such as inside/outside; use labels that are removable after installation but durable enough not to be lost during delivery, storage, handling, and installation.

Part 2 Products

2.1 ASSEMBLIES

- .1 Sound-control window assembly:
 - .1 Dimensions, profiles, and features specified and indicated on Drawings are required; do not deviate unless specifically approved by Contract Administrator under substitution procedures specified in Part B - Bidding Procedures.
 - .2 Design to fit openings indicated on Drawings; design to accommodate deviation of actual construction from dimensions indicated on Drawings.
 - .3 Design interface between frame and adjacent construction so that gap between them has at least the equivalent performance as specified for window; coordinate with anchorage requirements.

2.2 SOUND-CONTROL WINDOW

- .1 Fixed sound-control window: Single, factory-assembled fixed glazing panel reglazable from inside; non-combustible framing, no horizontal mullions.
 - .1 Glazing: 16 mm laminated.
 - .2 Sound transmission Class (STC) Rating: Minimum STC 42 rating based on 64 STC curve and 1/3 octave band, complying with ASTM E90 and ASTM E413, for assembled unit.
 - .3 Factory-glazed.
 - .4 Wall-mounted frame and sash frame: Extruded aluminum; white powder coated finish.
 - .5 Wall frame: Complete with sash boot.
 - .6 Sash frame: Complete with glazing boot.
 - .7 Product:
 - .1 Soundproof Windows, Inc; Studio Max Window ST650, with vertical glass.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.3 ASSEMBLY COMPONENTS

- .1 Aluminum framing: ASTM B221M extrusions of alloy and temper selected by manufacturer for strength, corrosion resistance, non-combustible. Custom height to match curtain wall framing.
- .2 Frame anchors: Provide anchorage devices as necessary to securely fasten windows to adjacent construction.
- .3 Glazing: Laminated monolithic type; made up of 6 mm ultra-clear annealed float glass, 1.5 mm polyvinyl butyral (PVB) interlayer, 9.5 mm ultra-clear annealed float glass.
- .4 Glazing seals: Factory installed; manufacturer's standard framing and sash boots.
- .5 Mounting foam tape: 3 mm thick, type recommended by window manufacturer.
- .6 Sealant: Type recommended by window manufacturer, compatible with mounting foam tape.
 - .1 VOC content and emission restrictions for sealants: in accordance with Section 01 61 16.

2.4 FINISHES

- .1 Powder coat: Manufacturer's standard powder-coat finish. Colour: White.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that window openings are ready for installation of windows.
- .2 Notify Contract Administrator if conditions are not suitable for installation of windows; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions and drawing details.
- .2 Provide foam tape around perimeter of mounting frame.
- .3 Install windows in correct orientation.
- .4 Anchor windows securely in manner so as to achieve performance specified.
- .5 Apply bead of sealant around perimeter of framing.

3.3 CLEANING

- .1 Clean exposed surfaces promptly after installation without damaging finishes.
- .2 Remove and replace defective work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Thermoformed plastic skylights with integral frame.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry: Wood support curbs.
- .2 Section 07 52 00 - Modified Bituminous Membrane Roofing: Roofing system and base flashing at skylight curb.
- .3 Section 08 08 00 - Commissioning of Openings

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Separate prices:
 - .1 See Tender No. 543-2022B; Part B – Bidding Procedures and Form B Prices, for separate prices affecting this section.
 - .2 This section includes base bid items.

1.4 REFERENCE STANDARDS

- .1 AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights 2017.
- .2 ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- .3 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- .4 CAN/CSA A440.4 - Window, Door, and Skylight Installation 2019.
- .5 MBC - Manitoba Building Code 2011.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with other work having a direct bearing on work of this section.
 - .1 Coordinate the work with the installation of roofing system, and roofing vapour retarder.
 - .2 Coordinate this section with dimensions, tolerances, and method of attachment with other adjacent work.

1.6 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide structural, thermal, and daylighting performance values.
- .3 Shop Drawings: Indicate configurations, dimensions, locations, anchoring methods, and installation details.
 - .1 Prepared by manufacturer of skylights, and stamped and sealed by a professional structural engineer.
- .4 Design data: Include structural load calculations at points of attachment to building structure.

- .5 Grade substantiation: Prior to submitting Shop Drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - .1 Evidence of CSA Certification.
 - .2 Test reports by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- .6 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention, and anchoring requirements.
- .7 Manufacturer's qualification statement.
- .8 Designer's qualification statement.
- .9 Installer's qualification statement.

1.7 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with not less than three years documented experience.
- .2 Designer qualifications: Perform design under direct supervision of Professional Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
- .3 Installer qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.8 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for additional requirements.

1.9 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Provide 15 year manufacturer warranty, including coverage for leakage due to defective skylight materials or construction.

Part 2 Products

2.1 MANUFACTURERS

- .1 Unit skylights:
 - .1 Velux America, Inc; CMT2 Curb Mount Traditional Double Dome Skylight.

2.2 UNIT SKYLIGHTS

- .1 Unit skylights: Factory-assembled glazing in aluminum outer frame, and thermally-broken PVC inner frame, free of visual distortion, and weathertight.
 - .1 Shape: Square dome.
 - .2 Glazing: Double.
 - .3 Operation: None; fixed.
 - .4 Nominal size: 1500 by 1500 mm.

2.3 PERFORMANCE REQUIREMENTS

- .1 Provide unit skylights that comply with the following:
 - .1 Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific skylight type:
 - .1 Performance Grade (PG): Equivalent to or greater than specified design pressure.
 - .2 Air infiltration/exfiltration rating: Fixed (0.2 L/s/m² maximum).
 - .3 Design Pressure (DP): In accordance with Manitoba Building Code (MBC).
 - .4 Allow for expansion and contraction within system components caused by a cycling surface temperature range of 95 degrees C without causing detrimental effects to system or components.
 - .5 Energy code compliance: Comply with ASHRAE Std 90.1 I-P or the authorities having jurisdiction as required for unit skylights.

2.4 COMPONENTS

- .1 Double glazing: Acrylic plastic; factory sealed.
 - .1 Outer and inner glazing: Clear transparent, thickness to meet performance requirements.
- .2 Frames: Extruded aluminum, ASTM B221M; thermally broken, reinforced and welded corner joints, integral curb frame mounting flange and counterflashing to receive roofing flashing system, with integral condensation collection gutter, glazing retainer; clear anodized finish.

2.5 ACCESSORIES

- .1 Anchorage devices: Type recommended by manufacturer, exposed to view.
- .2 Counterflashings: Same metal type and finish as skylight frame.
- .3 Protective back coating: Zinc molybdate alkyd.
- .4 Sealant: Elastomeric, silicone or polyurethane, compatible with material being sealed.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that openings and substrate conditions are ready to receive work of this section.
- .3 Verify that curbs installed under other sections are complete.

3.2 PREPARATION

- .1 Apply protective back coating on aluminum surfaces of skylight units that will be in contact with cementitious materials or dissimilar metals.

3.3 INSTALLATION

- .1 Install unit skylights in accordance with manufacturer's instructions and CAN/CSA A440.4.
- .2 Install skylight units and mount securely to curb assembly; install counterflashing as required.

- .3 Apply sealant to achieve watertight assembly.

3.4 CLEANING

- .1 Remove protective material from prefinished aluminum surfaces.
- .2 Wash down exposed surfaces; wipe surfaces clean.
- .3 Remove excess sealant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Hardware for aluminum and hollow metal doors.
- .2 Hardware for fire-rated doors.
- .3 Thresholds.
- .4 Weatherstripping and gasketing.

1.2 RELATED REQUIREMENTS

- .1 Section 08 06 71 - Door Hardware Schedule: Schedule of door hardware sets.
- .2 Section 08 44 13 - Glazed Aluminum Curtain Walls: Door weatherstripping.
- .3 Section 28 10 00 - Access Control: Electronic access control devices.

1.3 REFERENCE STANDARDS

- .1 BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems 2013.
- .2 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies 2010.
- .3 CSA B651 - Accessible Design for the Built Environment 2018.
- .4 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations 2021.
- .5 DHI (H&S) - Sequence and Format for the Hardware Schedule 1996.
- .6 DHI (KSN) - Keying Systems and Nomenclature 1989.
- .7 ITS (DIR) - Intertek Testing Services, Directory of Listed Products current edition.
- .8 NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- .9 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- .2 Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- .3 Preinstallation meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - .1 Contract Administrator.
 - .2 Installer's architectural hardware consultant (AHC).
 - .3 Hardware installer.
 - .4 City's security consultant.
- .4 Submit templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

-
- .5 Keying requirements meeting:
 - .1 Attendance required:
 - .1 Contractor.
 - .2 City.
 - .3 Contract Administrator.
 - .4 Installer's architectural hardware consultant (AHC).
 - .5 Hardware installer.
 - .6 City's security consultant.
 - .2 Agenda:
 - .1 Establish keying requirements.
 - .2 Verify locksets and locking hardware are functionally correct for project requirements.
 - .3 Verify that keying and programming complies with project requirements.
 - .4 Establish keying submittal schedule and update requirements.
 - .3 Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - .1 Access control requirements.
 - .2 Key control system requirements.
 - .3 Schematic diagram of preliminary key system.
 - .4 Flow of traffic and extent of security required.
 - .4 Record minutes and distribute copies within two days after meeting to participants, with two copies to Contract Administrator, City, participants, and those affected by decisions made.
 - .5 Deliver established keying requirements to manufacturers.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be supplied for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- .3 Shop Drawings - Door hardware schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 - .1 Prepared by or under supervision of architectural hardware consultant (AHC).
 - .2 Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 - .3 List groups and suffixes in proper sequence.
 - .4 Provide complete description for each door listed.
 - .5 Provide manufacturer's and product names, and catalogue numbers; include functions, types, styles, sizes and finishes of each item.
 - .6 Include account of abbreviations and symbols used in schedule.
- .4 Shop Drawings - electrified door hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 - .1 Prepared by or under supervision of architectural hardware consultant (AHC) and electrified hardware consultant (EHC).

- .2 Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
- .3 Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related coloured wire connections to each device.
- .5 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .6 Maintenance data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - .1 Submit manufacturer's parts lists and templates.
- .7 Keying schedule:
 - .1 Submit Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- .8 Installer's qualification statement.
- .9 Supplier's qualification statement.
- .10 Warranty: Submit manufacturer's warranty and ensure that forms have been completed in City's name and registered with manufacturer.
- .11 Maintenance materials and tools: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 10 - Closeout Submittals, for additional provisions.
 - .2 Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.6 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- .2 Installer qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- .3 Supplier qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.8 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Warranty against defects in material and workmanship for period indicated, from Date of Substantial Performance.
 - .1 Closers: Five years, minimum.
 - .2 Exit devices: Three years, minimum.
 - .3 Locksets and cylinders: Three years, minimum.
 - .4 Other hardware: Two years, minimum.

Part 2 Products

2.1 DESIGN AND PERFORMANCE CRITERIA

- .1 Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- .2 Provide individual items of single type, of same model, and by same manufacturer.
- .3 Provide door hardware products that comply with the following requirements:
 - .1 Applicable provisions of federal, provincial, and local codes.
 - .2 Fire-rated doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with CAN/ULC S104.
 - .3 Hardware on fire-rated doors: Listed and classified by ULC (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
 - .4 Products requiring electrical connection: Listed and classified by ULC (DIR) as suitable for the purpose specified.
- .4 Electrically-operated or controlled hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with CSA C22.1.
 - .1 Refer to Section 28 10 00 for additional access control system requirements.
- .5 Lock function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Section 08 06 71 - Door Hardware Schedule.
- .6 Fasteners:
 - .1 Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - .1 Aluminum fasteners are not permitted.
 - .2 Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - .2 Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - .1 Self-drilling (Tek) type screws are not permitted.
 - .3 Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 - .4 Provide wall grip inserts for hollow wall construction.
 - .5 Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
 - .6 Fire-rated applications: Comply with NFPA 80.
 - .1 Provide machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - .2 Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
 - .7 Concealed fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.2 DOOR HARDWARE ITEMS

- .1 Refer to Section 08 06 71 - Door Hardware Schedule

2.3 KEY CONTROL SYSTEMS

- .1 Key control systems: Comply with guidelines of BHMA A156.28.
 - .1 Provide keying information in compliance with DHI (KSN) standards.
 - .2 Keying: Grand master keyed.
 - .3 Include construction keying and control keying with removable core cylinders.
 - .4 Supply keys in following quantities:
 - .1 1 each Grand Master keys.
 - .2 6 each Construction Master keys.
 - .3 15 each Construction keys.
 - .4 2 each Construction Control keys.
 - .5 2 each Control keys if new system.
 - .5 City or City's agent install permanent cores.

2.4 FINISHES

- .1 Finishes: Identified in Section 08 06 71 - Door Hardware Schedule.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on Shop Drawings.
- .2 Verify that electric power is available to power operated devices and of correct characteristics.

3.2 INSTALLATION

- .1 Install hardware in accordance with manufacturer's instructions and applicable codes.
- .2 Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- .3 Use templates provided by hardware item manufacturer.
- .4 Do not install surface mounted items until application of finishes to substrate are fully completed.
- .5 Door hardware mounting heights: Distance from finished floor to centreline of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on Drawings.
 - .1 Mounting heights in compliance with CSA B651:
 - .1 Locksets: 1024 mm.
 - .2 Push plates/pull bars: 1067 mm.
 - .3 Deadlocks (deadbolts): 1219 mm.
 - .4 Exit devices: 1024 mm.

- .6 Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3 SITE QUALITY CONTROL

- .1 Provide an architectural hardware consultant (AHC) to inspect installation and certify that hardware and installation has been supplied and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

- .1 Adjust hardware for smooth operation.
- .2 Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.5 CLEANING

- .1 Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- .2 Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.6 PROTECTION

- .1 Do not permit adjacent work to damage hardware or finish.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Insulating glass units.
- .2 Glazing units.
- .3 Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 07 25 00 - Weather Barriers.
- .3 Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- .4 Section 08 44 35 - Protective Framed Glazing Assemblies: Glazing fire-tested as part of the wall assembly.
- .5 Section 08 83 00 - Mirrors.

1.3 REFERENCE STANDARDS

- .1 ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- .2 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .3 ASTM C1036 - Standard Specification for Flat Glass 2021.
- .4 ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- .5 ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.
- .6 ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- .7 ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.
- .8 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- .9 ASTM E413 - Classification for Rating Sound Insulation 2022.
- .10 ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- .11 ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.
- .12 CAN/CGSB 12.1 - Safety Glazing 2017.
- .13 CAN/CGSB 12.3 - Flat, Clear Float Glass 1991 (R2017).
- .14 CAN/CGSB 12.20 - Structural Design of Glass in Buildings 1989.
- .15 CAN/CGSB 19.13 - Sealing Compound, One Component, Elastomeric, Chemical Curing 1987.
- .16 GANA (GM) - GANA Glazing Manual 2008.
- .17 GANA (LGRM) - Laminated Glazing Reference Manual 2009.

- .18 GANA (SM) - GANA Sealant Manual 2008.
- .19 IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).
- .20 ITS (DIR) - Intertek Testing Services, Directory of Listed Products current edition.
- .21 LBNL WINDOW - Lawrence Berkeley National Laboratory WINDOW 8.
- .22 MBC - Manitoba Building Code 2011.
- .23 NBC - National Building Code of Canada 2015.
- .24 NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.
- .25 NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).
- .26 NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.
- .27 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data on insulating glass unit and glazing unit glazing types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- .3 Product data on glazing compounds and accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colours.
- .4 Samples: Submit two samples 300 by 300 mm in size of each type of glazing.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to VOC-content and VOC-emission requirements for glazing sealants and primers.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Certificate: Certify that products of this section meet or exceed specified requirements.
- .7 Installer's qualification statement.
- .8 Warranty documentation: Submit manufacturer warranty and ensure that forms have been completed in City's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- .1 Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- .2 Installer qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- .3 Quality limitations for heat strengthened and tempered glass: Perform tempering or heat strengthening in accordance with CAN/CGSB 12.1 and as follows:
 - .1 Fabricate glass using horizontal roller heating process only, with roller wave distortion parallel to bottom edge of glass as when installed.

- .2 Apply heat treatment prior to the application of low-e coatings to minimize appearance of roller wave distortion.

1.6 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals for additional warranty requirements.
- .2 Insulating glass units: Provide a 10 year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- .3 Laminated glass: Provide a five year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- .1 Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - .1 Comply with ASTM E1300 or CAN/CGSB 12.20 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - .2 Ultimate limit states: Positive and negative pressure acting normal to plane of glass using wind load requirements of Section 4.1.7 of the MBC for High Importance Category using Importance Factor (I_w) accounting for normal windload and gust velocities.
 - .3 Reference velocity pressure: Velocity pressure (q) located in National Building Code (NBC) Structural Commentaries, Wind Load and Effects, (Part 4 of Division B), based on probability of being exceeded in any one year of 1 in 50.
 - .4 Occupant safety (glass acting as guards): Design glass minimum lateral design loads of 0.5 kPa for all glass installed in walls, partitions or barriers having a 600 mm or higher elevation from adjacent slabs or grade; glass acting as guards criteria govern where minimum normal windload pressure (non gust) is lower than required loads for occupant safety in accordance with Section 4.1.5 of the MBC.
 - .5 Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load and as required to maintain full contact with glazing throat.
 - .6 Glass thicknesses listed are minimum.
 - .7 Multipliers: Modify glass thicknesses based on substituting heat treated or laminated glass configurations as required to obtain the most economical glass assembly.
 - .8 Confirm glass thicknesses by analyzing project loads and in-service conditions and provide glass in strengths (annealed or heat treated) and actual thickness required to meet deflection criteria.
- .2 Vapour retarder and air barrier seals: Provide completed assemblies that maintain continuity of building enclosure vapour retarder and air barrier.
 - .1 In conjunction with vapour retarder and joint sealer materials described in other sections.
 - .1 See Section 07 25 00.

- .2 To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapour retarder and air barrier seal.
- .3 To maintain a continuous vapour retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- .3 Thermal and optical performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - .1 Centre of glass U-value: Comply with NFRC 100 using LBNL WINDOW computer program.
 - .2 Center of glass solar heat gain coefficient (SHGC): Comply with NFRC 200 using LBNL WINDOW computer program.
 - .3 Solar optical properties: Comply with NFRC 300 test method.

2.2 GLASS MATERIALS

- .1 Float glass: Provide float glass based glazing unless noted otherwise.
 - .1 Annealed type: CAN/CGSB 12.3, Clear Transparent, or Type 1 - Transparent Flat Glass, Class 1 - Clear, Quality Q3 - Architectural Glass in accordance with ASTM C1036.
 - .1 Quality: Glazing with specific defect limitations as defined by Table 3 of CAN/CGSB 12.3 based on area of glass units.
 - .2 Annealed type: CAN/CGSB 12.3, Ultra-Clear (Low-Iron), or Type 1 - Transparent Flat Glass, Class 1 - Clear, Quality Q3 - Architectural Glass in accordance with ASTM C1036.
 - .1 Quality: Glazing with specific defect limitations as defined by Table 3 of CAN/CGSB 12.3 based on area of glass units.
 - .3 Clear safety glass: Heat treated glass manufactured in compliance with CAN/CGSB 12.1 and as follows:
 - .1 Classification: Type 1 - Transparent Flat Glass, Class 1 - Clear, Quality Q3 - Architectural Glass in accordance with ASTM C1036.
 - .2 Kind: FT - Fully Tempered in compliance with ASTM C1048.
 - .3 Labelling: Required.
- .2 Laminated glass: Heat treated laminated glass manufactured in accordance with CAN/CGSB 12.1, and as follows:
 - .1 Glass Classification: Type 1 - Transparent Flat Glass, Class 1 - Clear, Quality Q3 - Architectural Glass in compliance with ASTM C1048.
 - .2 Laminating type: Type I - Laminated Glass.
 - .3 Labelling: Required.
 - .4 Edges: Ground with no chips, cracks or flaws, with sharp corners, and edges eased and polished.
 - .5 Standard tolerances listed in ASTM C1172 apply to glass having non exposed edges.
 - .6 Laminating film material: See Glass Type GL3 - Sound control glazing.

2.3 INSULATING GLASS UNITS

- .1 Insulating glass units: Types as indicated.
 - .1 Durability: Certified by an independent testing agency to comply with ASTM E2190.

-
- .2 Coated glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapour deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 - .3 Warm-edge spacers: Flexible silicone with polyisobutylene (PIB) primary seal, inner acrylic adhesive seal, and outer silicone seal.
 - .1 Spacer width: As required for specified insulating glass unit.
 - .2 Spacer height: 6.85 mm.
 - .3 Manufacturers:
 - .1 Quanex IG Systems, Inc; Super Spacer TriSeal.
 - .4 Spacer colour: Black.
 - .4 Edge seal:
 - .1 Dual-sealed system: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, an inner acrylic adhesive seal, and silicone sealant as an outer seal applied around perimeter.
 - .2 Colour: Black.
 - .5 Purge interpane space with dry air, hermetically sealed.
- .2 Type GL1 - Insulating glass units: Vision glass, triple glazed.
 - .1 Applications: Exterior glazing as indicated on Drawings.
 - .2 Space between lites filled with argon.
 - .3 Outboard lite: Fully tempered float glass with acid-etched pattern, 6 mm thick, minimum.
 - .1 Tint: Ultra-clear on west elevation; clear elsewhere.
 - .2 Acid-etched pattern: 6 mm dia. dot on 100 by 100 mm grid pattern, on #1 surface.
 - .3 Coating: Vitro Solarban 60 VT Low-E (passive type), on #2 surface.
 - .4 Product: Walker Glass AviProtek E.
 - .4 Middle lite: Heat-strengthened float glass, 6 mm thick, minimum.
 - .1 Tint: Ultra-clear on west elevation; clear elsewhere.
 - .5 Inboard lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Ultra-clear on west elevation; clear elsewhere.
 - .6 Total thickness: 45 mm.
 - .7 Glazing method: To meet performance criteria.
 - .3 Type GL3 - Sound control glazing: Laminated double insulating glass.
 - .1 Applications: Interior glazing where indicated.
 - .2 Tint: Clear.
 - .3 Sound transmission class (STC) rating: Provide at least STC 44 rating, complying with ASTM E90 and ASTM E413, based on 915 by 2130 mm glass size.
 - .4 Overall thickness: 40 mm, nominal.
 - .5 Laminated double insulating glass:
 - .1 Outer layer, outboard side: Tempered glass.
 - .1 Thickness: 6 mm.
 - .2 Interlayer: Polyvinyl butyral (PVB), 1.5 mm thick, clear.
 - .3 Outer layer, inboard side: Tempered glass.
 - .1 Thickness: 6 mm.

- .4 Air space: 19 mm, filled with air.
 - .5 Inner layer: Tempered glass.
 - .1 Thickness: 6 mm.
 - .6 Glazing method: Wet/dry; captured perimeter, SSG vertical joints.
- .4 Type GL5 - Insulating glass units: Safety glazing.
- .1 Applications:
 - .1 Glazed lites in exterior doors.
 - .2 Other locations required by applicable federal, provincial, and municipal codes and regulations.
 - .2 Space between lites filled with argon.
 - .3 Outboard lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Ultra-clear on west elevation; clear elsewhere.
 - .2 Coating: Solarban 60 Low-E (passive type), on #2 surface.
 - .4 Inboard lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Ultra-clear on west elevation; clear elsewhere.
 - .5 Total thickness: 25 mm.
 - .6 Glazing Method: Dry glazing method, gasket glazing.

2.4 GLAZING UNITS

- .1 Type GL2 - Monolithic interior vision glazing:
 - .1 Applications: Interior glazing unless otherwise indicated.
 - .2 Glass Type: Fully tempered float glass.
 - .3 Tint: Ultra-Clear.
 - .4 Thickness: 6 mm, nominal.
- .2 Type GL4 - Fire-protection-rated glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve fire-doors indicated fire-rating period of 90 minutes or less.
 - .1 Applications:
 - .1 Glazing in fire-rated door assembly.
 - .2 Other locations as indicated on Drawings.
 - .2 Glass type: Safety ceramic glass.
 - .3 Provide products listed by ITS (DIR) or ULC (DIR) and approved by authorities having jurisdiction.
 - .4 Safety glazing certification: CAN/CGSB 12.1 Class B.
 - .5 Glazing method: As required for fire rating.
 - .6 Fire-rating period: As indicated on Drawings.
 - .7 Listing and labelling requirements: Provide fire rated glass and glazing products that have been tested and listed by a testing agency acceptable to the Authorities Having Jurisdiction for performance levels specified, permanently labelled with certification mark indicating the following:
 - .1 Manufacturer's name.
 - .2 Test standard.
 - .3 Approved usage.
 - .4 Hose stream - Passed (if applicable).
 - .5 Impact classification (if applicable).

- .6 Fire time rating.
- .8 Products:
 - .1 Technical Glass Products; Firelite Plus.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.5 GLAZING COMPOUNDS

- .1 Silicone sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining, conforming to CAN/CGSB 19.13; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; colour as selected.
 - .1 VOC content and emission restrictions for interior sealants: in accordance with Section 01 61 16.

2.6 ACCESSORIES

- .1 Setting blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 25 mm for each square metre of glazing or minimum 100 mm by width of glazing rabbet space minus 1.5 mm by height to suit glazing method and pane weight and area.
- .2 Spacer shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 75 mm long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- .3 Glazing tape, back bedding mastic type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black colour.
 - .1 Width: As required for application.
 - .2 Thickness: As required for application.
 - .3 Spacer rod diameter: As required for application.
- .4 Glazing gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; colour black.
- .5 Warning decals: Vinyl film, 50 mm dia. Decal colour selected by Contract Administrator.

2.7 FABRICATION

- .1 Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- .2 Provide stepped (offset) insulating glazing units where indicated. Provide factory-applied UV-resistant buttered fill at corners.

Part 3 Execution

3.1 VERIFICATION OF CONDITIONS

- .1 Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- .2 Verify that the minimum required face and edge clearances are being provided.

- .3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- .4 Verify that sealing between joints of glass framing members has been completed effectively.
- .5 Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

- .1 Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- .2 Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- .3 Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- .4 Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- .5 Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- .6 Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- .1 Application - Exterior or interior glazed: Set glazing infills from either the exterior or the interior of the building.
- .2 Place setting blocks at 1/4 points with edge block no more than 150 mm from corners.
- .3 Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- .4 Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

- .1 Application - Interior glazed: Set glazing infills from the interior of the building.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points with edge block no more than 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described above.

- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Carefully trim protruding tape with knife.

3.6 INSTALLATION - WET/DRY PRESSURE GLAZED SYSTEMS - CURTAIN WALL CW1

- .1 Application - Exterior Glazed: Set glazing infills from exterior side of building.
- .2 Apply heel bead of silicone sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapour seal.
- .3 Place setting blocks at 1/4 points with edge block no more than 150 mm from corners.
- .4 Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- .5 Install pressure plates without displacing glazing gasket; exert pressure for full continuous contact.
- .6 Apply cap bead of silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.
- .7 Install cover plate.

3.7 INSTALLATION - STRUCTURAL SILICONE GLAZING - CURTAIN WALL CW2

- .1 See Section 08 44 13 for wall framing assembly requirements.
- .2 Application - Site Glazed: Follow basic guidelines of structural silicone glazing for glazing application.
 - .1 Four-sided structural: Glass with four sides structurally adhered to horizontal and vertical metal back-up mullion.
- .3 Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.
- .4 Provide only structural silicone sealant, tested and manufactured for structural glazing.

3.8 INSTALLATION - WARNING DECALS

- .1 Install warning decals, applied in accordance with film manufacturer's instructions.
- .2 Apply decals spaced at 150 mm o.c., in two rows at 1200 and 1500 mm AFF to centre of decals.
- .3 Place without air bubbles, creases or visible distortion.

3.9 CLEANING

- .1 Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- .2 Remove non-permanent labels immediately after glazing installation is complete.
- .3 Clean glass and adjacent surfaces after sealants are fully cured.
- .4 Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Performance in accordance with glass manufacturer's written recommendations.

3.10 PROTECTION

- .1 After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

- .2 Remove and replace glass that is damaged during construction period prior to Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Glass mirrors.
 - .1 Annealed float glass.

1.2 REFERENCE STANDARDS

- .1 ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- .2 ASTM C1036 - Standard Specification for Flat Glass 2021.
- .3 ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data on mirror types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- .3 Sustainable design submittals: Submit evidence of compliance including, but not limited to, product life cycle assessment.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Warranty: Submit manufacturer warranty and ensure that forms have been completed in City's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

- .1 Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's instructions.

1.5 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

Part 2 Products

2.1 MATERIALS

- .1 Mirror design criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- .2 Mirror glass: ASTM C1036, Type 1 - Transparent Flat, Class 1 - Clear, Quality - Q2 (general use mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503; complete with safety film backing.
 - .1 Thickness: 6 mm.
 - .2 Size: As indicated on Drawings.

2.2 ACCESSORIES

- .1 Setting blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 25 mm for each square metre of glazing or minimum 100 mm by width of glazing rabbet space minus 1.5 mm by height to suit glazing method and pane weight and area.
- .2 Mirror attachment accessories: Satin anodized aluminum J-channels, maximum 12 mm face width, by depth suitable for 6 mm thick mirror glass; back leg punched and slotted for fasteners.

Part 3 Execution

3.1 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.

3.2 INSTALLATION

- .1 Install mirrors in accordance with manufacturers recommendations.
- .2 Set mirrors plumb and level, and free of optical distortion.
- .3 Set mirrors with edge clearance free of surrounding construction
- .4 Fasten bottom channel securely to substrate. Place setting blocks at 1/4 points with edge block no more than 150 mm from corners. Set mirrors resting on setting blocks installed in stainless steel J-channels.

3.3 CLEANING

- .1 Remove labels after work is complete.
- .2 Clean mirrors and adjacent surfaces.

END OF SECTION

GENERAL NOTES:

- 1 REFER TO INTERIOR ELEVATIONS FOR EXTENT OF FINISHES
- 2 REFER TO FLOOR PLANS FOR ROOMS WITH PLYWOOD BACKERBOARD
- 3 REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATION FOR ADDITIONAL INFORMATION.
- 5 ALL EXPOSED DRYWALL SURFACES NOT NOTED ARE TO BE PAINTED
- 6 ALL EXPOSED CONCRETE MASONRY UNITS TO RECEIVE SEALER. REFER TO SECTION 04 22 00
- 7 ALL GYPSUM WALLBOARD BULKHEADS TO BE PAINTED
- 8 ALL EXPOSED COLUMNS TO RECEIVE PAINT FINISH
- 9 TILE BASEBOARD FINISH TO BE 100MM HIGH.
- 10 ALL GLUE LAMINATED BEAMS AND WOOD DECKING TO REMAIN EXPOSED WITH PROTECTIVE COATING

KEYNOTE

- 1 ALL EXPOSED STRUCTURAL STEEL INCLUDING OWSJ TO BE RECEIVE PAINT FINISH. STEEL ROOF DECK TO REMAIN EXPOSED WITH NO PAINT FINISH
- 2 NO BASE AT CONCRETE MASONRY UNIT WALL OR CONCRETE WALL
- 3 PAINT FINISH AT GYPSUM WALL BOARD ONLY
- 4 EXTEND COVE BASE 100MM

LEGEND

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
ACT	ACOUSTIC CEILING TILE	CMU-B	CONCRETE MASONRY UNIT - BURNISHED	PT	PAINT
CB	INTEGRAL COVED BASE	EXP	EXPOSED STRUCTURE	RB	RUBBER BASE
CONC	CONCRETE	FAP-1	FLUID APPLIED FLOORING	RF	RUBBER FLOORING
CONC-D	CONCRETE WITH DENSIFIER	FAP-2	FLUID APPLIED FLOORING	T	PORCELAIN FLOOR TILE
CONC-S	CONCRETE - SEALED	GWB	GYPSUM WALL BOARD	WD	WOOD
CMU	CONCRETE MASONRY UNIT	HBC	HI BUILD COATING		

ROOM.	ROOM NAME	FLOOR	BASE	WALL FINISH				CEILING		REMARKS
				NORTH	SOUTH	EAST	WEST	MAT	FIN	
MAIN FLOOR										
100	VESTIBULE	CONC-D	RB	PT	PT	N/A	N/A	GWB	PT	
101	LOBBY	CONC-D	RB	PT	PT	N/A	PT	ACT	N/A	
102	TRAINING CLASSROOM	CONC-D	RB	PT	PT	CMU-B	N/A	ACT	N/A	
102A	STORAGE	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
102B	STORAGE	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
103	UTR	T	T	PT	PT	PT	PT	GWB	PT	
104	W/C	T	T	PT	PT	PT	PT	GWB	PT	
105	IT	CONC-D	RB	PT	PT	PT	PT	EXP	N/A	
106	LOBBY	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
107	VESTIBULE	CONC-D	RB	PT	PT	PT	N/A	ACT	N/A	
107.1	STORAGE	CONC-D	RB	PT	PT	PT	PT	EXP	N/A	
108	FLOOR WATCH	CONC-D	RB	PT	PT	PT	PT/CMU-B	ACT	N/A	3
109	CORRIDOR	CONC-D	RB	PT	PT/CMU-B	N/A	N/A	ACT	N/A	3
110	JANITOR ROOM	FAP-1	CB	CMU	CONC	CONC	CONC	EXP	N/A	
111	CAPTAIN/LIEUTENANT OFFICE	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
111A	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
112	STORAGE	CONC-D	N/A	CMU	CMU	CMU	CONC	EXP	N/A	

ROOM.	ROOM NAME	FLOOR	BASE	WALL FINISH				CEILING		REMARKS
				NORTH	SOUTH	EAST	WEST	MAT	FIN	
113	SHOWER	FAP-1	CB	HBC	HBC	HBC	HBC	GWB	PT	
114	INVESTIGATORS OFFICE	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
114A	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	
115	HAZMAT EQUIPMENT STORAGE	CONC-D	RB	PT	PT	PT	PT	ACT	N/A	2
116	VESTIBULE	CONC-D	RB	PT	CMU-B	N/A	N/A	EXP	N/A	
117	APPARATUS BAYS	FAP-2	CB	CMU-B	N/A	CMU-B	CMU-B	EXP	PT	1,4
118	AMB RESTOCK	CONC-D	RB	PT	CMU	PT	PT	EXP	N/A	2
119	JANITOR ROOM	FAP-1	CB	PT	CMU	PT	PT	EXP	N/A	2,4
120	W/C	FAP-1	CB	PT	CMU	PT	PT	GWB	PT	2,4
121	EVIDENCE	CONC-D	RB	PT	CMU	PT	PT	EXP	N/A	2
122	TOOL REPAIR	CONC-D	RB	PT	CMU	PT	PT	EXP	N/A	2
123	HOSE WASH	FAP-2	N/A	CMU-B	CMU-B	CMU-B	CMU-B	EXP	N/A	1,4
124	SCBA	CONC-D	RB	CMU	PT	PT	CMU	EXP	N/A	1,2
125	PPE STORAGE	CONC-D	RB	PT	PT	CMU/PT	PT	EXP	N/A	1
126	MECHANICAL	CONC-S	RB	PT	PT	PT	PT	EXP	N/A	
STR1	STAIR 1	CONC-D	RB	PT/CMU-B	CMU-B	CMU-B	CMU-B	EXP	N/A	2,3
STR2	STAIR 2	CONC-D	RB	PT/CMU-B	CMU-B	N/A	CMU-B	EXP	N/A	2,3

SECOND FLOOR

200	FITNESS AREA	RF	RB	PT	PT	CMU-B / PT	PT	ACT/WD	N/A	2,3
201	OUTDOOR AREA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
202	KITCHEN	CONC-D	RB	PT	PT	CMU-B	PT	ACT/WD	N/A	2
203	DAY ROOM	CONC-D	RB	PT	PT	CMU-B	PT	ACT/WD	N/A	2
204	CORRIDOR	CONC-D	RB	PT	CMU-B/PT	PT	N/A	ACT	N/A	2,3
205	SUPPORT SERVICES	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
206	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
207	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
208	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
209	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
210	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
211	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
212	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
213	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
214	SLEEPING QUARTERS	CONC-D	RB	PT	PT	PT	PT	GWB	PT	
215	OFFICE	CONC-D	RB	PT	CMU-B	PT	PT	ACT	N/A	
216A	JANITOR	FAP-1	CB	PT	CMU-B	PT	PT	GWB	PT	4
216B	LAUNDRY ROOM	FAP-1	CB	PT	CMU-B	PT	PT	GWB	PT	4
217	SHOWER	FAP-1	CB	HBC	CMU-B/HBC	HBC	HBC	GWB	PT	4
218	SHOWER	FAP-1	CB	HBC	CMU-B/HBC	HBC	HBC	GWB	PT	4
219	SHOWER	FAP-1	CB	HBC	CMU-B/HBC	CMU-B/HBC	HBC	GWB	PT	4
220	HOSE WASH	CONC-D	N/A	CMU-B	CMU-B	CMU-B	CMU-B	EXP	PT	1
221	MECHANICAL / ELECTRICAL	CONC-S	RB	CMU-B	PT	PT	CMU	EXP	PT	
STR1	STAIR 1	CONC-D	RB	CMU-B	CMU-B	CMU-B	CMU-B	GWB	PT	2
STR2	STAIR 2	CONC-D	RB	CMU-B	CMU-B	CMU-B	CMU-B	GWP	PT	

Part 1 General

1.1 SECTION INCLUDES

- .1 Performance criteria for gypsum board assemblies.
- .2 Acoustic insulation.
- .3 Gypsum sheathing.
- .4 Cementitious backing board.
- .5 Gypsum board.
- .6 Shaft wall assemblies.
- .7 Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 05 41 00 - Structural Metal Stud Framing: Exterior wind-load-bearing metal stud framing.
- .3 Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- .4 Section 09 22 16 - Non-Structural Metal Framing.

1.3 REFERENCE STANDARDS

- .1 ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2010 (Reaffirmed 2016).
- .2 ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- .3 ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- .4 ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- .5 ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- .6 ASTM C834 - Standard Specification for Latex Sealants 2017.
- .7 ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- .8 ASTM C954 - 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 2022.
- .9 ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- .10 ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- .11 ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

- .12 ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.
- .13 ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2022.
- .14 ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- .15 ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- .16 ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- .17 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- .18 ASTM E413 - Classification for Rating Sound Insulation 2022.
- .19 California Department of Public Health (CDPH) - Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.2 Version 1.2 2017.
- .20 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.
- .21 CAN/ULC S114 - Test for Determination of Non Combustibility in Building Materials 2018.
- .22 GA-216 - Application and Finishing of Gypsum Panel Products 2016.
- .23 SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate size of pockets and blocking requirements, for window treatments specified in Section 12 24 00.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Indicate special details associated with fireproofing, acoustic seals, and shaftwall assemblies.
 - .1 Shaftwall assemblies:
 - .1 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
 - .2 Indicate locations, dimensions, openings and requirements of related work.
 - .3 Design data: Shop Drawings signed and sealed by a professional structural engineer.
 - .3 Product data: Provide data on gypsum board, accessories, and joint finishing system.
 - .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.

- .5 Designer's qualification statement.
- .6 Installer qualification statement.

1.6 QUALITY ASSURANCE

- .1 Designer qualifications: Design framing system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the Province in which the Project is located.
- .2 Installer qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

Part 2 Products

2.1 GYPSUM BOARD ASSEMBLIES

- .1 Sustainability requirements:
 - .1 General: Provide products containing recycled content.
 - .2 VOC content: In accordance with restrictions specified in Section 01 61 16, and tested in accordance with SCAQMD 1168.
 - .3 VOC emissions: Tested in accordance with California Department of Public Health (CDPH).
- .2 Provide completed assemblies complying with ASTM C840 and GA-216.
 - .1 See PART 3 for finishing requirements.
- .3 Interior partitions, indicated as acoustic, or with an indicated STC rating: Provide completed assemblies with the following characteristics:
 - .1 Acoustic attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- .4 Shaft walls at HVAC shafts: Provide completed assemblies with the following characteristics:
 - .1 Air pressure within shaft: Sustained loads of 0.24 kPa with maximum mid-span deflection of L/240.
 - .2 Acoustic attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- .5 Fire-rated assemblies: Provide completed assemblies complying with applicable code, and as indicated on Drawings.

2.2 SHAFTWALL FRAMING MATERIALS

- .1 General: Provide products with recycled content.
- .2 Shaftwall studs and accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements for both vertical and horizontal assemblies.
 - .1 Fire-resistance rating: as indicated.
 - .2 Framing: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated. Profile: CT- shape, CH- shape, and E-shape as indicated.
 - .1 Depth: Indicated.

- .3 Firestop tracks: Provide firestop track at head of shaft wall on each floor level as required, or as recommended by shaftwall assembly manufacturer.
 - .1 Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated.
- .4 Track fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

2.3 BOARD MATERIALS

- .1 Gypsum board: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - .1 Application: Use for vertical surfaces, unless otherwise indicated.
 - .2 Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board, except in areas to receive high build epoxy wall coatings.
 - .3 Mould- and moisture-resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .1 Mould- and moisture-resistant board is required where indicated on the Drawings as "moisture-resistant".
 - .4 Thickness:
 - .1 Vertical surfaces: 16 mm.
 - .5 Mould- and moisture-resistant paper-faced products:
 - .1 CGC; Sheetrock Mold Tough.
 - .2 CertainTeed; M2Tech.
 - .3 Georgia Pacific; ToughRock Mold-Guard.
- .2 Backing board for wet areas, and exterior walls:
 - .1 Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and surfaces behind glazed thin brick.
 - .2 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .3 ANSI cement-based board: Non-gypsum-based; aggregated Portland cement panels with glass fibre mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - .1 Thickness: 12.7 mm.
- .3 Ceiling board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - .1 Application: Ceilings, unless otherwise indicated.
 - .2 Thickness: 13 mm.
 - .3 Edges: Tapered.
- .4 Exterior sheathing board: Sizes to minimize joints in place; ends square cut.
 - .1 Application: Exterior sheathing, unless otherwise indicated.
 - .2 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .3 Glass mat faced sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 - .4 Regular board thickness: 13 mm.
 - .5 Edges: Square.

- .6 Products:
 - .1 CertainTeed; Glasroc Sheathing.
- .5 Shaftwall and coreboard: Type X; 25 mm thick by 610 mm wide, beveled long edges, ends square cut.
 - .1 Glass mat faced type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
 - .2 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.

2.4 ACCESSORIES

- .1 Acoustic insulation for non-rated assemblies: Meeting the requirements of CAN/ULC S702.1, ASTM E90; glass fibre acoustic sound batts, Type 1 for all properties other than thermal, width to friction fit steel studs; unfaced. Thickness to fill a minimum of 90 percent of the cavity width, nominal density 12.2 kg/m³ minimum; STC ratings as indicated on Drawings. Provide products containing recycled content.
 - .1 VOC-content and VOC-emission requirements: See Section 01 61 16.
- .2 Acoustic insulation for fire- and smoke-rated assemblies: Meeting the requirements of CAN/ULC S702.1, mineral fibre acoustic sound batts, Type 1 for all properties except thermal performance, width to friction fit steel studs; unfaced. Thickness to fill a minimum of 90 percent of the cavity width, nominal density 40 kg/m³ minimum; STC ratings as indicated on Drawings; having maximum flame spread and smoke developed of 0/0 in accordance with CAN/ULC S102 and being non-combustible in accordance with CAN/ULC S114. Provide products containing recycled content.
 - .1 VOC-content and VOC-emission requirements: See Section 01 61 16.
- .3 Acoustic sealants for fire-rated assemblies: Use only fire rated materials as final seal in fire rated assemblies; apply acoustic sealants prior application of fire seals; provide materials specified in Section 07 84 00.
- .4 Acoustic sealant for exposed joints: Lightweight low trigger resistance, non-sag, paintable, non-staining, latex sealant in accordance with ASTM C834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction:
 - .1 VOC-content and VOC-emission requirements: See Section 01 61 16.
 - .2 Products:
 - .1 Tremco Commercial Sealants & Waterproofing; Tremflex 834.
 - .2 Pecora; AC-20+Silicone.
 - .3 Master Builders Solutions; MasterSeal NP 520.
 - .4 Substitutions: See Part B - Bidding Procedures.
- .5 Acoustic sealant for concealed joints: Lightweight low trigger resistance, non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission:
 - .1 VOC-content and VOC-emission requirements: See Section 01 61 16.
- .6 Finishing accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - .1 Types: As detailed or required for finished appearance.
 - .2 Special shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

- .7 Joint materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - .1 Tape: 50 mm wide, coated glass fibre tape for joints and corners, except as otherwise indicated.
 - .2 Tape: 50 mm wide, creased paper tape for joints and corners, except as otherwise indicated.
 - .3 Ready-mixed vinyl-based joint compound.
 - .4 Chemical hardening type compound.
- .8 Screws for fastening of gypsum panel products to cold-formed steel studs less than 0.84 mm in thickness and wood members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- .9 Screws for fastening of gypsum panel products to steel members from 0.84 to 2.84 mm in thickness: ASTM C954; steel drill screws, corrosion resistant.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION

- .1 Shaft wall framing: Install in accordance with manufacturer's installation instructions.
 - .1 Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 600 mm on centre.
 - .2 Install studs at spacing required to meet performance requirements.
- .2 Shaft wall liner: Cut panels to accurate dimension and install sequentially between special friction studs.
 - .1 Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

- .1 Acoustic insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- .2 Acoustic sealant: Install in accordance with manufacturer's instructions.
 - .1 Place continuous bead at perimeter of each layer of gypsum board.
 - .2 Seal around penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.4 BOARD INSTALLATION

- .1 Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- .2 Single-layer non-rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- .3 Fire-rated construction: Install gypsum board in strict compliance with requirements of assembly listing.
- .4 Exposed gypsum board in interior wet areas: Seal joints, cut edges, and holes with water-resistant sealant.

- .5 Exterior sheathing: Comply with ASTM C1280. Install sheathing parallel or perpendicular to framing, with edges butted tight and ends occurring over firm bearing and staggered, using self-tapping screws.
 - .1 Seal joints, cut edges, and holes with water-resistant sealant.
- .6 Exterior soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
- .7 Cementitious backing board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- .8 Installation on metal framing: Use screws for attachment of gypsum board.
- .9 Installation on wood framing: For non-rated assemblies, install as follows:
 - .1 Single-layer Applications: Screw attachment.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

- .1 Control joints: Place control joints consistent with lines of building spaces and as indicated.
- .2 Corner beads: Install at external corners, using longest practical lengths.
- .3 Edge trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- .1 Glass mat faced gypsum board: Use fibreglass joint tape, bedded and finished with chemical hardening type joint compound.
- .2 Paper-faced gypsum board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- .3 Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - .1 Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - .2 Level 3: Walls to receive high build epoxy wall finish.
 - .3 Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - .4 Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- .4 Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - .1 Feather coats of joint compound so that camber is maximum 0.8 mm.
- .5 Fill and finish joints and corners of cementitious backing board as recommended by manufacturer applicable to final finish.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Metal partition, ceiling, and soffit framing.
- .2 Framing accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 05 41 00 - Structural Metal Stud Framing: Exterior wall stud framing.
- .2 Section 05 50 00 - Metal Fabrications: Metal fabrications attached to stud framing.
- .3 Section 06 10 00 - Rough Carpentry: Wood blocking within stud framing.
- .4 Section 07 84 00 - Firestopping: Sealing top-of-wall assemblies at fire rated walls.
- .5 Section 08 31 00 - Access Doors and Panels.
- .6 Section 09 21 16 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.3 REFERENCE STANDARDS

- .1 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- .2 ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- .3 ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- .4 CSSBI S18 - Guide Specification for Non-loadbearing Steel Framing Current Edition.
- .5 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data:
 - .1 Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
 - .2 Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

Part 2 Products

2.1 FRAMING MATERIALS

- .1 General: Provide products containing recycled content.
- .2 Fire-rated assemblies: Comply with applicable code and as indicated on Drawings.
- .3 Non-loadbearing framing system components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and CSSBI S18 for the spacing indicated, with maximum deflection of wall framing of L/360 at 240 Pa for standard assemblies up to 3.6 m high, L/360 at 360 Pa for tall assemblies greater than 3.6 m high to a maximum of 4.1 m high, and L/360 at 480 Pa for assemblies greater than 4.1 m high.
 - .1 Studs: C shaped with flat or formed webs with knurled faces.
 - .2 Runners: U shaped, sized to match studs.
 - .3 Ceiling channels: C shaped.
 - .4 Furring: Hat-shaped sections, minimum depth of 22 mm.
- .4 Ceiling hangers: Type and size as specified in ASTM C754 for spacing required.
- .5 Partition head to structure connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - .1 Structural performance: Maintain lateral load resistance and vertical movement capacity required by applicable code.
 - .2 Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot dipped galvanized coating.
 - .3 Provide components ULC (DIR) listed for use in ULC-listed fire-rated head of partition joint systems of fire rating and movement required.
- .6 Deflection and firestop track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- .7 Anchorage devices: Powder actuated.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

- .1 Comply with requirements of ASTM C754.
- .2 Extend partition framing to structure where indicated and to ceiling in other locations.
- .3 Partitions terminating at ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- .4 Partitions terminating at structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

- .5 Align and secure top and bottom runners at 600 mm on centre.
- .6 Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- .7 Install studs vertically at spacing indicated on Drawings.
- .8 Align stud web openings horizontally.
- .9 Secure studs to tracks using fastener method. Do not weld.
- .10 Stud splicing is not permissible.
- .11 Fabricate corners using a minimum of three studs.
- .12 Double stud at wall openings, door and window jambs, not more than 50 mm from each side of openings.
- .13 Coordinate erection of studs with requirements of door frames and other openings; install supports and attachments.
- .14 Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- .15 Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, opening frames, and wall-mounted projection screens, and TVs.
- .16 Standard wall furring: Install at masonry walls scheduled to receive gypsum board, not more than 100 mm from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 600 mm on centre.

3.3 CEILING AND SOFFIT FRAMING

- .1 Comply with requirements of ASTM C754.
- .2 Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- .3 Install furring independent of walls, columns, and above-ceiling work.
- .4 Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- .5 Space main carrying channels at maximum 1 800 mm on center, and not more than 150 mm from wall surfaces. Lap splice securely.
- .6 Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- .7 Place furring channels perpendicular to carrying channels, not more than 50 mm from perimeter walls, and rigidly secure. Lap splices securely.
- .8 Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 600 mm past each opening.
- .9 Laterally brace suspension system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Tile for floor applications.
- .2 Non-ceramic trim.

1.2 DEFINITIONS

- .1 Large Format Tile: Tile larger than 380 mm in one or more directions.

1.3 REFERENCE STANDARDS

- .1 ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2014.
- .2 ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2010).
- .3 ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- .4 ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).
- .5 ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- .6 ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- .7 ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.
- .8 ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- .9 ISO 13007-1 - Ceramic tiles -- Grouts and adhesives -- Part 1: Terms, definitions and specifications for adhesives 2014.
- .10 TTMAC (IM) - Tile Installer Technical Handbook 2018/2019.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts.
- .3 Shop Drawings: Indicate tile layout, patterns, colour arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.
- .4 Samples: Mount tile and apply grout on two plywood panels, minimum 600 by 600 mm in size illustrating pattern, colour variations, and grout joint size variations.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Installer's qualification statement.
- .7 Maintenance data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- .8 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 10 - Closeout Submittals, for additional provisions.
 - .2 Extra tile: 1 percent of each size, colour, and surface finish combination.

1.5 QUALITY ASSURANCE

- .1 Maintain one copy of ANSI A108/A118/A136 installation standards and TTMAC (IM) on site.
- .2 Installer qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.7 SITE CONDITIONS

- .1 Maintain ambient and substrate temperature no lower than 10 degrees C during installation of mortar materials.

Part 2 Products

2.1 TILE

- .1 Porcelain floor tile, Type T: Heavy-commercial .
 - .1 Size: 300 by 600 mm, nominal.
 - .2 Edges: Rectified.
 - .3 Surface finish: R10 matte.
 - .4 Colours: #5224 Jet Black.
 - .5 Products:
 - .1 C & S Tile, Ceramstone Collection; Icon Series.
 - .2 Substitutions: Not permitted.

2.2 TRIM AND ACCESSORIES

- .1 Non-ceramic trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - .1 Applications:
 - .1 Edges of floor tile at door openings.
 - .2 Coved floor-to-wall joints.
 - .3 Top edges of cut tile wall base.
 - .2 Products:
 - .1 Coved transition: Schluter; Dilex-AHK.

- .2 Edges of floor tile at door openings, and top edge of cut tile wall base: Schluter Schiene.

2.3 SETTING MATERIALS

- .1 Improved latex-portland cement mortar bond coat: Polymer-modified, non-sagging, dry-set cement mortar for use with large and heavy tile, complying with ANSI A118.4, ANSI A118.11, ANSI A118.15, and ISO 13007-1 C2TES1P1.
 - .1 Products:
 - .1 Mapei; Ultraflex LFT..
 - .2 Custom Building Products: Versabond LFT.
 - .3 Flextile; 56SR Mortar.
 - .4 Laticrete; 4-XLT.
 - .5 Substitutions: See Part B - Bidding Procedures.

2.4 GROUTS

- .1 Epoxy grout: ANSI A118.3 and ISO 13007-1 RG, chemical- and stain-resistant, water-cleanable epoxy grout.
 - .1 Colours: As selected by Contract Administrator from manufacturer's full line.
 - .2 Products:
 - .1 Mapei; Kerapoxy CQ.
 - .2 Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout.
 - .3 Flextile; 100-Flex Epoxy.
 - .4 Laticrete; SpectrLock Pro Premium.
 - .5 Substitutions: See Part B - Bidding Procedures.
- .2 Flexible grout: Silicone rubber to ASTM C920, non-solvent curing type; colour selected by Contract Administrator from full range of colours to match other grout materials.
 - .1 Applications: Between tile and plumbing fixtures, expansion joints and other sealant-filled joints in tiling, including control, contraction, and isolation joints.
 - .2 Products:
 - .1 Mapei; Mapesil T Plus.
 - .2 Custom Building Products; Commercial 100% Silicone Seal.
 - .3 Flextile; Ultra-Performance Hybrid Caulk.
 - .4 Laticrete; Latacil.
 - .5 Substitutions: See Part B - Bidding Procedures.

2.5 ACCESSORY MATERIALS

- .1 Concrete floor slab crack isolation membrane (uncoupling membrane): Material complying with ANSI A118.12; not intended as waterproofing.
 - .1 Type: Trowel-applied.
 - .2 Thickness: 3 mm, maximum.
 - .3 Crack resistance: No failure at 1.6 mm gap, minimum.
 - .4 Products:
 - .1 Mapei; Mapeguard UM.
 - .2 Custom Building Products; RedGard Upcoupling Mat.
 - .3 Flextile; FlexMat Uncoupling.

.4 Laticrete; Strata-Mat

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- .2 Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- .3 Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

3.2 PREPARATION

- .1 Protect surrounding work from damage.
- .2 Vacuum clean surfaces and damp clean.
- .3 Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.3 INSTALLATION - GENERAL

- .1 Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions and TTMAC (IM) recommendations.
- .2 Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- .3 Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- .4 Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- .5 Form internal vertical angles square.
- .6 Install non-ceramic trim in accordance with manufacturer's instructions. Apply small continuous bead of clear silicone sealant at junction of trim at top of wall base and wall surfaces.
- .7 Sound tile after setting. Replace hollow sounding units.
- .8 Keep control and expansion joints free of mortar, grout, and adhesive.
- .9 Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- .10 Grout tile joints unless otherwise indicated.
- .11 At changes in plane and tile-to-tile control joints, use flexible grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

- .1 Over concrete substrates, install in accordance with TTMAC (IM) 329LFT.
 - .1 Use uncoupling membrane under tile unless other underlayment is indicated.
- .2 Install movement joints in accordance with manufacturer's written instructions and TTMAC (IM) 301MJ.

3.5 CLEANING

- .1 Clean tile and grout surfaces.

3.6 PROTECTION

- .1 Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Acoustical units (ACT) and suspension system.
- .2 Perimeter trim.
- .3 Extruded-aluminum edge trim.
- .4 Extruded-aluminum edge trim.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 21 13 00 - Sprinklers: Sprinkler heads in ceiling system.
- .3 Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- .4 Section 26 51 13 - Interior Luminaires: Light fixtures in ceiling system.
- .5 Section 28 46 00 - Fire Alarm: Fire alarm components in ceiling system.

1.3 REFERENCE STANDARDS

- .1 ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- .2 ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- .3 ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.
- .4 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- .2 Do not install acoustical units until after interior wet work is dry.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on suspension system components, acoustical units, and extruded-aluminum edge trim.
- .3 Samples: Submit two samples 150 by 150 mm in size illustrating material and finish of acoustical units, and 150 mm long samples of extruded aluminum edge trim.
- .4 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.

- .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 10 - Closeout Submittals, for additional provisions.
 - .2 Extra acoustical units: Quantity equal to 5 percent of total installed.

1.6 SITE CONDITIONS

- .1 Maintain uniform temperature of minimum 16 degrees C, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

Part 2 Products

2.1 ACOUSTICAL UNITS

- .1 Acoustical units - General: ASTM E1264, and CAN/ULC S102 for flame spread 25 or less and smoke develop rating less than 50.
 - .1 VOC content and VOC emission restrictions: As specified in Section 01 61 16.
- .2 Acoustical tile Type ACT: Painted mineral fibre, ASTM E1264 Type IV, high-recycled content, with the following characteristics:
 - .1 Size: 610 by 1220 mm.
 - .2 Thickness: 25 mm.
 - .3 Composition: Form 2 - Wet formed.
 - .4 Light reflectance: 85 percent minimum, determined in accordance with ASTM E1264.
 - .5 NRC: 0.80 minimum, determined in accordance with ASTM E1264.
 - .6 Edge: Square or angled tegular.
 - .7 Surface colour: White.
 - .8 Surface pattern: E - lightly textured.
 - .9 Products:
 - .1 Armstrong; Calla Health Zone 2234.
 - .2 USG/CGC; Mars High-NRC-High CAC 80/40 88346.
 - .3 Substitutions: See Part B - Bidding Procedures.

2.2 SUSPENSION SYSTEMS

- .1 Metal suspension systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter mouldings, and hold down clips as required; high-recycled content.
- .2 Exposed steel suspension system: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
 - .1 Profile: Tee; 24 mm wide face.
 - .2 Construction: Double web.
 - .3 Finish: White painted.
 - .4 Products:
 - .1 Armstrong; Prelude XL 15/16 HRC.
 - .2 USG/CGC; Donn DX HRC.
 - .3 Substitutions: See Part B - Bidding Procedures.

2.3 ACCESSORIES

- .1 Support channels and hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- .2 Perimeter mouldings: Same material and finish as grid.
 - .1 At exposed grid: Provide W-shaped moulding for mounting at same elevation as face of grid.
- .3 Extruded-aluminum edge trim: Profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with the following:
 - .1 Baked-enamel finish: Manufacturer's standard painted finish. Colour: as selected by Contract Administrator from manufacturer's full range.
 - .2 Height: Nominal 150 mm.
 - .3 Products:
 - .1 Armstrong; Axiom Classic AX6STR/CUR.
 - .2 USG; Compasso Standard.
 - .3 Substitutions: See Part B - Bidding Procedures.
- .4 Touch-up paint: Type and colour to match acoustical and grid units.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

- .1 Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- .2 Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- .3 Locate system on room axis according to reflected ceiling plan.
- .4 Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- .5 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- .6 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- .7 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- .8 Support fixtures independent of suspension grid.
- .9 Do not eccentrically load system or induce rotation of runners.

- .10 Perimeter moulding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - .1 Use longest practical lengths.
 - .2 Overlap and rivet corners.

3.3 INSTALLATION - ACOUSTICAL UNITS

- .1 Install acoustical units in accordance with manufacturer's instructions.
- .2 Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- .3 Fit border trim neatly against abutting surfaces.
- .4 Install units after above-ceiling work is complete.
- .5 Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- .6 Cutting acoustical units:
 - .1 Cut to fit irregular grid and perimeter edge trim.
 - .2 Make field cut edges of same profile as factory edges.
 - .3 Double cut and site paint exposed reveal edges.
- .7 Where round obstructions occur, provide preformed closures to match perimeter moulding.
- .8 Install hold-down clips on panels within 6 m of an exterior door.

3.4 TOLERANCES

- .1 Maximum variation from flat and level surface: 3 mm in 3 m.
- .2 Maximum variation from plumb of grid members caused by eccentric loads: 2 degrees.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Resilient base.
- .2 Installation accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

- .1 ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- .2 CAN/ULC S102.2 - Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies 2018.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colours available; and installation instructions.
- .3 Verification samples: Submit two samples, 150 mm long in size illustrating colour for each resilient flooring product specified.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Installer's qualification statement.
- .6 Maintenance data: Include maintenance procedures, recommended maintenance materials.
- .7 Maintenance materials: Furnish the following for City's use in maintenance of project.
 - .1 See Section 01 78 10 - Closeout Submittals, for additional provisions.
 - .2 Extra wall base: 5 linear metres of each type and colour.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Store materials off of the floor in an acclimatized, weather-tight space.
- .2 Protect roll materials from damage by storing on end.

1.7 SITE CONDITIONS

- .1 Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 21 degrees C to achieve temperature stability. Thereafter, maintain conditions above 13 degrees C.

Part 2 Products

2.1 RESILIENT BASE

- .1 Resilient base - Type RB: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove; cradle-to-cradle certified.
 - .1 Products:
 - .1 Tarkett; BaseWorks Rubber Wall Base.
 - .2 Substitutions: See Part B - Bidding Procedures.
 - .2 Flame spread: Meet requirements of CAN/ULC S102.2 as applicable for required flame spread ratings.
 - .3 Height: 100 mm and 150 mm as indicated.
 - .4 Thickness: 3.2 mm.
 - .5 Finish: Satin.
 - .6 Length: Roll.
 - .7 Colour: To be selected by Contract Administrator from manufacturer's full range.
 - .8 Accessories: Premoulded end stops.

2.2 ACCESSORIES

- .1 Primers and adhesives: Waterproof; types recommended by manufacturer.
 - .1 VOC content and emission restrictions: in accordance with Section 01 61 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.2 PREPARATION

- .1 Clean substrate.

3.3 INSTALLATION - RESILIENT BASE

- .1 Fit joints tightly and make vertical. Maintain minimum dimension of 450 mm between joints.
- .2 Miter internal corners. At external corners, "V" cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premoulded units.
- .3 Install base on solid backing. Bond tightly to wall and floor surfaces.
- .4 Scribe and fit to door frames and other interruptions.

3.4 CLEANING

- .1 Remove excess adhesive from floor, base, and wall surfaces without damage.
- .2 Clean in accordance with manufacturer's written instructions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Rubber tile, adhesively installed.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

- .1 ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension 2016 (Reapproved 2021).
- .2 ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness 2015 (Reapproved 2021).
- .3 ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.
- .4 UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate depth of recess in concrete substrate with thickness of flooring to ensure top of finished flooring is flush with adjacent floor finishes.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's printed data sheets for products specified.
- .3 Selection samples: Manufacturer's colour charts for flooring materials specified, indicating full range of colours and textures available.
- .4 Verification samples: Actual flooring material specified, not less than 600 mm square, mounted on solid backing.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment, compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and VOC-content and VOC-emission requirements:
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's installation instructions: Indicate special procedures, conditions requiring special attention, and seaming.
- .7 Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- .8 Concrete sub-floor test report: Submit a copy of the moisture, alkalinity (pH), and adhesion test reports.
- .9 Installer's qualification statement.
- .10 Maintenance data: Include maintenance procedures, recommended maintenance materials.

- .11 Maintenance materials: Furnish the following for City's use in maintenance of project.
 - .1 See Section 01 78 10 - Closeout Submittals, for additional provisions.
 - .2 Extra flooring material: Three full size tiles of each type and colour.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: An experienced installer approved in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- .2 Maintain temperature in storage area between 13 degrees C and 30 degrees C.
- .3 Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.8 SITE CONDITIONS

- .1 Maintain temperature in spaces to receive resilient athletic flooring between 20 and 30 degrees C for not less than 48 hours before beginning installation, during, and for not less than 48 hours after installation has been completed.
- .2 Unpack and allow flooring materials to acclimate for not less than 24 hours prior to installation in area of installation.

Part 2 Products

2.1 PREFORMED ATHLETIC FLOORING

- .1 Rubber tile flooring - Type RF: Non-vulcanized, non-laminated recycled rubber and EPDM granules with polyurethane binder, formed into rectangular tiles.
 - .1 Maximum VOC-content: As specified in Section 01 61 16.
 - .2 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.
 - .3 Thickness: Minimum 9.5 mm.
 - .4 Size: 1220 by 1830 mm.
 - .5 Tensile strength: Minimum 2.0 MPa, per ASTM D412.
 - .6 Durometer Hardness, Type A: Minimum of 64, when tested in accordance with ASTM D2240.
 - .7 Surface texture: Smooth.
 - .8 Colour: Black.
 - .9 Products:
 - .1 Edgewood Athletics; Voyager Athletic Tile Rubber Fitness Matting.
 - .2 Substitutions: See Part B - Bidding Procedures

2.2 ACCESSORIES

- .1 Leveling compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- .2 Flooring adhesive: Waterproof; types recommended by flooring manufacturer.

- .1 Maximum VOC content: in accordance with Section 01 61 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- .2 Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring substrate.
- .3 Cementitious sub-floor surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture, pH and adhesion.
 - .1 Test in accordance with ASTM F710.
 - .2 Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - .3 Do not install flooring until concrete subfloor has been cured minimum 60 days.
 - .4 Verify that no curing compounds or sealers have been applied to the concrete subfloor. Report findings to Contract Administrator.

3.2 PREPARATION

- .1 Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- .2 Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 3 mm in 3 metre radius.
- .3 Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.
- .4 Broom and vacuum clean areas to receive athletic flooring immediately before beginning installation.

3.3 INSTALLATION

- .1 Starting installation constitutes acceptance of sub-floor conditions.
- .2 Comply with manufacturer's recommendations.
- .3 Rubber tile flooring:
 - .1 Lay out centre lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from centre, and adjust as necessary to avoid tiles less than one-half width at perimeter.
 - .2 Lay tiles square with room axis, matching for colour and pattern by selecting from cartons and mixing as recommended by manufacturer. Offset planks to avoid four corners from meeting at one spot.
 - .3 Roll flooring with 30 kg roller during and after completion.
 - .4 Butt seams of rubber sheet flooring in compliance with manufacturer's printed instructions. Hold seams in place with suitable holding tape until adhesive cures. Remove within 24 hours.

3.4 CLEANING

- .1 Clean flooring using methods and products recommended by manufacturer.

3.5 PROTECTION

- .1 Prohibit foot traffic on resilient athletic flooring for minimum 24 hours after installation.
- .2 Do not place equipment on resilient athletic flooring for minimum 72 hours after installation.
- .3 Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Fluid-applied flooring and base, referred to in the Room Finish Schedule as "FAP#".

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

- .1 ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.4 PRICE AND PAYMENT PROCEDURES

- .1 Separate prices:
 - .1 See Tender No. 543-2022B; Part B – Bidding Procedures and Form B Prices, for separate prices affecting this section.
 - .2 This section includes base bid items.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting:
 - .1 Before starting work of this section, hold a pre-installation meeting to review conditions of surfaces and possible adaptations to suit, and use of materials and application procedures required to meet specified quality standards and acceptance criteria.
 - .2 Attendees to include Contractor, floor coating applicator, Contract Administrator, City, and coating system manufacturer's representative.
 - .3 Schedule pre-installation conference prior to required mock-up. Incorporate modifications to application procedure into mock-up.

1.6 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colours available.
- .3 Samples for selection: Submit two samples 50 by 50 mm in size illustrating manufacturer's standard colours available for selection by Contract Administrator.
- .4 Samples for verification: Submit two stepped samples of each flooring system, 150 by 300 mm in size illustrating materials, colour, texture, and pattern for each floor material for each colour specified.
- .5 Sustainable design submittals: Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

- .7 Applicator's qualification statement.
- .8 Maintenance data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.7 QUALITY ASSURANCE

- .1 Applicator qualifications: Company specializing in performing the work of this section, with minimum five years documented experience, and approved by manufacturer.
- .2 Supervisor qualifications: Trained by product manufacturer.

1.8 MOCK-UP

- .1 See Section 01 45 00 - Quality Control for additional requirements.
- .2 Construct mock-ups of each type of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - .1 Number of mock-ups to be prepared: As required to gain acceptance.
 - .2 Use same materials and methods, and applicators for use in the work.
 - .3 Use reviewed design samples as basis for mock-ups.
 - .4 Locate where directed.
 - .5 Minimum size: 900 mm by 900 mm, including 900 mm long integral cove base.
- .3 Obtain approval of mock-up by Contract Administrator before proceeding with work.
- .4 Approved mock-up may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to Project site in original wrappings and containers, labeled with manufacturer's name, material or product brand name, and lot number if any.
- .2 Store resin materials in a dry, secure area, protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer..

1.10 SITE CONDITIONS

- .1 Store materials in area of installation for minimum period of 48 hours prior to installation.
- .2 Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.
- .3 Provide ventilation continuously during and after fluid-applied flooring application.

Part 2 Products

2.1 FLUID-APPLIED FLOORING SYSTEMS

- .1 Single source responsibility: Provide material produced by a single manufacturer for the entire installation.
- .2 Maximum VOC content: See Section 01 61 16.
- .3 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.
- .4 Fluid-applied flooring Type FAP1: Comprised of epoxy resin primer, two-component epoxy base coats, two-component clear UV-resistant epoxy sealer, with double broadcast aggregate.

- .1 Aggregate: Quartz granules.
- .2 Sealer: Epoxy.
- .3 System thickness: 3.2 mm, nominal, when dry.
- .4 Texture: Slip resistant.
- .5 Sheen: Gloss.
- .6 Colour: As selected by Contract Administrator, similar to Stonshield "Glacier".
- .7 Products:
 - .1 Sika Corporation; Sikafloor Quartzite Broadcast System.
 - .2 Stonhard; Stonshield SLT (double broadcast) with Stonkote CE4 sealer.
 - .3 Mapei; Mapecoat Universal with Mapefloor DQ double broadcast.
 - .4 Substitutions: See Part B - Bidding Procedures.
- .5 Fluid-applied flooring Type FAP2: Troweled epoxy mortar, comprised of epoxy primer, three component epoxy mortar base with blended aggregates, and pigmented epoxy resin topcoat.
 - .1 Mortar base coat: 6.4 mm thick; colour as selected.
 - .2 Top coat: Epoxy, two component, solvent-free; colour as selected. Allow for two colours; one for field and safety yellow for line marking.
 - .3 Texture: Orange peel.
 - .4 Colour: Solid colour, silver grey.
 - .5 Products:
 - .1 Stonhard; Stoneclad GS with Stonkote GS4 topcoat.
 - .2 Mapei; Mapefloor EP20 epoxy resin mortar, and Mapefloor I 302 SL.
 - .3 Sika; Morritex Trowel with Sikafloor FastFlor CR top coat.
 - .4 Substitutions: See Part B - Bidding Procedures.

2.2 INTEGRAL COVE BASE

- .1 Manufacturer's standard component mix for wall surfaces and other non-horizontal surface applications.

2.3 ACCESSORIES

- .1 Base caps: Zinc with projecting base of 3 mm; colour as selected.
- .2 Fillet strips: Moulded of flooring resin material.
- .3 Repair mortar: Manufacturer's recommended concrete filler.
- .4 Subfloor filler: Type recommended by fluid-applied flooring manufacturer.
- .5 Primer: Epoxy type recommended by fluid-applied flooring manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- .2 Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive integral cove base.
- .3 Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

- .4 Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity. Obtain instructions if test results are not within limits recommended by flooring materials manufacturer.

3.2 PREPARATION

- .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- .2 Prepare concrete surfaces according to ICRI 310.2R, CSP per manufacturer's recommendations.
- .3 Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- .4 Vacuum clean substrate.
- .5 Apply primer to surfaces required by flooring manufacturer.
- .6 Treat control joints and other non-moving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.3 INSTALLATION - ACCESSORIES

- .1 Install fillet strips at base of walls where flooring is to be extended up wall as base.
- .2 Install terminating cap strip at top of base; attach securely to wall substrate.

3.4 INSTALLATION - FLOORING

- .1 Apply in accordance with manufacturer's instructions.
- .2 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
- .3 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- .4 Apply each coat to minimum thickness required by manufacturer.
- .5 Finish to smooth level surface.
- .6 Cove at vertical surfaces.
 - .1 Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, and sanding. Round internal and external corners. Form coves smooth to the touch, with no nibs or aggregate protruding through seal coat.
 - .2 Height: As indicated.
- .7 Terminations:
 - .1 Chase edges to "lock" flooring system into concrete substrate along lines of termination.
 - .2 Penetration treatment: Lap and seal resinous system onto perimeter of penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
 - .3 Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.
 - .4 Treat floor drains by chasing flooring system to lock in place at point of termination.

- .8 Joints and cracks:
 - .1 Treat control joints to bridge potential cracks and to maintain monolithic protection.
 - .2 Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces, as well as horizontal and vertical interfaces.
 - .3 Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 PROTECTION

- .1 Prohibit traffic on floor finish for 48 hours after installation.
- .2 Barricade area to protect flooring until fully cured.
- .3 Protect resinous flooring materials from damage and wear during construction operations. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application.

3.6 CLEANING

- .1 Remove temporary covering and clean resinous flooring just prior to Substantial Performance. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Surface preparation.
- .2 Site application of paints.
- .3 Scope: Finish interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- .4 Do not paint or finish the following items:
 - .1 Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory-finished.
 - .2 Items indicated to receive other finishes.
 - .3 Items indicated to remain unfinished.
 - .4 Fire-rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - .5 Floors, unless specifically indicated.
 - .6 Glass.
 - .7 Concrete masonry units.
 - .8 Exposed concrete.
 - .9 Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- .2 Section 05 50 00 - Metal Fabrications: Shop-primed items.
- .3 Section 05 52 13 - Pipe and Tube Railings: Shop-primed items.
- .4 Section 05 51 00 - Metal Stairs: Shop-primed items.
- .5 Section 06 18 00 - Glue Laminated and Cross Laminated Construction: Factory-applied protective undercoat
- .6 Section 06 20 00 - Finish Carpentry: Shop-finished wood soffit and cladding boards.
- .7 Section 09 96 00 - High-Performance Coatings.

1.3 REFERENCE STANDARDS

- .1 ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- .2 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.
- .3 MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- .4 MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.

-
- .2 Product data: Provide complete list of products to be used, with the following information for each:
 - .1 Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - .2 MPI product number (e.g. MPI 47).
 - .3 Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - .4 Manufacturer's installation instructions.
 - .3 Samples: Submit three paper "draw down" samples, 216 by 279 mm in size, illustrating range of colours available for each finishing product specified.
 - .1 Where sheen is specified, submit samples in only that sheen.
 - .2 Where sheen is not specified, discuss sheen options with Contract Administrator before preparing samples, to eliminate sheens definitely not required.
 - .3 Retain draw downs as reviewed on site, as acceptable standard for colour and sheen.
 - .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
 - .5 Certification: By manufacturer that paints and finishes comply with VOC limits specified.
 - .6 Maintenance data: Submit data including finish schedule showing where each product/colour/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and colour samples of each colour and finish used.
 - .7 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 Extra paint and finish materials: one , 4 L of each colour; from the same product run, store where directed.
 - .2 Label each container with colour in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

- .1 Applicator qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- .2 Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and instructions for mixing and reducing.
- .3 Paint materials: Store at minimum ambient temperature of 7 degrees C and a maximum of 32 degrees C, in ventilated area, and as required by manufacturer's instructions.

1.7 SITE CONDITIONS

- .1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- .2 Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- .3 Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- .4 Provide lighting level of 860 lx measured mid-height at substrate surface.

Part 2 Products

2.1 MANUFACTURERS

- .1 Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- .2 Provide paint and finishes from manufacturers with each paint line having a minimum of four tint base mixtures, and minimum four sheen levels, including matte, eggshell, semi-gloss and gloss.

2.2 PAINTS AND FINISHES - GENERAL

- .1 Paints and finishes: Ready mixed, unless intended to be a site-catalyzed paint.
 - .1 Where MPI paint numbers are specified, provide products listed in the MPI (APL) for specified MPI categories.
 - .2 Use paint finish coats with minimum volume solids of 36 percent before tinting.
 - .3 Use highest quality products for material such as linseed oil, shellac, turpentine, etc. not specifically listed by brand name.
 - .4 Conform to latest MPI requirements for painting and repainting work including preparation and priming.
 - .5 Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - .6 Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and site experience.
 - .7 For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base colour.
 - .8 Supply each paint material in quantity required to complete entire project's work from a single production run.
 - .9 Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- .2 VOC-content, and VOC-emission requirements: See Section 01 61 16, for paints and coatings applied on-site within, or part of, the building's continuous plane of air-tightness.
- .3 Sheen: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Contract Administrator from the manufacturer's full line.
- .4 Colours:
 - .1 Selection to be made by Contract Administrator after award of Contract.
 - .2 Extend colours to surface edges; colours may change at any edge as directed by Contract Administrator.
 - .3 In all areas, finish pipes, ducts, conduit, and equipment the same colour as the wall/ceiling they are mounted on/under.

2.3 PAINT SYSTEMS - INTERIOR

- .1 Perform painting work in accordance with MPI Premium Grade requirements.
- .2 INT 5.1C - Water-based, dry-fall, over quick-dry alkyd primer.
 - .1 Surfaces include: Exposed OWSJ scheduled to be painted.
- .3 Structural steel with intumescent thin film coatings (non-MPI system).
 - .1 High performance acrylic latex, approved by intumescent coating manufacturer
 - .2 Surfaces include structural steel with intumescent thin film coatings.
- .4 INT 5.1R - High-performance architectural latex over quick-dry alkyd primer.
 - .1 Surfaces include: Exposed structural steel, railings, guards, ladders, and other metal fabrications; factory-primed ferrous metal access panels and fire extinguisher cabinets, and other ferrous metals scheduled or indicated to be painted.
- .5 INT 5.3L - Alkyd over water-based galvanized primer.
 - .1 Surfaces include hollow metal doors and frames, and other galvanized metals scheduled or indicated to be painted.
- .6 Glue-laminated wood components (non-MPI system): High-adhesion, UV-resistant, water-repellent, low-VOC, heat- and fire-resistant finishing system with FSR/SDC 75/450 when tested to CAN/ULC S102, and forming a part of factory-applied protective coating as part of glue laminated wood specifications, as follows:
 - .1 Factory-applied protective undercoat: Sansin KP-12, clear.
 - .2 Two coats Sansin SDF-FR (clear).
- .7 Wood decking (non-MPI system): UV-resistant, water-repellent, low-VOC, heat- and fire-resistant finishing system with FSR/SDC 75/450 when tested to CAN/ULC S102.
 - .1 Two coats Sansin SDF-FR (clear).
- .8 INT 6.4M - Water-based varnish, clear.
 - .1 Gloss level: G4.
 - .2 Surfaces: Interior plywood scheduled or indicated to be receive clear finish.
- .9 INT 6.4PP - Fire-Retardant, Pigmented, Water-Based: ULC certified.
 - .1 Surfaces include: Electrical and telecommunications equipment mounting boards.
- .10 INT 9.2B - High-performance architectural latex over latex primer sealer.
 - .1 Surfaces include: Gypsum board wall and ceiling surfaces, not otherwise scheduled to receive high build coatings (HBC).

2.4 PAINT SYSTEMS - EXTERIOR

- .1 Perform painting work in accordance with MPI Premium Grade requirements.
- .2 EXT 3.2F - Alkyd zone/traffic marking.
 - .1 Surfaces include: Concrete apron, and other exterior concrete surfaces scheduled or indicated to receive traffic markings.
- .3 EXT 5.1T - Polyurethane, Pigmented (over high build self-priming epoxy)
 - .1 Surfaces include: Exterior metal fabrications, including concrete filled steel bollards, and other ferrous metals scheduled or indicated to be painted.

- .4 EXT 5.3N - Alkyd (over water-based galvanized primer).
 - .1 Surfaces include: Hollow metal doors and frames, and other galvanized metals scheduled or indicated to be painted.

2.5 ACCESSORY MATERIALS

- .1 Accessory materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- .2 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- .3 Test shop-applied primer for compatibility with subsequent cover materials.
- .4 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - .1 Gypsum board: 12 percent.
 - .2 Interior and exterior wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

- .1 As painting operations progress, place "WET PAINT" signs.
- .2 Clean surfaces thoroughly and correct defects prior to application.
- .3 Prepare surfaces in accordance with MPI (APSM) using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- .4 Remove or repair existing paints or finishes that exhibit surface defects.
- .5 Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- .6 Seal surfaces that might cause bleed through or staining of topcoat.
- .7 Metal doors to be painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- .1 Remove unfinished louvres, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- .2 Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- .3 Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- .4 Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- .5 Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- .6 Dark colours: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

- .7 Sand wood and metal surfaces lightly between coats to achieve required finish.
- .8 Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- .9 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- .1 Remove smears and spatter immediately as operations progress.
- .2 Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- .1 Protect finishes until completion of project.
- .2 Touch-up damaged finishes after Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 High build epoxy wall coatings, referred to in the Room Finish Schedule as "HBC".
- .2 Surface preparation.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Sequencing: Install high-performance wall coatings before flooring cove base is applied. Coordinate with Section 09 67 00 - Fluid-Applied Flooring.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on specified products, describing physical and performance characteristics; and colours available.
- .3 Samples for selection: Submit two samples 50 by 50 mm in size illustrating manufacturer's standard colours available for selection by Contract Administrator.
- .4 Samples for verification: Submit two stepped samples 150 by 300 mm in size illustrating colour and texture available for each colour specified.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .7 Applicator's qualification statement.
- .8 Maintenance data: Include cleaning procedures and repair and patching techniques.
- .9 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 Extra coating materials: One litre of each type and colour.
 - .2 Label each container with manufacturer's name, product number, colour number, and room names and numbers where used.

1.5 QUALITY ASSURANCE

- .1 Applicator qualifications: Company specializing in performing the work of this section.
 - .1 Minimum five years of documented experience.
 - .2 Approved by manufacturer.

1.6 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control for additional requirements.

- .2 Provide mock-up , full height of wall by 1 metre wide, illustrating coating, colour, and surface sheen.
- .3 Locate where directed.
- .4 Obtain approval of mock-up by Contract Administrator before proceeding with work.
- .5 Accepted mock-up may remain as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- .2 Container label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and instructions for mixing and reducing.
- .3 Store resin materials in a dry, secure area, protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.8 SITE CONDITIONS

- .1 Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- .2 Maintain ambient temperature required by manufacturer for minimum 24 hours before, during, and 72 hours after installation of coating.
- .3 Restrict traffic from area where coating is being applied or is curing.

Part 2 Products

2.1 EPOXY COATINGS

- .1 Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer, patch, or filler coat.
 - .1 Lead content: None.
 - .2 Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.
 - .3 Maximum VOC-content: See Section 01 61 16.
 - .4 VOC-emissions: Provide evidence of compliance in accordance with Section 01 61 16.
- .2 Epoxy coating Type HBC:
 - .1 Number of coats: Two.
 - .2 Product characteristics:
 - .1 Dry film thickness, per coat, 0.30 mm, minimum.
 - .2 Sheen: Gloss.
 - .3 Texture: Orange-peel.
 - .4 Colour: Custom colour to match Benjamin Moore #OC-17 White Dove.
 - .5 Products:
 - .1 Stonhard; Stoneglaze VSR.
 - .2 Mapei; Mapefloor I 302 SL.
 - .3 Sika; Sikagard 100 Duroplast.
 - .4 Substitutions: See Part B - Bidding Procedures.

- .3 Primer:
 - .1 Dry film thickness: As recommended by manufacturer, applicable to substrate.
 - .2 Products:
 - .1 Stonhard; Primer 180 for gypsum substrates, Stoneglaze E4 for CMU substrates.
 - .2 Mapei; Primer SN, with Additix PE for CMU substrates.
 - .3 Sika; Sikagard Duroplast PS for gypsum substrates, Duroplast EE for CMU substrates.
 - .4 Substitutions: See Part B - Bidding Instructions.
 - .4 Patching compound: As recommended by coating manufacturer for specific substrate.

2.2 ACCESSORY MATERIALS

- .1 Accessory materials: Provide sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Do not begin application of coatings until substrates have been properly prepared.
- .3 Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- .4 Examine surfaces scheduled to be finished prior to start of work. Report conditions that may potentially affect proper application.
- .5 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is in accordance with manufacturer's requirements.
- .6 Masonry: Verify masonry joints are struck flush.
- .7 Gypsum substrates: Verify joints have been properly finished and fully cured.
- .8 Proceed with coating application only after unacceptable conditions have been corrected.
 - .1 Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- .1 Clean surfaces of loose foreign matter.
- .2 Remove finish hardware, fixture covers, and accessories and store.
- .3 Masonry:
 - .1 Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - .2 Prepare surface as recommended by coating manufacturer.
- .4 Gypsum substrates:
 - .1 Prepare surface as recommended by coating manufacturer.

- .2 Seal and prime porous joint filler compounds.
- .5 Protect adjacent surfaces and materials not receiving coating from spatter; mask if necessary to provide adequate protection. Repair damage.

3.3 PRIMING

- .1 Apply primer to wall surfaces. Apply in accordance with coating manufacturer's instructions, and in thickness required to fill holes.
- .2 Apply patching compound to areas unfilled by primer in accordance with coating manufacturer's instructions.

3.4 COATING APPLICATION

- .1 Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.
- .2 Apply in uniform thickness coats, without runs, drips, pinholes, brush or roller marks, or variations in colour, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

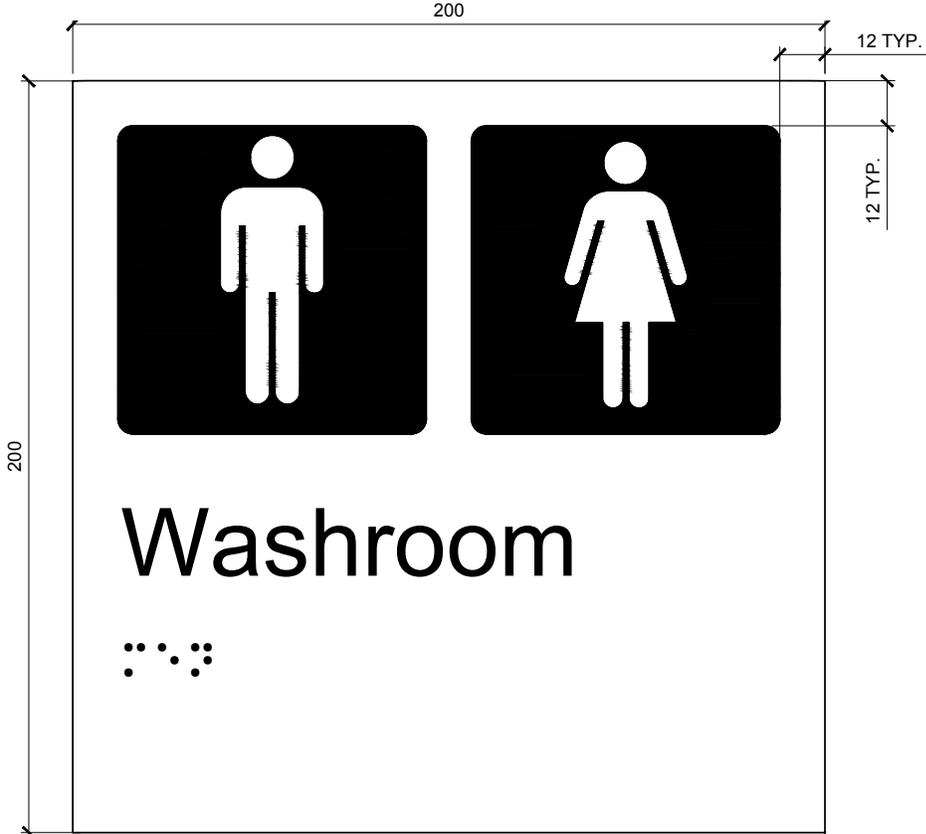
3.5 CLEANING

- .1 Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- .2 Clean surfaces immediately of splatter, and excess material.
- .3 After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 PROTECTION

- .1 Protect finished work from damage.

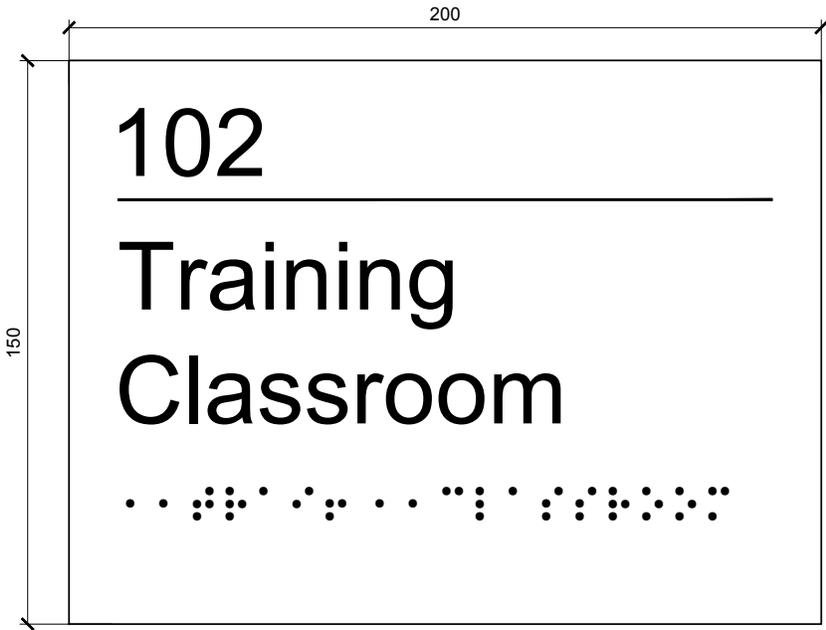
END OF SECTION



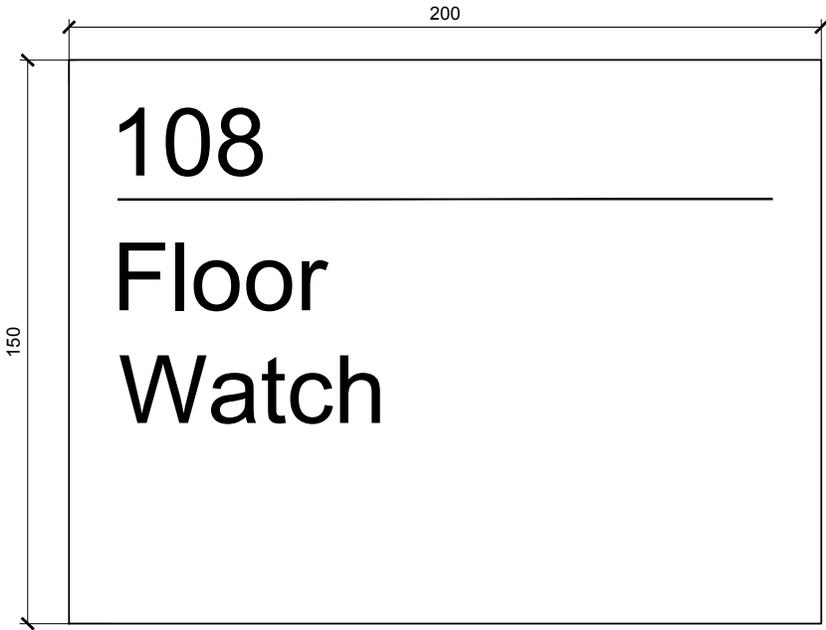
1 TYPE A
GENDER NEUTRAL W/C
NTS



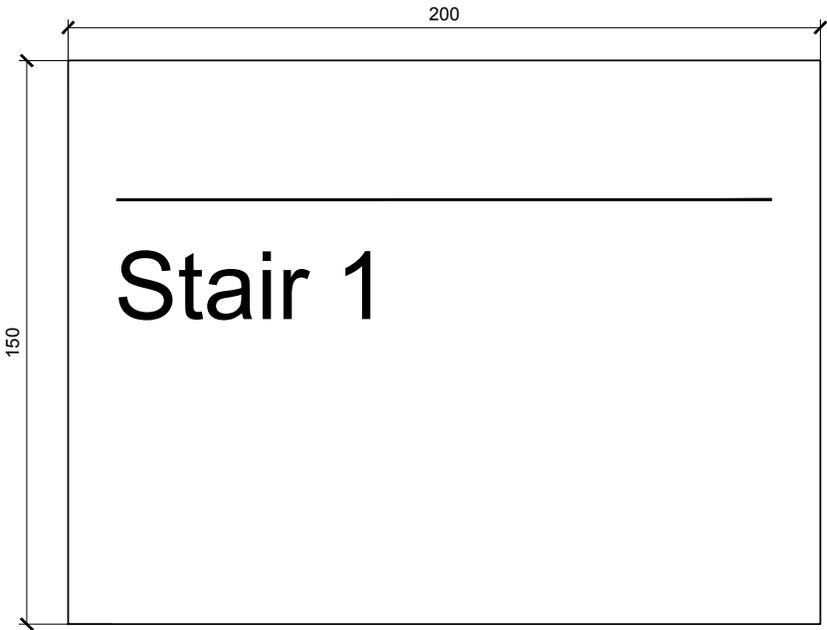
2 TYPE B
UNIVERSAL TOILET ROOM
NTS



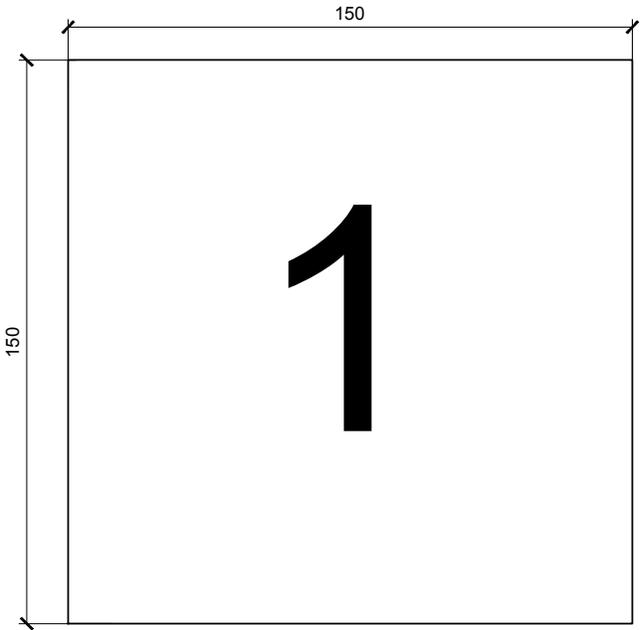
1 TYPE C
ROOM IDENTIFICATION - ACCESSIBLE
NTS



1 TYPE D
ROOM IDENTIFICATION
NTS



1 TYPE E
STAIRWELL IDENTIFICATION
NTS



2 TYPE F
STAIRWELL LANDING
NTS



3 TYPE G
DOOR CONTROLS
NTS

Part 1 General

1.1 SECTION INCLUDES

- .1 Whiteboards and tackboards.

1.2 REFERENCE STANDARDS

- .1 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies 2018.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide manufacturer's data on whiteboard, tackboard, and accessories.
- .3 Samples: Submit colour charts for selection of colour and texture of tackboard.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Test reports: Show compliance to specified surface burning characteristics requirements.
- .6 Manufacturer's printed installation instructions.
- .7 Maintenance data: Include data on regular cleaning, and stain removal.

Part 2 Products

2.1 VISUAL DISPLAY BOARDS

- .1 Whiteboards: 12 mm thick, fully-wrapped frameless, magnetic, board with proprietary EVS surface on steel backing.
 - .1 Colour: Matte white.
 - .2 Gloss: 40 GU with gloss meter set at 60 degree angle.
 - .3 Size: As indicated on Drawings.
 - .4 Mounting: Integral cleat
 - .5 Accessories: Provide 610 mm long magnetically mounted marker tray, four assorted colour dry erase markers, four magnetic cleaning cloths, and four rare earth magnetics per board..
 - .6 Product:
 - .1 Egan Visual; 1/2" Dimension Stele.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Tackboards: Composition cork consisting of a combination of oxidized linseed oil, rosin and finely ground cork calendered onto a jute backing and factory-laminated to backing; self-healing. Provide products containing recycled content.
 - .1 Cork thickness: 6 mm.

- .2 Colour: As selected from manufacturer's full range. Allow for three colours selected by Contract Administrator.
- .3 Backing: Particleboard, 6 mm thick, laminated to tack surface.
- .4 Surface burning characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with CAN/ULC S102.
- .5 Size: As indicated on Drawings.
- .6 Product:
 - .1 ASI Visual Display Products; Aluminum Framed Tackboard with Forbo tackable surface.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .7 Frame: Extruded aluminum, with concealed fasteners.
- .8 Frame profile: Manufacturer's standard.
- .9 Frame finish: Anodized, natural.

2.2 ACCESSORIES

- .1 Mounting brackets: Concealed.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site measurements are as indicated.
- .2 Verify that internal wall blocking is ready to receive work and positioning dimensions are as instructed by the manufacturer.

3.2 INSTALLATION

- .1 Install boards in accordance with manufacturer's instructions.
- .2 Secure units level and plumb.

3.3 CLEANING

- .1 Clean board surfaces in accordance with manufacturer's instructions.
- .2 Cover with protective cover, taped to frame.
- .3 Remove temporary protective cover at Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Room and door signs, stair and stairwell signs.
- .2 Door control signs.
- .3 Building identification signs.

1.2 RELATED REQUIREMENTS

- .1 Section 10 06 10 - Signage Schedule

1.3 REFERENCE STANDARDS

- .1 City of Winnipeg Accessibility Design Standards - City of Winnipeg Accessibility Design Standards 2015.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colours, locations, overall dimensions of each sign.
- .3 Shop Drawings:
 - .1 Indicate sign styles, lettering font, foreground and background colours, locations, overall dimensions of each sign.
 - .2 Submit drawn to scale details indicating word and letter spacing.
- .4 Selection samples: Where colours are not specified, submit two sets of colour selection charts or chips.
- .5 Verification samples: Submit two samples of each type of sign, and two samples of individual dimensional letters, illustrating sign material, style, font, colour, and method of attachment.
 - .1 Accepted samples will be returned for installation.
- .6 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .7 Manufacturer's installation instructions: Include installation templates and attachment devices.
- .8 Manufacturer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- .2 Source limitations: Obtain each sign type through one source from a single manufacturer.

- .3 Regulatory requirements: Comply with City of Winnipeg Accessibility Design Standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Package signs as required to prevent damage before installation.
- .2 Store tape adhesive at normal room temperature.

1.7 SITE CONDITIONS

- .1 Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- .2 Maintain this minimum temperature during and after installation of signs.

Part 2 Products

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 Design exterior signs, including anchors and connections, to withstand effects of gravity loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components.
 - .1 Wind loads: as indicated on Drawings.
- .2 Design exterior entrance signs to allow for thermal movements from ambient and surface temperature changes acting on sign by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - .1 Temperature change: 80 deg C, ambient; 100 deg C, material surfaces.
- .3 Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 SIGNAGE APPLICATIONS

- .1 Accessibility compliance: Signs are required to comply with City of Winnipeg Accessibility Design Standards.
- .2 Interior room and door signs, stair and stairwell signs:
 - .1 Sign panel: Solid core acrylic, 3 mm thick with non-glare finish. Colour selected by Contract Administrator from manufacturer's full colour range.
 - .2 Lettering and pictogram: Surface-applied modified acrylic polymer, raised 0.8 mm from background surface. Font: sans serif font selected by Contract Administrator. Colour selected by Contract Administrator from manufacturer's full colour range, contrasting sign panel.
 - .3 Braille: Provide Braille information to accompany sign lettering or pictogram using Raster method with 0.8 mm by 1.5 mm dia. high clear domed acrylic Grade 1 uncontracted Braille dots.
 - .4 Sign size and layout: See Section 10 06 10 - Signage Schedule.
 - .5 Sign message: See Article "Interior Signage Type Schedule" in Part 3.
 - .6 Mounting: Double-sided tape.
- .3 Door controls signs:
 - .1 Vinyl decal.
 - .2 Mounting: On composite metal panel (CMP) in locations indicated on Drawings.

- .4 Building address:
 - .1 Vinyl decal.
 - .2 Mounting: On interior face of glass above entrance door D100A.
- .5 Building identification signs:
 - .1 Use individual metal letters.
 - .2 Mount on outside wall in location indicated on Drawings.

2.3 VINYL DECALS

- .1 Vinyl decals: Die-cut characters from cast vinyl film of nominal minimum thickness of 0.076 mm with pressure-sensitive adhesive backing. Colour: As selected by Contract Administrator from manufacturer's full colour range.
 - .1 Character font and size: As indicated.
 - .2 Message:
 - .1 Building address: To be confirmed, allow for four numerals.
 - .2 Door controls: See Interior Sign Type Schedule in Part 3.

2.4 DIMENSIONAL LETTERS

- .1 Metal letters: Rated for exterior use.
 - .1 Metal: Type 304 stainless steel sheet, formed; minimum 1.59 mm thick face and 0.79 mm thick returns; soldered or welded construction; single-piece face.
 - .2 Finish: No. 4 brushed.
 - .3 Edge style: Square; polished.
 - .4 Return depth: 100 mm.
 - .5 Character font and size: As indicated on Drawings.
 - .6 Character case: Upper case only, except as otherwise indicated on Drawings.
 - .7 Message: As indicated on Drawings.
 - .8 Mounting: Concealed non-corroding stud mounting, projection from wall surface to be determined.

2.5 ACCESSORIES

- .1 Tape adhesive: Double sided tape, permanent adhesive.

2.6 FABRICATION

- .1 Layout sign graphics with words, letters, numbers, and symbols, properly spaced.
- .2 Comply with requirements indicated for materials, thicknesses, finishes, colours, designs, shapes, sizes, and details of construction.
- .3 Sheet and plate metal materials:
 - .1 Cut, drill, and punch metals cleanly and accurately.
 - .2 Remove burrs and sharp or rough areas on exposed surfaces.
 - .3 Cut out characters with smooth edges, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects.
- .4 Design, and fabricate sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.
- .5 Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

- .6 Vinyl decals: Die-cut each character from single piece of vinyl.
- .7 Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install neatly, with horizontal edges level.
- .3 Locate signs and mount at heights indicated on Drawings and in accordance with City of Winnipeg Accessibility Design Standards.
- .4 Corrosion protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.
- .5 Vinyl decals:
 - .1 Clean mounting surfaces.
 - .2 Remove edge of decal backing and adhere decals to substrate in accordance with manufacturer's instructions.
 - .3 Place without air bubbles, creases or visible distortion.
 - .4 Mounting height: as indicated or directed by Contract Administrator.
- .6 Protect from damage until Substantial Performance; repair or replace damaged items.

3.3 INTERIOR SIGNAGE TYPE SCHEDULE

- .1 One sign per location below unless otherwise noted, message as indicated.
- .2 Sign Type A - Gender Neutral W/C
 - .1 104 Washroom
- .3 Sign Type B - Universal Toilet Room
 - .1 103 Universal Toilet Room
- .4 Sign Type C - Room Identification - Accessible
 - .1 102 Training Classroom
 - .2 102A Storage Room
 - .3 102B Storage Room
- .5 Sign Type D - Room Identification
 - .1 105 IT Room
 - .2 108 Floor Watch
 - .3 110 Janitor Room
 - .4 111 Captain and Lieutenant Office (note: Quantity 3 – locate at interior of Stair 1 and Stair 2)
 - .5 111A Sleeping Quarters

-
- .6 112 Storage Room
 - .7 113 Washroom
 - .8 114 Investigator's Office
 - .9 114A Sleeping Quarters
 - .10 115 Hazardous Equipment Storage
 - .11 115A Sprinkler Room (note: room number on Drawings is 126)
 - .12 117 Apparatus Bays
 - .13 118 Ambulance Restock
 - .14 119 Janitor Room
 - .15 120 Washroom
 - .16 121 Evidence Room
 - .17 122 Tool Repair Room
 - .18 124 SCBA Room
 - .19 125 PPE Storage Room
 - .20 205 Support Services Room
 - .21 206 Sleeping Quarters
 - .22 207 Sleeping Quarters
 - .23 208 Sleeping Quarters
 - .24 209 Sleeping Quarters
 - .25 210 Sleeping Quarters
 - .26 211 Sleeping Quarters
 - .27 212 Sleeping Quarters
 - .28 213 Sleeping Quarters
 - .29 214 Sleeping Quarters
 - .30 215 Office
 - .31 216A Janitor Room
 - .32 216B Laundry Room
 - .33 217 Washroom
 - .34 218 Washroom
 - .35 219 Washroom
 - .36 221 Mechanical & Electrical Room
 - .6 Sign Type E - Stairwell Identification
 - .1 Stair 1 (Quantity: 3)
 - .2 Stair 2 (Quantity: 3)
 - .3 Firepole (Quantity: 2)
 - .7 Sign Type F - Stairwell Landing
 - .1 1 (Quantity: 2 Stair 1 interior at main (x1), Stair 2 interior at main (x1))
 - .2 2 (Quantity: 2 Stair 1 interior at main (x1), Stair 2 interior at main (x1))
 - .8 Sign Type G - Door Controls
 - .1 1 (plus direction triangle)
 - .2 2 (plus direction triangle)
 - .3 3 (plus direction triangle)
 - .4 4 (plus direction triangle)

.5 5 (plus direction triangle)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Tactile warning surface.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate installation of tactile attention indicators with concrete finishing work.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submission procedures.
- .2 Product data: Provide data on each type of tactile warning device specified.
- .3 Samples: Submit two samples, 150 mm long, of each type of device illustrating colour and finish.

Part 2 Products

2.1 MATERIALS

- .1 Tactile warning surface indicators: Solid, non-slip, abrasive bar with tapered shape for recessed installation in stair landings, made from two-part epoxy and aluminum oxide abrasive.
 - .1 Size: 6 mm wide by 12 mm.
 - .2 Colour selected by Contract Administrator from manufacturer's standard range.
 - .3 Product:
 - .1 Balco USA; Model AS-2.
- .2 Adhesive: Manufacturer's recommended clear epoxy.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify exact location before installation.

3.2 INSTALLATION - TACTILE WARNING SURFACE

- .1 Preparation:
 - .1 Mark strip locations on substrates.
 - .2 Cut channel of width and minimum depth recommended by manufacturer to allow for 1.6 mm projection of installed warning indicator.
- .2 Installation:
 - .1 Apply adhesive to prepared channel.
 - .2 Install single-length warning indicators spaced 50 mm centre-to-centre full width of stair tread and extending for a depth of 915 mm starting one tread depth back from the stair nosing.

3.3 CLEANING AND PROTECTION

- .1 Protect tactile attention indicators against damage during construction period in accordance with manufacturer's instructions.
- .2 Protect tiles against damage from rolling loads following installation by covering with plywood.
- .3 Clean tactile attention indicators not more than four days prior to date scheduled for review intended to establish date of Substantial Completion, using manufacturer's recommended method.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Stainless steel sheet protective wall covering.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Indicate physical dimensions, features, and anchorage details.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Maintenance data: For each type of product . Include information regarding recommended and potentially detrimental cleaning materials and methods.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products in original, undamaged protective packaging. Label items to designate installation locations.
- .2 Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in conformance with manufacturer's recommendations for each type of item.

Part 2 Products

2.1 PRODUCT TYPES

- .1 Protective wall covering:
 - .1 Material: Stainless steel. Provide products with recycled content.
 - .2 Thickness: 1.5 mm.
 - .3 Mounting: Adhesive.
- .2 Adhesives and primers: As recommended by manufacturer.

2.2 FABRICATION

- .1 Fabricate components with tight joints, corners and seams.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate surfaces for adhered items are clean and smooth.

- .1 Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- .2 Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

- .1 Position bottom edge of protective wall covering at top edge of mop sink.
 - .1 Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
 - .2 Apply adhesive with 3 mm V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
 - .3 Minimize joints. No horizontal joints permitted.
 - .4 Use a roller to ensure maximum contact with adhesive.

3.3 CLEANING

- .1 Clean wall protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Commercial toilet and shower accessories.
- .2 Diaper changing stations.
- .3 Utility room accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 22 42 02 - Plumbing Fixtures: Back rest, shower grab bars, folding seat, curtain rod, curtain and hooks.
- .2 Division 26 - Electrical: Electric hand dryers.

1.3 REFERENCE STANDARDS

- .1 ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- .2 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- .3 ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- .4 ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- .3 Samples: Submit two samples of each accessory, illustrating colour and finish.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used stainless steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Manufacturer's installation instructions: Indicate special procedures and conditions requiring special attention.

Part 2 Products

2.1 MANUFACTURERS

- .1 Commercial toilet and shower accessories, and utility room accessories:
 - .1 Bobrick Washroom Equipment.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Baby changing stations:
 - .1 Koala Kare.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .3 Provide products of each category type by single manufacturer.
- .4 Provide products with recycled content where possible.

2.2 MATERIALS

- .1 Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - .1 Grind welded joints smooth.
 - .2 Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- .2 Keys: Provide two keys for each accessory to City; master key lockable accessories.
- .3 Stainless steel sheet: ASTM A666, Type 304.
- .4 Stainless steel tubing: ASTM A269/A269M, Grade TP304 or TP316.
- .5 Mirror glass: In accordance with ASTM C1503; 6 mm nominal thickness, with silvering, electroplated copper coating, and protective organic coating.

2.3 FINISHES

- .1 Stainless steel: Satin finish, unless otherwise noted.
- .2 Back paint components where contact is made with incompatible building finishes to prevent electrolysis.

2.4 COMMERCIAL TOILET AND SHOWER ACCESSORIES

- .1 Toilet paper dispenser - TP1: Double roll, recessed, stainless steel unit and door with tumbler lock.
 - .1 Products:
 - .1 Bobrick; B-35883.
- .2 Toilet paper dispenser - TP2: Double roll, surface mounted, stainless steel, with chrome-plated plastic spindles with heavy-duty internal spring, and stainless steel utility shelf.
 - .1 Attached (welded) shelf: 1.0 mm satin finished stainless steel, with rolled or formed edge at front.
 - .2 Products:
 - .1 Bobrick; B-2840.

-
- .3 Combination towel dispenser/waste receptacle - PTD-1: Recessed with projecting paper towel dispenser and waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
 - .1 Waste receptacle liner: Reusable, heavy-duty vinyl.
 - .2 Automatic towel dispenser: Universal standard-core rolls up to 200 mm wide and 200 mm diameter, non-perforated roll. Electronic sensor automatically dispenses towel when hands are placed under towel opening.
 - .3 Power: external 6-volt AC to DC power supply.
 - .4 Waste receptacle capacity: 45 liters.
 - .5 Products:
 - .1 Bobrick; B-39747 with AC adapter kit.
 - .4 Liquid soap dispenser - DLS: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and plastic container; stainless steel lever operation, and window gauge refill indicator, tumbler lock.
 - .1 Minimum capacity: 1.0 liters.
 - .2 Products:
 - .1 Bobrick; B-26617.
 - .5 Mirrors: Stainless steel framed, 6 mm thick annealed float glass; ASTM C1036.
 - .1 Annealed float glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - .2 Size:
 - .1 M1: 1050 by 1220 mm
 - .2 M2: 610 by 915 mm.
 - .3 M3: 610 by 915 mm.
 - .3 Frame: 1.3 mm angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - .4 Backing: Full-mirror sized, minimum 0.8 mm galvanized steel sheet and non-absorptive filler material.
 - .5 Fixed tilt mirrors: Minimum 100 mm tilt from top to bottom.
 - .6 Product:
 - .1 Bobrick; B-290, and B-293 tilt.
 - .6 Grab bars - GB#: Stainless steel, peened surface.
 - .1 Standard duty grab bars:
 - .1 Dimensions: 32 mm outside diameter, minimum 1.2 mm wall thickness, concealed flange mounting with snap flange covers, 38 mm clearance between wall and inside of grab bar.
 - .2 Finish: Satin.
 - .3 Length:
 - .1 GB1: 610 mm.
 - .2 GB2: 760 mm.
 - .3 GB3: 915 mm.
 - .4 Products:
 - .1 Bobrick; B-5806 series.
 - .7 Shelf - SH: 1.2 mm satin-finished stainless steel, with 19 mm returned edges, and hemmed edge at shelf front; stainless steel mounting brackets welded to shelf.

- .1 Size: 125 mm deep by 405 mm long.
- .2 Products:
- .8 Sanitary napkin disposal unit - SN: Stainless steel, surface-mounted, cover with full-length stainless steel piano-type hinge.
 - .1 Products:
 - .1 Bobrick; B-270.
- .9 Coat hooks and towel hooks - CH: Stainless steel hook and mounting bracket, auto-release spring-loaded hook with 9 kg capacity, that releases at a load of 18 kg or more.
 - .1 Product:
 - .1 Bobrick; B-983.
- .10 Bench - BN: 2.8 mm stainless steel, brushed finish, with integral brackets with pre-drilled mounting holes for wall-mounting; hemmed edges.
 - .1 Custom size: 460 mm deep by 915 mm long.
 - .2 Capacity: 340 kg static load.
 - .3 Product:
 - .1 G2 Automated Technologies; KryptoMax KM-FWB.
 - .2 Norix Group, Inc.; IBW Bench (no cuff rings).
 - .4 Substitutions: Custom-fabricated bench may be acceptable provided stamped and sealed Shop Drawings are provided.

2.5 BABY CHANGING STATIONS

- .1 Baby changing station - BCT: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285; horizontal orientation.
 - .1 Outer shell: Stainless steel, satin finish.
 - .2 Bed: Injection-moulded polyethylene.
 - .3 Mounting: Surface.
 - .4 Colour: Grey.
 - .5 Products:
 - .1 Koala Kare; KB310-SSRE.

2.6 UTILITY ROOM ACCESSORIES

- .1 Combination utility shelf/mop and broom holder - MH: 1.2 mm thick stainless steel, Type 304, with 12 mm returned edges, 1.6 mm steel wall brackets.
 - .1 Hooks: Four, 1.6 mm stainless steel rag hooks at shelf front.
 - .2 Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - .3 Length: 865 mm.
 - .4 Shelf: 200 mm deep.
 - .5 Product:
 - .1 Bobrick; B-239.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify exact location of accessories for installation.
- .3 Verify that site measurements are as indicated on Drawings.
- .4 See Section 09 22 16 for installation of blocking, reinforcing plates, and concealed anchors in walls.

3.2 PREPARATION

- .1 Deliver inserts and rough-in frames to site for timely installation.
- .2 Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- .1 Install accessories in accordance with manufacturers' instructions in locations indicated on Drawings.
- .2 Install plumb and level, securely and rigidly anchored to substrate.
- .3 Mounting heights: As required by accessibility regulations, unless otherwise indicated.

3.4 PROTECTION

- .1 Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Fire extinguishers.
- .2 Fire extinguisher cabinets.
- .3 Accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 04 22 00 - Concrete Unit Masonry: Roughed-in wall openings.
- .2 Section 09 22 16 - Non-Structural Metal Framing: Roughed-in wall openings.

1.3 REFERENCE STANDARDS

- .1 FM (AG) - Factory Mutual, Approval Guide current edition.
- .2 NFPA 10 - Standard for Portable Fire Extinguishers 2017.
- .3 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate sizes and locations of fire extinguisher cabinets with wall depths.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide extinguisher operational features, extinguisher ratings and classifications, colour and finish, anchorage details, installation instructions, and extinguisher cabinet features.
- .3 Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- .4 Manufacturer's installation instructions: Indicate special criteria and wall opening coordination requirements.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel and stainless steel content.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Maintenance data: Include test, refill or recharge schedules and re-certification requirements.

1.6 SITE CONDITIONS

- .1 Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

Part 2 Products

2.1 MANUFACTURERS

- .1 Fire extinguisher cabinets and accessories:
 - .1 Strike First; Elite Architectural series, fully-recessed, full glass door, fully stainless steel.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.2 FIRE EXTINGUISHERS

- .1 Fire extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - .1 Provide extinguishers labeled by ULC (DIR) or FM (AG) for purpose specified and as indicated.
- .2 Multipurpose dry chemical type fire extinguishers: Carbon steel tank, with pressure gauge.
 - .1 Class: A:B:C type.
 - .2 Size: 4.54 kg.
 - .3 Finish: Baked polyester powder coat, red colour.
 - .4 Temperature range: Minus 40 degrees C Minus 40 degrees C to 49 degrees C 49 degrees C.

2.3 FIRE EXTINGUISHER CABINETS

- .1 General: Provide products with recycled content.
- .2 Cabinet construction: Non-fire rated.
 - .1 Formed stainless steel sheet; 0.9 mm thick base metal.
- .3 Cabinet configuration: Fully recessed type.
 - .1 Size to accommodate accessories.
 - .2 Trim: Flat square edge.
- .4 Door: 0.9 mm metal thickness, reinforced for flatness and rigidity with roller type catch, and D-handle. Hinge doors for 180 degree opening with two butt hinge.
- .5 Door glazing: Full tempered glass door, clear, 3 mm thick, and set in resilient channel glazing gasket.
- .6 Cabinet mounting hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- .7 Weld, fill, and grind components smooth.
- .8 Finish of cabinet interior, exterior, and door: No. 4 - Brushed stainless steel.

2.4 ACCESSORIES

- .1 Extinguisher brackets: Formed steel, chrome-plated.
- .2 Cabinet signage: Fire Extinguisher (vertical decal).

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install cabinets plumb and level in wall openings, at heights shown in Section 10 06 22 - Accessory Mounting Schedule.
- .3 Secure rigidly in place.
- .4 Place extinguishers in cabinets.
- .5 Position cabinet signage on door as directed.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Metal wardrobe lockers.
- .2 Gear lockers.

1.2 REFERENCE STANDARDS

- .1 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's published data on locker construction, sizes and accessories, and colour chart.
- .3 Shop Drawings: Indicate locker plan layout, numbering plan.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Manufacturer's installation instructions: Indicate component installation assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Protect locker finish and adjacent surfaces from damage.

Part 2 Products

2.1 MANUFACTURERS

- .1 Wardrobe lockers:
 - .1 Hadrian; Emperor.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Gear lockers:
 - .1 Geargrid Corporation; GearGrid Fire Station Wall Mount Lockers, and Double-sided Lockers on GearGrid Tubular Frame Wall
 - .2 Substitutions: See Part B - Bidding Procedures.

2.2 WARDROBE LOCKERS

- .1 General: Provide products containing recycled content.
- .2 Metal lockers, wall-mounted with matching closed base, and free-standing with matching closed base.
 - .1 Width: 457 mm.

- .2 Depth: 610 mm.
- .3 Height: 1830 mm.
- .4 Configuration: Single tier.
- .5 Fittings:
 - .1 Hat shelf.
 - .2 Single shoe shelf.
 - .3 Coat rod.
 - .4 Hooks: Three single prong.
- .6 Ventilation: Louvres in locker frame or in door panel.
- .7 Locking: Padlock hasps, for padlocks provided by users.
- .3 Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 230, with Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
 - .1 Where ends or sides are exposed, provide flush panel closures (expansion trim) between end of lockers and adjacent wall.
 - .2 Colour: To be selected by Contract Administrator from manufacturer's standard range.
- .4 Locker body: Formed and flanged; with steel stiffener ribs; electric spot welded.
 - .1 Body (sides and back): 0.6 mm, minimum.
 - .2 Shelves, tops and bottoms: 0.76 mm, minimum.
 - .3 Z-base: 1.9 mm minimum.
 - .4 Metal base height: 100 mm.
- .5 Frames: Formed channel shape, welded and ground flush, welded to body, resilient bumper and latching for quiet operation.
 - .1 Door frame: 1.5 mm, minimum.
- .6 Doors: Hollow double pan, sandwich construction, 25 mm thick; welded construction, channel reinforced top and bottom with structural and sound-deadening honeycomb core, grind and finish edges smooth.
 - .1 Door outer face: 0.91 mm, minimum.
 - .2 Door inner face: 0.61 mm, minimum.
 - .3 Form recess for operating handle and locking device.
- .7 Hinges: Continuous piano hinge with powder coat finish to match locker colour.
- .8 Trim and dressed end panels: 0.9 mm, minimum.
- .9 Number plates: Provide rectangular shaped plastic plates. Form numbers in contrasting colour.

2.3 GEAR LOCKERS

- .1 General: Provide products containing recycled content.
- .2 Single-sided lockers: Above-floor wall mounted lockers.
 - .1 Locker frame: Heavy-duty steel tubing.
 - .2 Side and back grid: 6 mm dia. wire, 75 by 75 mm grid pattern.
 - .3 Shelves: Wire grid, two per locker; adjustable at 75 mm increments; top shelf complete with nameplate holder.
 - .4 Hooks: Three per locker.

- .5 Size: 457 mm wide by 610 mm by 1892 mm high.
- .6 Mounting: Steel wall brackets.
- .7 Finish: Powder-coated; colour selected by Contract Administrator from manufacturer's standard colour range.
- .3 Double-sided lockers: Above-floor tubular frame mounted lockers.
 - .1 Locker frame: Heavy-duty steel tubing.
 - .2 Side and back grid: 6 mm dia. wire, 75 by 75 mm grid pattern.
 - .3 Shelves: Wire grid, two per locker; adjustable at 75 mm increments; top shelf complete with nameplate holder.
 - .4 Hooks: Three per locker.
 - .5 Size: 457 mm wide by 610 mm (each side) by 1892 mm high.
 - .6 Horizontal frame: 100 by 100 mm HSS, mechanically fastened to vertical posts.
 - .7 Posts and baseplates: 100 by 100 mm HSS vertical post with 12.7 mm thick square baseplates, pre-drilled for anchoring to floor.
 - .8 Finish: Powder-coated; colour selected by Contract Administrator from manufacturer's standard colour range.

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble and install in accordance with manufacturer's instructions.
- .2 Place and secure wardrobe lockers on prepared base.
- .3 Install lockers plumb and square.
- .4 Secure lockers with anchor devices to suit substrate materials.
- .5 Bolt adjoining wardrobe locker units together to provide rigid installation.
- .6 Wardrobe lockers: Install end panels, filler panels, sloped tops, and trim.
- .7 Install fittings if not factory installed.
- .8 Replace components that do not operate smoothly.

3.2 CLEANING

- .1 Clean locker interiors and exterior surfaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Extra-heavy duty post type shelving.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's data sheets on each product to be used, including:
 - .1 Rated uniform shelf loads.
 - .2 Details of shelving assemblies, including reinforcement.
 - .3 Accessories.
 - .4 Assembly Installation methods.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Manufacturer's qualification statement.

1.3 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Inspect for dents, scratches, or other damage. Replace damaged units.
- .2 Store in manufacturer's unopened packaging until ready for installation.
- .3 Store under cover and elevated above grade.

Part 2 Products

2.1 EXTRA-HEAVY DUTY SHELVING

- .1 Products:
 - .1 Global Industrial (distributor); Extra Heavy Duty Shelving Model WB236640.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Steel post-and-shelf type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified. Provide products with recycled content.
 - .1 Unit width: 915 mm.
 - .2 Unit depth: 610 mm, minimum.
 - .3 Shelf capacity: Uniform distributed load of 1300 kg minimum.
 - .4 Adjustability of shelving: Continuous along length of post at 25 mm increments.
 - .5 Shelves per unit: Five, including top (four shelf openings).

- .6 Unit height: 2440 mm, overall , maximum.
- .7 Finish: Baked enamel, medium gloss.
- .8 Colour: Manufacturer's standard grey.
- .9 Number of units: As indicated on Drawings.
- .3 Posts: Formed sheet members; perforations may be exposed on face of members.
 - .1 Metal Thickness: 1.5 mm.
 - .2 Post shape: Angle posts forming corners.
 - .3 Post face width: 50 mm, maximum.
 - .4 Connecting hardware: Bolts.
- .4 Shelves: Formed sheet, finished on all surfaces .
 - .1 Shelf profile: Flanged edges all for sides, complete with channel reinforcement welded to underside of shelf.
 - .2 Shelf connection to posts: Bolts and nuts, four per corner.

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble and install in accordance with manufacturer's instructions.
- .2 Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required. Space shelves evenly.
- .3 Out-of-square tolerance: Maximum of 3 mm difference in distance between bottom shelf and top, measured along any post in any direction.

3.2 CLEANING

- .1 Clean shelving and surrounding area after installation.

3.3 PROTECTION

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of flagpoles on cast-in-place concrete piles.

1.2 RELATED SECTIONS

- .1 32 16 15 – Site Concrete

1.3 REFERENCES

- .1 American Society for Testing Materials (ASTM)
 - .1 ASTM B221 - Aluminum Alloy Extruded Bar, Rod, Wire, Shape and Tube.
 - .2 ASTM B241 - Aluminum and Aluminum Alloy Seamless Pipe and Seamless Extruded Tube.

1.4 SYSTEM DESCRIPTION

- .1 Tapered Aluminum Flagpole with internal halyard mechanism.
 - .1 Type: Ground set; tiltable.
 - .2 Pole Design: Cone tapered.
 - .3 Nominal Height: 10.67m, measured from ground.
 - .4 Halyard Internal type.
 - .5 Foundation: Cast-in-Place concrete pile as detailed on the Drawings.

1.5 PERFORMANCE

- .1 Pole with Flag Flying: Resistant without permanent deformation, 100 km/hr wind velocity, non-resonant, safety design factor of 2.5.
- .2 Pole without Flag: Resistant without permanent deformation, 145 km/hr wind velocity, non-resonant, safety design factor of 2.5.

1.6 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 Submit prefabricated product data and shop drawings:
 - .1 Indicate on shop drawings, foundations, detailed dimensions, base attachment details, anchor requirements and imposed loads.
 - .2 Provide data on pole, accessories, and configurations.
 - .3 Submit manufacturer's installation instructions.
 - .4 Indicate and list hardware and miscellaneous items.
 - .5 Submit shop drawing for custom flag. Artwork to be provided by Contract Administrator.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site, suitably packaged, clearly marked indicating manufacturer name and any other identifying symbols or information. Do not deliver materials long before they are required on site. Cause no delays to schedule.

- .2 Accept products of this section on site in new condition and verify no damage.
- .3 Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- .4 Leave protective covering in place until final cleaning of site. Provide instructions for removal of protective covering.
- .5 Protect flagpoles and accessories on site from damage or moisture.
- .6 Store materials in a dry location off the ground and prevent damage.
- .7 Replace all materials damaged, or unfit for use during delivery or storage.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Pole: aluminum 6063 alloy, T6 temper, 10.67m tall, cone tapered.
- .2 Finial Ball: aluminum, 150mm diameter.
- .3 Truck Assembly: cast aluminum, revolving, stainless steel ball bearings, non-fouling.
- .4 Halyard: Internal type; 8mm diameter stainless steel aircraft cable, locking cover. Removable hand crank.
- .5 Flag Attachment: stainless steel, neoprene covered counterweight and flag retaining loop.
- .6 Pole Base Attachment: tilting aluminum base with base cover.
- .7 Lightning Ground Rod: 3m long copper rod, 19mm Diameter.
- .8 Steel Surfaces in Contact with Concrete: asphaltic paint.
- .9 Concealed Steel Surfaces: galvanized to 380gm/m²
- .10 Aluminum: clear anodized.
- .11 Stainless: No. 4 satin finish.
- .12 Flag: 1143 x 2286mm, supplied by City of Winnipeg.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Ewing Flagpole or All Canadian Flagpole Co. or approved equal.

Part 3 Execution

3.1 RELATED WORK

- .1 Ensure that all related Work has been approved by the Contract Administrator prior to commencing site furniture installation.

3.2 INSTALLATION

- .1 Install flagpole, base assembly, and fittings in accordance with manufacturers instructions.
- .2 Electrically ground flagpole installation.
- .3 Install foundation plate and centering wedges for flagpoles base set on concrete base and fasten.

3.3 TOLLERANCES

- .1 Maximum variation from plumb – 25mm.

3.4 ADJUSTMENTS

- .1 Adjust operating devices so that halyard functions smoothly.
- .2 Clean with product specifically developed for stainless steel that will not mar or disfigure the railing finish.

3.5 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

EQUIPMENT DESCRIPTION						LOCATION		MECHANICAL						ELECTRICAL						KEY NOTES			
EQUIP #	DESCRIPTION	SIZE (W x D x H)	QTY	MODEL NO.	SUPPLIED BY	ROOM #	ROOM NAME	WATER		STEAM	DRAIN	GAS		EXHAUST		VOLTS	PHASE	KW	H.P.		RATED AMPS	DIRECT	PLUG TYPE
								HOT	COLD			MBH	SIZE	CFM	DUCT								
E01	COMMERCIAL ELECTRIC RANGE		1	IMPERIAL RANGE IR-6E	CONTRACT	202	KITCHEN									208	1	17.3	--	84	Yes	--	
E02	COMMERCIAL DISHWASHER	606mm x 635mm x 851mm	1	MOYER DIEBEL NEXUS N900 UNDERCOUNTER HIGH TEMPERATURE DISHWASHER	CONTRACT	202	KITCHEN									208	1	--	--	30	--	14-30P	
E03	GLASS SLIDING COMMERCIAL REFRIGERATOR	1207mm x 788mm x 1982mm	2	HABCO: SE46SXG STAINLESS XTERIOR DISPLAY REFRIGERATOR - SWING DOORS	CONTRACT	202	KITCHEN									120	1	--	--	4.3	--	5-15P	
E04	COMMERCIAL FREEZER	1226mm x 788mm x 1982mm	1	HABCO: SF46SA	CONTRACT	202	KITCHEN									120	1	--	--	2.7	--	5-15P	
E06	MICROWAVE (UNDERCOUNTER)	24" x 23" x 15 7/8"	2	Sharp SMD2477ASC 24 Inch Microwave Drawer Oven	CONTRACT	202	KITCHEN									120	1	1.7	--	15	--	5-20P	
E07	COFFEE MAKER				OWNER	202	KITCHEN		n/a														
E08	STACKABLE WASHER + DRYER	686mm x 749mm x 1880mm	1	MAYTAG COMBINATION STACKABLE WASHER AND DRYER- NON VENDING OPTIONS: MLE22PDAZW / MLE22PRAZW	CONTRACT	216	JANITOR / LAUNDRY																9
E09	PROJECTOR (SHORT THROW)		1	Optoma GT1080HDRx Short Throw Gaming Projector	OWNER	102	TRAINING CLASSROOM									120	1			15			
E10	PROJECTOR (PORTABLE)		1		OWNER	102	TRAINING CLASSROOM									120	1			15			
E11	COFFEE MAKER		1		OWNER	102	TRAINING CLASSROOM		n/a							120	1			15			
E12	DEFIBRILLATOR		1			102B	STORAGE																
E13	LOCK BOX (SURFACE MOUNT)	178mm x 127mm x 178mm	1	ELECTRONIC KNOXVAULT 4400 + SENTRALOK-A-SYSTEM	OWNER	118	AMBULANCE RESTOCK																
E14	GAS DETECTION BUMP SYSTEM				OWNER	115	HAZMAT EQUIP STORAGE									120	1			15			
E16	GEAR EXTRACTOR	826mm x 1108mm x 1410mm	1	UNIMAC 30 LB OPL WASHER 100G 200-240/50-60/1/3 # UCT030QNGXU70B000	OWNER	123	HOSE WASH		3/4"	1/2"	2 3/8"					208	3	--	3				6
E17	BOTTLE FILLING STATION	170cmX86cmX175c	1	JORDAIR : J-FFS-D8-4	OWNER	124	SCBA																
E18	BOTTLE FILLING COMPRESSOR	170cmX86cmX175c	1	FIRE-KAT6-181-3E	OWNER	124	SCBA																
E19	PRESSURE WASHERS			DA Lincoln	OWNER		APPARATUS BAYS 116									220				20			
E20	ELLIPTICAL		1		OWNER	200	FITNESS AREA																

GENERAL NOTES:

1. ALL SERVICE CONNECTION LOCATIONS TO BE COORD. WITH CONTRACTOR AND OWNER PRIOR TO CONSTRUCTION.

KEY NOTES:

- 1 ITEM TO BE INSTALLED BY OWNER. COORDINATE SCHEDULING OF INSTALLATION WITH OWNER PRIOR TO CONSTRUCTION.
- 2 ITEM TO BE CONNECTED TO GREASE INTERCEPTOR. REFER TO MECH.
- 3 CONFIRM ELEC. REQUIREMENTS ON SITE PRIOR TO CONSTRUCTION.
- 4 CUTSHEET MODEL STATES MINI-KAT6-1214-3E. OWNER TO CONFIRM COMPRESSOR MODEL AS POWER REQUIREMENTS MAY DIFFER.
- 5 COMPRESSOR IS AVAILABLE AT DIFFERENT 3PH VOLTAGES. OWNER TO CONFIRM WHAT IS BEING PURCHASED. 600V AND 208V ARE AVAILABLE.
- 6 OWNER TO CONFIRM WHETHER THE MODEL WILL BE 1, 3, OR 7 SPEED AND CONFIRM ELECTRICAL REQUIREMENTS.
- 7 INSTALLATION MANUAL PROVIDED. OWNER TO CONFIRM IF THIS IS REQUIRED, AND WHERE IT NEEDS TO GO.
- 8 SUGGESTED FUTURE ALLOWANCE IN MECH ROOM FOR STANADLONE STEAM GENERATOR, TO PROVIDE STEAM REQUIRED FOR GEAR WASHER.
- 9 OWNER TO CONFIRM ELECTRICAL REQUIREMENTS. CUTSHEET SAYS "N/A" FOR WASHER ELECTRICAL REQUIREMENTS
- 10 MECH TO PROVIDE EXHAUST FAN AND FRESH AIR INLET FOR ROOM COOLING AND COMPRESSOR AIR INTAKE PIPE ACCORDING TO INSTALL INSTRUCTIONS.

Part 1 General

1.1 SECTION INCLUDES

- .1 Commercial washer and dryer.
- .2 Connections to utilities.

1.2 RELATED REQUIREMENTS

- .1 Division 22 - Plumbing: Water service and drain connections

1.3 REFERENCE STANDARDS

- .1 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations 2021.
- .2 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, wiring diagrams, and Energy Star rating.
- .3 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention.
- .4 Sustainable design submittals: Submit evidence of ENERGY STAR labeling, manufacturer's published water use rates, or Integrated Water Factor (IWF) labeling..
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Operation data: Provide operating data for the specified equipment.
- .6 Maintenance data: Provide lubrication and periodic maintenance requirement schedules.
- .7 Warranty: Submit manufacturer warranty and ensure forms have been completed in City's name and registered with manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Store products clear of floor in a manner to prevent damage.
- .2 Coordinate size of access and route to place of installation.

1.6 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals, for additional warranty requirements.
- .2 Provide five year manufacturer warranty for replacement or repair of scheduled equipment, including disconnection and removal of defective unit, and connection of replacement unit.

Part 2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Comply with applicable codes for utility requirements.
- .2 Products requiring electrical connection: Listed and classified by CSA C22.1 as suitable for the purpose specified and indicated.

2.2 EQUIPMENT

- .1 Equipment Schedule: Refer to schedule at end of this section.
 - .1 Electrical wiring and components: Comply with ULC (DIR) listed product standards.
- .2 Installation accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify ventilation outlets, service connections, and supports are correct and in required location.
- .2 Verify that water service, and electric power is available and of the correct characteristics.

3.2 INSTALLATION

- .1 Install items in accordance with manufacturers' instructions.
- .2 Insulate to prevent electrolysis between dissimilar metals.
- .3 Use anchoring devices appropriate for equipment and expected usage.

3.3 ADJUSTING

- .1 Adjust equipment and apparatus to ensure proper working order and conditions.
- .2 Remove and replace equipment creating excessive noise or vibration.

3.4 CLEANING

- .1 Remove masking or protective covering from stainless steel and other finished surfaces.
- .2 Wash and clean equipment.
- .3 Polish glass, plastic, hardware, accessories, fixtures, and fittings.

3.5 PROTECTION

- .1 Remove protective coverings from prefinished work.
- .2 Protect finished work from damage.

3.6 COMMERCIAL LAUNDRY EQUIPMENT SCHEDULE

- .1 Stackable washer and dryer set - E07:
 - .1 Size: 686 mm wide by 751 mm deep (plus open door) by 1905 mm high.

- .2 Electrical: 240 V, 60 Hz.
- .3 Fuel type: Electric.
- .4 Washer: 88 litre capacity; 40 litres average total water usage per cycle; Energy Star certified.
- .5 Dryer: 190 litre capacity; 101 litres per second airflow.
- .6 Product:
 - .1 Maytag Commercial; Combination Stack Washer/Dryer Model MLE22PDAZW/MLE22PRAZW.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Foodservice equipment.
- .2 Connections to utilities.

1.2 REFERENCE STANDARDS

- .1 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- .2 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations 2021.
- .3 NSF 7 - Commercial Refrigerators and Freezers 2016.
- .4 NSF 51 - Food Equipment Materials 2017.
- .5 ULC (DIR) - Online Certifications Directory (Canada) Current Edition.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, and wiring diagrams.
- .3 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; evidence of ENERGY STAR labeling, manufacturer's published water use rates, or Integrated Water Factor (IWF) labeling; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Operation data: Provide operating data for the specified equipment.
- .6 Maintenance data: Provide lubrication and periodic maintenance requirement schedules.
- .7 Warranty: Submit manufacturer warranty and ensure forms have been completed in City's name and registered with manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Store products clear of floor in a manner to prevent damage.
- .2 Coordinate size of access and route to place of installation.

1.5 WARRANTY

- .1 See Section 01 78 10 - Closeout Submittals 01 78 00 - Closeout Submittals, for additional warranty requirements.

- .2 Provide one year manufacturer warranty for replacement or repair of scheduled equipment, including disconnection and removal of defective unit, and connection of replacement unit.
- .3 Refrigerators and freezers: Provide five year manufacturer warranty for replacement or repair of refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit; 45 months parts and 3 year labour warranty.

Part 2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Comply with applicable codes for utility requirements.
- .2 Products requiring electrical connection: Listed and classified by CSA C22.1 as suitable for the purpose specified and indicated.

2.2 EQUIPMENT

- .1 Equipment Schedule: Refer to schedule at end of this section.
 - .1 Cooler and freezer units: Listed by ULC (DIR).
 - .2 Electrical wiring and components and self-contained refrigeration systems: Comply with ULC (DIR) listed product standards.
- .2 Installation Accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

2.3 MATERIALS

- .1 Stainless steel sheet: ASTM A666 Type 304 commercial grade, No. 4 finish.

2.4 FINISHES

- .1 Stainless Steel: No. 4 finish.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify ventilation outlets, service connections, and supports are correct and in required location.
- .2 Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- .1 Install items in accordance with manufacturers' instructions.
- .2 Insulate to prevent electrolysis between dissimilar metals.
- .3 Use anchoring devices appropriate for equipment and expected usage.

3.3 ADJUSTING

- .1 Adjust equipment and apparatus to ensure proper working order and conditions.
- .2 Remove and replace equipment creating excessive noise or vibration.

3.4 CLEANING

- .1 Remove masking or protective covering from stainless steel and other finished surfaces.
- .2 Wash and clean equipment.
- .3 Polish glass, plastic, hardware, accessories, fixtures, and fittings.

3.5 PROTECTION

- .1 Remove protective coverings from prefinished work.
- .2 Protect finished work from damage.

3.6 FOODSERVICE EQUIPMENT SCHEDULE

- .1 Electric range - E01: Stainless steel front, sides, backguard, shelf, 127 mm deep landing ledge and kickplates; six 230 mm dia. round plate elements in solid top; four 150 mm dia. swivel casters.
 - .1 Size: 915 mm wide by 915 mm high to top of cooktop.
 - .2 Electrical: 208 V, single phase.
 - .3 Product:
 - .1 Imperial Range; Model IR-6-E.
- .2 Dishwasher - E02: Undercounter, high-temperature dishwasher with built-in 5kW booster heater; counter-balanced door; LCD control display; automatic fill at start-up, automatic cleaning at shutdown; pumped drain; 66 deg wash temperature, 82 deg C final rinse temperature to meet NSF sanitization requirements.
 - .1 Size: 530 mm wide by 850 mm high.
 - .2 Electrical: 208 V, 60 Hz, single phase.
 - .3 Capacity: 24 racks per hour.
 - .4 Total cycle time: 150 seconds.
 - .5 Water consumption: 5.3 litres per rack.
 - .6 Product:
 - .1 Moyer Diebel, Nexus Model N900.
- .3 Refrigerator - E03: Stainless steel front and sides, NSF 51-approved white aluminum liner with stainless steel coved corner floor; raised interior floor; self-closing swing doors with insulated safety glass, magnetic gaskets and hold-open feature; LED lighting; six wire coated shelves; self-contained bottom-mounted cassette forced-air refrigeration system removable from front of unit; designed to operate at set point between 1 and 4 degrees C; NSF 7 compliant, cUL listed, Energy Star rated. Provide 125 mm dia. swivel casters (two locking) per unit.
 - .1 Size: 1207 mm wide by 788 mm deep by 1982 mm high, not including casters.
 - .2 Electrical: 115 V, 60 Hz, single phase.
 - .3 Product:
 - .1 Habco; Stainless Xterior Display Refrigerator, Model SE46HCSXG.
- .4 Freezer - E04: Stainless steel front and sides, NSF 51-approved white aluminum liner with stainless steel coved corner floor; raised interior floor; self-closing swing door with hold-open feature, and large-grip recessed handle; automatic-actuated interior lighting; three adjustable shelves; non-removable split forced-air refrigeration system bottom-mounted accessible from front of unit; designed to operate at set point between 1 and 4 degrees C; NSF 7 compliant, cUL listed, Energy Star rated. Provide 125 mm dia. swivel casters (two locking) per unit.

- .1 Size: 607 mm wide by 788 mm deep by 1982 mm high, not including casters.
- .2 Electrical: 115 V, 60 Hz, single phase.
- .3 Product:
 - .1 Habco; Solid, Stainless Steel Xterior Freezer; Model SF24SX.
- .5 Microwave drawer oven - E06: Drawer style microwave oven with auto-touch drawer opening, digital LCD hidden control panel; built-in ready.
 - .1 Size: 610 mm wide.
 - .2 Capacity: 0.03 cu. m.
 - .3 Power: 950 Watts.
 - .4 Electrical: 120 V, 60 Hz, single phase.
 - .5 Product:
 - .1 Sharp; Model SMD2477ASC.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Front projection screen assemblies.
- .2 Projector suspended ceiling mount.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry: Wood blocking in ceilings.
- .2 Section 09 21 16 - Gypsum Board Assemblies: Suspended gypsum board ceilings for recessed screens.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's catalogue cuts and descriptive information on each product to be used, including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods.
- .3 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .4 Manufacturer's qualification statement.
- .5 Installer's qualification sStatement.
- .6 Operation and maintenance data: Provide manufacturer's operation and maintenance instructions.

1.4 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- .2 Installer qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
- .2 Store in a protected, clean, dry area with temperature maintained above 10 degrees C, and stack in accordance with manufacturer's recommendations.
- .3 Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

Part 2 Products

2.1 FRONT PROJECTION SCREENS

- .1 Front projection screens: Factory assembled unless otherwise indicated.
 - .1 In Training Room: Manual, matte light diffusing fabric screen, ceiling recessed.
 - .1 Screen viewing area: 1753 mm high x 3118 mm wide, by 3575 mm diagonal.
 - .2 Products: Model 85743C Advantage Manual with CSR Custom manufactured by Da-Lite Screen Company.
 - .3 Substitutions: See Part B - Bidding Procedures.
 - .2 Matte light diffusing fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
 - .1 Material: Matte white vinyl on fibreglass backing, with nominal gain of 1.0 over viewing angle not less than 60 degrees from axis, horizontally and vertically.
 - .2 Seams: No seams permitted in fabric up to 2440 mm high by 1830 mm wide.
 - .3 Products: Matte-White manufactured by Da-Lite Screen Company.
 - .3 Masking borders: Black, on left and right sides, and bottom.
 - .4 Extra drops: Black; 50 mm at tope.
 - .5 Concealed-in-ceiling screen cases: Aluminum, with integral roller brackets.
 - .1 Door slat: Self trim.
 - .2 Case Finish: Baked enamel.
 - .3 Case colour: White.
 - .4 End caps: Steel; finished to match case.
 - .6 Manually-operated screens:
 - .1 Roller: 44 mm steel; spring loaded with controlled screen return.
 - .2 Screen pull: Ring on bottom bar, complete with 965 mm long pull rod.
 - .3 Vertical tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
 - .7 Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.2 PROJECTOR SUSPENDED CEILING MOUNT

- .1 Universal suspended ceiling mount kit; with independent roll-pitch-yaw; micro-adjustable; UL listed; 15.9 kg capacity. Colour: white.
 - .1 Product: Chief; SYSAUW Suspended Ceiling Projector System.
 - .2 Substitutions: See Part B - Bidding Procedures.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate is finished and ready to accept screen installation.

- .2 Verify that openings for recessed screens are correctly sized.
- .3 Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.2 PREPARATION

- .1 Coordinate screen installation with installation of projection systems.
- .2 Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.3 INSTALLATION

- .1 Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.
- .2 Do not site cut screens.
- .3 Install screens in mountings as specified and as indicated on Drawings.
- .4 Install plumb and level.
- .5 Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

3.4 PROTECTION

- .1 Protect installed products until completion of project.
- .2 Touch up, repair, or replace damaged products before Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Interior, manually-operated window shades and accessories, referred to on Drawings as roller shades "RS".

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Ceiling pocket for window shade systems.

1.3 REFERENCE STANDARDS

- .1 ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2020.
- .2 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- .3 CAN/ULC S109 - Standard Method for Flame Tests of Flame-Resistant Fabrics and Films 2014 (Reaffirmed 2019).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate shade pockets with Section 09 21 16 - Gypsum Board Assemblies.
- .2 Sequencing:
 - .1 Do not fabricate shades until site dimensions for each opening have been taken.
 - .2 Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide manufacturer's standard catalogue pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- .3 Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, and mounting dimension requirements for each product and condition.
- .4 Selection samples: Include fabric samples in full range of available colours and patterns.
- .5 Verification samples: Minimum size 150 mm square, representing actual materials, colour and pattern.
- .6 Manufacturer's instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- .7 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used stainless steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.

- .8 Operation and maintenance data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of Shop Drawings.

1.6 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- .2 Handle and store shades in accordance with manufacturer's recommendations.

Part 2 Products

2.1 MANUFACTURERS

- .1 Manually-operated roller shades:
 - .1 Altex SunProject; Deko Lite-Lift Open Roll OR45.
 - .2 Substitutions: See Part B - Bidding Procedures.
- .2 Shade fabric:
 - .1 Altex TexOpaque Eco 6100 Blackout.
- .3 Source limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 WINDOW SHADE APPLICATIONS

- .1 Interior roller shades at locations indicated: Blackout shades.
 - .1 Type: Roll down, closed position is at window sill.
 - .2 Fabric: 100 percent polyester with PVC-free acrylic backing.
 - .3 Fabric performance requirements:
 - .1 Openness factor: 0 percent.
 - .2 Solar transmittance (Ts): 0.
 - .3 Visible light transmittance (Tv): 0.
 - .4 Solar absorption (As): 32.
 - .5 Solar reflectance (Rs): 68.
 - .4 Colour: As selected by Contract Administrator from manufacturer's full range of colours.
 - .5 Mounting: Outside in ceiling pocket, unless otherwise indicated.
 - .6 Operation: Manual.

2.3 ROLLER SHADES

- .1 Roller shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
 - .1 Drop: Regular roll.
 - .2 Size: As indicated on Drawings.

- .2 Fabric: Non-flammable, colour-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - .1 Blackout shades: Block virtually all the light; Openness Factor equal to zero (0).
 - .2 Flammability: Compliant with CAN/ULC S109.
 - .3 Fungal resistance: No growth when tested according to ASTM G21.
- .3 Roller tubes: As required for type of operation.
 - .1 Material: Extruded aluminum in accordance with ASTM B429/B429M or galvanized steel; as required for shade location.
 - .2 Size: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.
 - .3 Fabric attachment: Use extruded channel in tube to accept vinyl spline welded to fabric edge.
- .4 Hembars: Designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.
 - .1 Style: Exposed aluminum bottom bar, manufacturer's standard profile with closed ends, containing a spline groove top to receive and secure fabric end.
- .5 Manual operation for interior shades: Clutch operated continuous loop; beaded ball chain; allowing for ability to lower shade by pulling on hembar without damage to clutch or spring.

2.4 ACCESSORIES

- .1 Fascias: Size as required to conceal shade mounting.
 - .1 Style: As selected by Contract Administrator from shade manufacturer's full selection.
 - .2 Location: North window in Day Room 203.
 - .3 Material and colour: Aluminum; white.
- .2 Ceiling pocket closure: Extruded aluminum, complete with hanger; closure notched to avoid interference with chain. Finish: Powder-coated, colour white.
- .3 Brackets and mounting hardware: As recommended by manufacturer for mounting configuration and span indicated.
- .4 Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.5 FABRICATION

- .1 Site measure finished openings prior to ordering or fabrication.
- .2 Fabricate shades to fit openings within specified tolerances.
 - .1 Vertical dimensions: Fill openings from head to sill; extend shade fabric 50 mm beyond sill.
 - .2 Horizontal dimensions - Outside mounting: Extend shade fabric 25 mm beyond jambs on each side.
- .3 Dimensional tolerances: As recommended in writing by manufacturer.
- .4 At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centres; butt rollers end-to-end.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine finished openings for deficiencies that may preclude satisfactory installation.
- .2 Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- .1 Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

- .1 Install in accordance with manufacturer's instructions and reviewed Shop Drawings, using mounting devices as indicated.
- .2 Installation tolerances:
 - .1 Inside mounting: Maximum space between shade and jamb when closed of 3 mm.
 - .2 Maximum offset from level: 1.5 mm.
- .3 Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

- .1 Clean soiled shades and exposed components as recommended by manufacturer.
- .2 Replace shades that cannot be cleaned to "like new" condition.

3.5 PROTECTION

- .1 Protect installed products from subsequent construction operations.
- .2 Replace damaged products before Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Manufactured standard and custom stainless steel casework, with cabinet hardware.
- .2 Countertops
- .3 Wall-hung vanity tops.
- .4 Integral sinks.
- .5 Kitchen exhaust cover.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Wall-hung vanity top supports, brackets.
- .2 Section 07 92 00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls.
- .3 Section 12 46 33 - Waste Receptacles
- .4 Division 22 - Plumbing: Top-mount sinks, faucets, and other plumbing fixtures; connection to supply and waste piping to integral sinks.

1.3 REFERENCE STANDARDS

- .1 ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- .2 ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- .3 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- .4 CAN/CSA O121 - Douglas Fir Plywood 2017 (Reaffirmed 2022).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate brackets, blocking and backing in partitions.
 - .2 Coordinate mechanical and electrical requirements for plumbing and electrical services, fittings, and fixtures and for rough opening dimensions required for installation.
 - .3 Coordinate installation of casework with appliances and equipment.
 - .4 Coordinate drawer sizes to accommodate waste and recycling receptacles specified in Section 12 46 33.
- .2 Preinstallation meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Component dimensions, configurations, construction details, joint details, and attachments; manufacturer's catalogue literature on hardware, accessories, and service fittings, if any.

- .3 Shop Drawings:
 - .1 Indicate casework types, sizes, locations, using large scale plans, elevations, cross sections. Include rough-in and anchors, placement dimensions and tolerances and clearances required.
 - .2 Include layout of units with relation to surrounding walls, doors, windows, in-wall electrical outlets, appliances, and other building components.
 - .3 Indicate locations of hardware.
 - .4 Include rough-in, anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations.
- .4 Samples:
 - .1 Submit two samples of stainless steel countertop material with welded seam in centre of sample illustrating finish. Minimum sample size: 150 mm by 150 mm.
 - .2 Submit exposed cabinet fasteners, hardware and accessories: One unit for each type and finish.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, re-used stainless steel content; sustainably harvested wood; product labels, and VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .6 Manufacturer's qualification statement.
- .7 Maintenance data: Manufacturer's recommendations for care and cleaning.

1.6 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- .2 Single source responsibility: Provide work of this Section manufactured or furnished by a single casework company for single responsibility.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Protect items provided by this section during handling and installation, including finished surfaces and hardware items. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.
- .2 Coordinate size of access and route to place of installation.

Part 2 Products

2.1 CABINET FABRICATION

- .1 Assembly: All-welded construction. Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
 - .1 Provide cutouts for mechanical and electrical services where required.
- .2 Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.

-
- .1 Style: Flush overlay - square edge.
 - .2 Primary cabinet material: Stainless steel.
 - .3 Cabinet nominal dimensions: Unless otherwise indicated, provide cabinets of widths, heights and depths indicated on Drawings.
 - .4 Stainless steel sheet metal:
 - .1 Door and drawer fronts, cabinet floor, cabinet sides, gables, front and back panels, gusset plates; service, filler and cover panels; aprons, and rails: 1.59 mm minimum thickness.
 - .2 Drawer bodies, removable back panels, shelves, filler panels, backing sheet to doors and drawer fronts: 1.21 mm minimum thickness.
 - .5 Structural performance: Provide components that safely support the following minimum loads, without deformation or damage:
 - .1 Base units: 750 kg/linear metre across the cabinet ends.
 - .2 Drawers: 60 kg.
 - .3 Shelves: 45 kg.
 - .4 Work surfaces: 90 kg concentrated load.
 - .6 Corners and joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
 - .7 Edges and seams: Smooth. Form counter tops and shelves from continuous sheets.
 - .8 Shelf edges: Turned down 19 mm on each side and returned 19 mm front and back.
 - .9 Shelves: Adjustable and fixed shelves; reinforced with a stainless steel channel welded to underside of shelf.
 - .1 Adjustability: 13 mm increments.
 - .10 Ends: Close open ends with matching construction.
 - .11 Welding: Electric spot welded; joints ground smooth and flush.
 - .12 Drawers and doors: Fabricate 19 mm thick drawer and door fronts of sandwiched sheets of stainless steel welded together and reinforced for hardware.
 - .1 Fill with sound-deadening core.
 - .2 Reinforce hinge side of doors.
 - .13 Drawer bodies: Fabricate in one-piece stainless steel construction including the bottom, two sides, back and inner front. Provide bend on top edges.
 - .14 Fittings and fixture locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
 - .15 Access panels: Where indicated, for maintenance of utility service fixtures and fittings and mechanical and electrical components.
 - .16 Fixed panels at backs of open spaces between base cabinets.
 - .1 Cutouts for power receptacles where indicated on Drawings.
 - .17 Filler panels: Flanged on both sides, of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
 - .18 Feet: Stainless steel clad adjustable bullet feet. Provide removable stainless steel kick plate with spring clamp at kitchen base cabinets; same material and finish as cabinets.
 - .19 Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.
- .3 Kitchen exhaust cover above range hood: Fabricate from minimum 1.59 mm thick stainless steel sheet; removable where indicated for range hood maintenance access.

2.2 CABINET HARDWARE AND ACCESSORIES

- .1 Stainless steel of manufacturer's standard types, styles except as otherwise specified.
- .2 Swinging doors:
 - .1 Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
 - .1 Concealed hinges: Installed in cabinet edge, and on door back.
 - .1 European-style hinges for overlay doors: 105 degree opening angle, soft-closing type, Type 304 stainless steel; complete with mounting plates.
 - .2 Door pulls: Type 304 stainless steel bar pull; 14 mm dia.; matte finish, 370 mm long (320 mm c/c hole spacing).
 - .1 Product: Hafele; Verdana Collection #117.05.640.
 - .3 Stop silencers: Rubber, at top and bottom of hinged doors on closing edge to align door and silence its closing.
- .3 Drawers: Pulls and slides.
 - .1 Drawer pulls: Type 304 stainless steel bar pull; 14 mm dia.; matte finish, 274 mm long (224 mm c/c hole spacing) at drawer to right of stove in Kitchen 202, 370 mm long (320 mm c/c hole spacing) elsewhere.
 - .1 Product: Hafele; Verdana Collection #117.05.630 and #117.05.640.
 - .2 Slides: Steel, full extension arms, ball bearings; soft-closing, heavy-duty capacity.
- .4 Mask hooks: Stainless steel, single prong, profile to be confirmed.
- .5 Paper towel holder: Custom fabricated; undercabinet mounted.

2.3 COUNTERTOPS AND WALL-HUNG VANITY TOPS

- .1 Stainless steel countertops: ASTM A666, Type 304, stainless steel sheet; 1.59 mm minimum nominal sheet thickness, with plywood substrate.
 - .1 Finish: No. 4 satin brushed finish.
 - .2 Exposed edge shape:
 - .1 Straight turndown with return; 25 mm high face, 12 mm return to form drip edge.
 - .3 Back and end splashes: Same material; welded 6 mm radius coved joint to countertop; angled or square top edge as indicated and minimum 12 mm turndown.
 - .1 Splash depth where faucets are mounted in splash: 50 mm.
 - .2 Splash height: As indicated.
 - .4 Welding filler rods: of same composition as base material.
 - .5 Grind and polish factory- and field welds to provide invisible joint.
 - .6 Provide vertical stainless steel support for deck-mounted pre-rinse spray-arm.
- .2 Fabricate countertops up to 3650 mm long in one piece including nosing and back and end splashes; accurately fitted mechanical site joints in lengths over that dimension are permitted.
 - .1 Weld joints; grind smooth and polish to match.
 - .2 Finish exposed edges and surfaces in same manner as specified for work surface.
 - .3 Provide wall clips for support of back/end splash turndowns.

- .4 Cut holes for service fixtures, fittings, accessories, and equipment.
- .5 Provide waterfall edges where indicated, of same construction as countertops. Provide horizontal-to-vertical joint without seam. Mitre exposed front edge at corners.
- .3 Integral sinks: Same material, same thickness as countertop; bottom sloped to outlet; radiused interior corners; drain outlet location as indicated. Factory-punch holes for fittings, and flush weld sinks to countertops.
 - .1 Bowl size and drain:
 - .1 Hose Wash 123: Double bowl, each compartment 510 mm wide by 600 mm front-to-back by 350 mm deep; centre drain.
 - .2 Kitchen 202: Double bowl, each compartment 450 mm wide by 450 mm front-to-back by 350 mm deep; back corner drain.
 - .3 Kitchen 202: Single bowl, 460 mm wide by 400 mm front-to-back by 200 mm deep; centre drain.
 - .2 Equip integral sinks with stainless steel tailpieces, 89 mm dia. stainless steel strainer assemblies, and plug unless otherwise indicated.
 - .3 Outlets: 38-mm diameter, 150-mm minimum length, fabricated of same material as sink. Provide strainers at outlets.

2.4 MATERIALS

- .1 Stainless steel:
 - .1 Provide products having recycled content.
 - .2 Stainless steel sheet: ASTM A666 Type 304.
 - .3 Stainless steel tubing: ASTM A269/A269M, commercial grade, seamless welded.
 - .4 Stainless steel bars, and shapes: ASTM A276/A276M.
- .2 Wood-based components:
 - .1 Wood fabricated from old growth timber is not permitted.
 - .2 Provide sustainably harvested wood, certified or labeled.
 - .3 Plywood for supporting substrate: Douglas Fir Plywood, CAN/CSA O121, Grade G1S, Exterior; minimum 19 mm thick; join lengths using metal splines.
- .3 Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- .4 Sound deadening material: Inorganic, for sandwich panel fabrication.

2.5 FINISHES

- .1 Stainless steel: No. 4 finish.
- .2 Shop finish all components.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify adequacy of support framing and anchors.
- .2 Verify that service connections are correctly located and of proper characteristics.

3.2 INSTALLATION

- .1 Install casework, components and accessories in accordance with manufacturer's instructions.
- .2 Large components: Ensure that large components can be moved into final position without damage to other construction.
- .3 Use anchoring devices to suit conditions and substrate materials encountered.
- .4 Set casework items plumb and square, securely anchored to building structure, with no distortion.
 - .1 Base cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 13 mm leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
 - .2 Wall cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
 - .1 Maximum variation of finished gypsum board surface from true flatness exceeds 3 mm in 3 m in any direction.
- .5 Align cabinets to adjoining components.
- .6 Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1.6 mm. In addition, do not exceed the following tolerances:
 - .1 Variation of tops of base cabinets from level: 1.6 mm in 3 m.
 - .2 Variation of bottoms of upper cabinets from level: 3 mm in 3 m .
 - .3 Variation of faces of cabinets from a true plane: 3 mm in 3 m.
 - .4 Variation of adjacent surfaces from a true plane (Lippage): 0.8 mm.
 - .5 Variation in alignment of adjacent door and drawer edges: 1.6 mm.
- .7 Securely attach countertops to cabinets using concealed stainless steel fasteners and clips. Make flat surfaces level; shim where required. Do not exceed the following tolerances:
 - .1 Variation from horizontal: 3 mm in 3 m, maximum.
 - .2 Offset from wall, countertops: 3 mm maximum; 1.5 mm minimum.
 - .3 Site joints: 1.5 mm wide, maximum.
- .8 Separate dissimilar metals to prevent galvanic action.
- .9 Seal joint between countertop and vertical surfaces, or between back/end splashes and vertical surfaces with small continuous bead of sealant.
- .10 Site touch-up blemishes to original finish.

3.3 ADJUSTING

- .1 Adjust operating parts, including doors, drawers, hardware, fixtures to function smoothly.

3.4 CLEANING

- .1 Clean casework, counters, shelves, legs, hardware, fittings and fixtures.

3.5 PROTECTION

- .1 Do not permit finished casework to be exposed to continued construction activity.

- .2 Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.
- .3 Repair damage that occurs prior to Date of Substantial Performance, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Waste and recycling receptacles.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data indicating colour, and component dimensions.

Part 2 Products

2.1 WASTE AND RECYCLING RECEPTACLES

- .1 Waste: Polyethylene construction with built-in corner tabs for securing trash bags; 56.78 litre capacity, 267 mm long by 508 mm wide by 629 mm high. Colour: Grey.
 - .1 Product: Carlisle Food Service Product: TrimLine Rectangle Waste Container.
- .2 Recycling: Polyethylene construction with built-in corner tabs for securing recycling bags; 56.78 litre capacity, 267 mm long by 508 mm wide by 629 mm high; international "recycling" symbol. Colour: Blue..
 - .1 Product: Carlisle Food Service Product: TrimLine Rectangle Recycle Waste Container 342015REC14.

Part 3 Execution

3.1 INSTALLATION

- .1 Install waste receptacles in cabinets where indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Carpet mat.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data indicating properties of walk-off surface, component dimensions.
- .3 Samples: Submit two samples, 150 by 150 mm in size illustrating pattern, colour, finish, and edging.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment, and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.
- .5 Maintenance data: Include cleaning instructions, and stain removal procedures.

Part 2 Products

2.1 MATS

- .1 Carpet mat: Polypropylene needlepunch loop pile construction with Berber (hobnail) style wiper/scrapper surface, permanently bonded to rubber backing; 1220 mm wide by length indicated with tapered 32 mm black matching heavy-duty rubber edging on all edges.
 - .1 Face weight: 1790 g/sq. m.
 - .2 Total weight: 2914 g/sq. m.
 - .3 Colours: To be selected by Contract Administrator from manufacturer's standard range.
 - .4 Product:
 - .1 Edgewood Matting; Supreme Knob.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.2 FABRICATION

- .1 Fabricate mats in single unit sizes; fabricate multiple mats where indicated on Drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Install walk-off surface after cleaning of finish flooring.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Tool repair work bench.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Component materials and finishes, dimensions, configurations, and assembly instructions.
- .3 Manufacturer's installation instructions.
- .4 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used stainless steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Protect finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Description: L-shape work station; steel channel frame, single lockable drawer, 355 mm deep shelf below base table, table-top mounted uprights, solid wood top; complete with hardware, accessories, and fasteners required for assembly.
 - .1 Size:
 - .1 Base table: 2440 mm wide by 760 mm deep.
 - .2 Return: 1220 mm wide by 760 mm deep.
 - .2 Height: Adjustable from 760 to 940 mm, in 38 mm increments.
 - .3 Capacity: 450 kg, distributed evenly.
 - .4 Top: Solid Maple, 45 mm thick, square edges.
 - .5 Uprights: 1220 mm high fastened to work top, for mounting shelves, panels and accessories.
 - .6 Steel finish: Powder-coated.
 - .7 Accessories: Bin rail (1), shelf (1), panels (2), drawer (1).
 - .8 Product:
 - .1 U-Line (distributor) Deluxe L-Shaped Workstation, Model No. H-9629-MAP.
 - .2 Substitutions: See Part B - Bidding Procedures.

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble and install in accordance with manufacturer's written instructions. Confirm orientation of return table, and work top height with Contract Administrator before assembling.
- .2 Set tool bench plumb, square and level. Align top of base table and return table.

3.2 ADJUSTING

- .1 Adjust drawer for smooth operation.

3.3 CLEANING

- .1 Clean tool bench frame and work top surfaces thoroughly.

3.4 PROTECTION

- .1 Protect installed work bench from subsequent construction operations.
- .2 Protect work bench and work top from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on work bench.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Indoor bicycle racks.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's data sheets on each product to be used, including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods.
- .3 Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.
- .4 Selection Samples: For each finish product specified, colour chips representing manufacturer's full range of available colours and patterns.
- .5 Sustainable design submittals: Submit evidence of product life cycle assessment; and compliance of sustainable materials attributes, including but not necessarily limited to pre-consumer and postconsumer recycled content, and re-used steel content; and compliance with VOC-content and VOC-emission requirements.
 - .1 Refer to Section 01 33 29.03 - Sustainable Design Reporting - Green Globes.
 - .2 Refer to Section 01 35 66.13 - Sustainability Certification Procedures - Green Globes.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Store products in manufacturer's unopened packaging until ready for installation.
- .2 Handle racks with sufficient care to prevent scratches and other damage to the finish.

Part 2 Products

2.1 MANUFACTURERS

- .1 Indoor bicycle racks:
 - .1 Madrax; Wall-Rack; Model WRK-1-WM-G.
 - .2 Substitutions: See Part B - Bidding Procedures.

2.2 BICYCLE RACKS

- .1 Indoor bicycle racks: Device designed for indoor storage of bicycles; allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
 - .1 Style: Indoor, wall mounted, single level, vertical storage rack with locking loop.
 - .2 Capacity: One bicycle per rack; total four.
 - .3 Finish: Hot-dipped galvanized, maintenance-free and weather-resistant.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine surfaces to receive bicycle racks.
- .2 If substrate preparation is the responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.
- .3 Do not begin installation until unsatisfactory substrates have been properly repaired.

3.2 PREPARATION

- .1 Ensure surfaces to receive bicycle racks are clean, flat, and level.

3.3 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install bicycle racks level, plumb, square, and correctly located as indicated on Drawings.
- .3 Expansion anchor system: Prepare drilled holes, clean and dry holes, and install anchors and fastenings in accordance with manufacturer's written instructions.

3.4 CLEANING

- .1 Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.5 PROTECTION

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 Words and Terms

- .1 Conform to definitions and their defined meanings as in Section 01 19 00.
- .2 Refer to Section 01 19 00 for Specification Grammar.
- .3 Conform to the following definitions and their defined meanings in addition to those referenced in Section 01 19 00:
 - .1 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
 - .2 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.
 - .3 Provide: Wherever the term "provide" is used in relationship to equipment, piping and other materials specified for the work, it means "supply, install and connect". Wherever the terms "provide" is used in connection with services such as testing, balancing, start-up, preparation of drawings for any part of the work, it means procure, prepare, supervise, take responsibility for, and pay for these services.
 - .4 Typical: A representative characteristic that is standard for all installations whether individually noted or not throughout the documents. "Typical" applies to each individual or combined installation except where specifically noted or otherwise indicated that the application is non-typical.
 - .5 Exposed: Any work not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors, in closets or cupboards or under counters is considered exposed.
 - .6 New: Produced from new materials.
 - .7 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
 - .8 Defective: A condition determined exclusively by the Contract Administrator.

1.2 Contract Documents

- .1 Drawings, specifications, and schedules are complementary to each other and what is called for by one will be binding as if called for by all.
- .2 Should any discrepancy appear between the drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of the plans, and specifications, the Contractor shall obtain a ruling in writing from the Contract Administrator in writing before submitting the bid. If this is not done it will be assumed that the most expensive alternative has been included in the bid price.
- .3 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and will not be used as an excuse for deficiencies or

omissions. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass, while adequate space is allowed for service, maintenance, repair, or replacement for all equipment.

- .4 Drawings indicate general location and route of new and existing mechanical systems. The review of exact location and routing of systems prior to bidding is the responsibility of the Contractor. Install piping and duct systems not exactly shown in plan or indicated by note, by graphic, or diagrammatically in schematic or riser diagrams to provide an operational assembly or system.
- .5 Install components to physically conserve headroom, to minimize furring spaces, to accommodate installed Work, or other obstructions.
- .6 Install ceiling mounted or exposed mechanical components such as diffusers, sprinkler heads and grilles in accordance with reflected ceiling drawings or floor plans.
- .7 Locate devices with primary regard for convenience of operation and usage.
- .8 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional Work beyond Work described, to be brought to the attention of the Contract Administrator.
- .9 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.3 Description of the Work

- .1 Division of the Work among other contractors, subcontractors, suppliers or vendors is solely the Contractor's responsibility. Neither The City nor Contract Administrator assumes any responsibility to act as an arbiter to establish subcontract terms or disagreements between sectors or disciplines of the Work.

1.4 Contract Method

- .1 Construct Work under the contract requirements in the applicable Division 00 sections.
- .2 Contract Documents were prepared by the Contract Administrator for The City. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. The Contract Administrator accepts no responsibility for any damages suffered by any third party as a result of decisions made or actions based on the Contract Documents.

1.5 Permits, Inspection and Testing

- .1 File all necessary notices and approved layouts, obtain and pay for all Local Authority and Fire Underwriters Inspections, approvals and permits applicable to each Mechanical Section. Make changes required to secure Local Authorities approval, without extra cost. Where conflicting requirements occur, comply with most stringent regulation. Note that requirements shown or specified may exceed minimum standards set by Local Authorities.

- .2 The Regulations of the A.S.M.E. Code and the Provincial Labour Department shall cover the design, manufacture, installation, welding and tests of piping and other equipment as specified hereafter.
- .3 Obtain Registration Certificates for all pressure vessels, with suitable metal-framed glass covers installed where directed. Furnish all certificates required by Local Authorities before acceptance of building by The City.
- .4 The City may request the Mechanical Section to operate device or material installed for such time as Contract Administrator may require, as a thorough test, before final acceptance. Such tests shall not be construed as evidence of acceptance, and no claim for cost of such operation for test, or damage due to inadequacy or defect will be recognized.
- .5 Note that site reviews by the Contract Administrator are for the purpose of determining in general if the work is proceeding in accordance with the Contract Documents, and to endeavour to guard The City against defects and deficiencies and not to superintend the execution of the work, which is the Mechanical Contractor's and their Subcontractors' responsibility.

1.6 Examination

- .1 Examine all contract documents to ensure work can be performed without changes to the Work as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences have been brought to Contract Administrator's attention in writing, prior to bid closing.
- .2 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation as shown on the drawings.
- .3 Verify the locations and inverts of service lines leaving and entering building to ensure their proper function prior to commencing work.

1.7 Closeout Submittals

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Four weeks prior to Substantial Performance of the Work, submit to the Contract Administrator digital copies of operating and maintenance manuals and record drawings in Canadian English.
- .3 Copy will be returned with Contract Administrator's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator final digital copies of operating and maintenance manuals and record drawings, revised as per Contract Administrator's comments.
- .6 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.
- .7 Summary audit documents associated with requirements for Green Globes classification documentation.

- .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 On Contract Administrator's acceptance of the operating and maintenance manuals and record drawings, produce two hard copies of the closeout documents and ship to The City. Pay costs of transportation. Provide digital copy to City by electronic file transfer or physical media.

1.8 O eration and Maintenance Manual

- .1 Format – Hard Copy
 - .1 Refer also to Section 01 78 10 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 10.
 - .2 Organize data in the form of an instructional manual.
 - .3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.
 - .4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
 - .5 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
 - .6 Arrange content by systems under Section numbers and sequence of Table of Contents.
 - .7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .8 Text: Manufacturer's printed data, or typewritten data.
 - .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .2 Contents - Each Volume
 - .1 Refer also to Section 01 78 10 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 10.
 - .2 Table of Contents: Provide:
 - .1 Title of project.
 - .2 Date of submission.
 - .3 Names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
 - .3 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
 - .5 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

- .6 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate. pressure vessel acceptance.
- .7 Review Reports
- .8 CO's and RFI's
- .9 Training: Refer to Demonstration and Training in this Section.

1.9 Recordin Actual Site Conditions

- .1 Record information on a full-sized set of drawings, and within the Project Manual.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by change orders.
 - .5 Details not on original Contract Drawings.
 - .6 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.

1.10 Record Docu ents

- .1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:
 - .1 Drawings: Scan the full-sized field-verified as-built drawing set and save to PDF format. Scans shall be in colour and with good resolution to ensure drawings and markups are legible.
 - .2 Specifications: Adobe Acrobat (PDF).
- .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.
- .3 Submit completed record documents to Contract Administrator on physical electronic media or by electronic transfer.

1.11 Warranties and Bonds

- .1 Refer to Section 01 78 10 for Warranties and Bonds.

1.12 Fa rication and Wor ans i

- .1 Employ skilled mechanics in their respective trades, under competent supervision, and where required by Provincial or Local regulations holder of acceptable qualification certificates.

1.13 Qualit Assurance

- .1 Provide testing organization services as specified in subsequent Sections.
- .2 Testing organization: Current member in good standing of their respective professional or industry organization and certified to perform specified services.
- .3 Comply with applicable procedures and standards of the certification sponsoring association.
- .4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.
- .5 Qualifications:
 - .1 Provide adequate workforce training through meetings and demonstrations.
 - .2 Provide a designated experienced person on site with de-construction experience throughout the project for consultation and supervision purposes.

1.14 De onstration and Trainin

- .1 Refer also to Section 01 79 00 for Demonstration and Training. Where there is a discrepancy with this section, follow the requirements of 01 79 00.
- .2 Instruct The City's designated employees in proper care, operation, use and maintenance of all systems and equipment, and provide general explanatory literature required and start up supervision and instructions.
- .3 Provide two weeks prior notice to The City to schedule the training.
- .4 The City will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
- .5 Upon completion of instructions, forward to Contract Administrator with a copy to The City a letter indicating person instructed and dates that the instruction took place. If in Contract Administrator's opinion, this is not done satisfactorily, Contract Administrator may direct such instruction, and charge all costs involved to relevant section.

1.15 Conditions or De onstrations

- .1 Equipment has been inspected and put into operation in accordance with related sections.
- .2 Testing, adjusting, and balancing have been performed and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.16 Shop Drawings - Administrative Requirements

- .1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepmann.com.
- .2 Shop drawing documents shall be grouped by specification section. Clearly list the specification section on the front page or cover sheet of the submittal. Shop drawings related to multiple sections may not be grouped together into a single document. Documents that are groups incorrectly will be returned without being examined and shall be considered rejected.
- .3 Each drawing shall include the name of project as found on the drawings or specifications, the equipment supplier and the specification section that the equipment is specified under.
- .4 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Work affected by submittal shall not proceed until review is complete.
- .6 Present Shop Drawings, product data, samples and mock-ups in SI Metric and/or Imperial inch-pound units, to match the units used in the schedules.
- .7 Review submittals prior to submission to Contract Administrator. 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.
- .8 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .9 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .10 Verify field measurements and affected adjacent Work are coordinated.
- .11 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .12 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .13 Keep one reviewed copy of each submission on site.

1.17 Shop Drawings and Product Data Submissions

- .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 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated,

regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications. Indicate layouts, quantity, details of equipment, control wiring diagrams, sizes, capacities and roughing in and exact requirements for concrete pits, bases and other supporting members.

- .3 Each shop drawing must be certified by manufacturer and as such shall indicate that all product engineering has been performed to ensure the product will meet the requirements of the intended installation.
- .4 Shop drawings for grilles, registers and diffusers shall be accompanied by an itemized list indicating the unit locations by room number and the unit size.
- .5 Allow fifteen working days for Contract Administrator's review of each submission.
- .6 Adjustments made on Shop Drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .7 Make changes in Shop Drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of any revisions other than those requested.
- .8 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .9 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.

- .7 Operating weight.
- .8 Wiring diagrams.
- .9 Single line and schematic diagrams.
- .10 Relationship to other parts of the Work.
- .10 After Contract Administrator's review, distribute copies.
- .11 Submit one copy of Shop Drawings as a pdf document by email attachment for each requirement requested in specification Sections and as Contract Administrator may reasonably request. Any electronic copy of shop drawings shall bear all the required marks of certification and approval by the manufacturer and contractor(s) as indicated above. The Contract Administrator will review and mark up one copy of the shop drawing, and return to the contractor by email attachment. The contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.
- .12 Submit one electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product. Submittals shall be submitted as a pdf document by email attachment, or delivered as a hard copy. Any electronic copy of shop drawings shall bear all the required marks of certification and approval by the manufacturer and contractor(s) as indicated above.
- .13 Delete information not applicable to project.
- .14 Supplement standard information to provide details applicable to project.
- .15 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, one electronic copy will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed. The contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.
- .16 Checking of shop drawings by the Contract Administrator does not constitute acceptance of responsibility. Such checking constitutes assistance only to the Mechanical Division in the proper execution of their work.

1.18 Product Changes Substitutions

- .1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders, and Division 01 Product Exchange Procedures Division 01 Substitutions Sections. In case of a discrepancy between this section and Division 00 and Divisions 01, the more stringent requirements shall apply.
- .2 The Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- .3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

- .4 Any substituted item submitted for consideration must not exceed the available space and weight limitations, and all additional costs for mechanical, electrical, structural and architectural revisions required to incorporate the substituted material shall be the responsibility of the Mechanical Division. Review maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations.
- .5 A request constitutes a representation that the Bidder:
 - .1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - .2 Will provide the same warranty for the Substitution as for the specified Product.
 - .3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to The City.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
 - .5 Will reimburse The City and Contract Administrator for review or redesign services associated with re-approval by authorities.
- .6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.19 Progress Payment Submissions

- .1 Submit progress payment breakdowns for review by the Contract Administrator to the requirements of Division 01.
- .2 For mechanical submissions, provide line item breakdowns to indicate the following:
 - .1 Equipment progress payments for Fire Protection, Plumbing, Hydronic and HVAC.
 - .2 Labour progress payments for Fire Protection, Plumbing, Hydronic and HVAC.
 - .3 Controls
 - .4 Insulation
 - .5 Air Balancing
 - .6 Commissioning, Start Up and Training
 - .7 Close out documents – Record drawings, Operation and Maintenance documents.
- .3 Equipment and materials must be located on site or in bonded storage with proof of storage for payment request to be accepted.

1.20 Certificates and Transcripts

- .1 Submit Green Globes credit criteria associated with specified products in accordance with Green Globes requirements.

1.21 Product Supplied

.1 QUALITY

- .1 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.
- .2 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Contract Administrator.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

.2 AVAILABILITY

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

.3 STORAGE AND PROTECTION

- .1 Store and protect Products in accordance with manufacturers' written instructions.
- .2 Store with seals and labels intact and legible.
- .3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.
- .4 For exterior storage of fabricated Products, place on sloped supports above ground.
- .5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.
- .6 Cover open ends of pipes, fixtures, ductwork, etc. to prevent entry of building rubbish.
- .7 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

- .8 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .9 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.
- .4 **TRANSPORTATION AND HANDLING**
 - .1 Transport and handle Products in accordance with manufacturer's written instructions.
 - .2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
 - .3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.
 - .4 Protect all finished and unfinished work from soiling or damage, cover floors with tarpaulins or plywood as necessary, and repair any damage resulting from work of Mechanical Section.
 - .5 Protect finished surfaces to remain exposed, by paper, polyethylene or other satisfactory removable protective covering using paste acceptable to fixture manufacturer to prevent possible damage to finishes, until all reason for construction damage has passed and until acceptance by The City, and make good any such damage.

1.22 Special Cleanin

- .1 Maintain tidiness within work of Mechanical Sections and at completion remove protective paper, labels, etc. and tools and waste materials. Leave clean and in perfect operating condition.
- .2 Remove dirt, rubbish, grease, and dust for which this section is responsible from all exposed surfaces and fixtures.
- .3 Operate, drain and flush out bearings and refill with new charge of lubricant, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances within the scope of work area. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions. Refer to 23 31 00 for any additional duct cleaning requirements.
- .5 Clean exposed surfaces of mechanical equipment, ductwork, piping, etc., and polish plated work.
- .6 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install extended nipples to outside of bearing enclosures for lubrication purposes.
- .7 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.

- .8 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces, infiltrate into occupied areas, or trigger fire alarm smoke or dust detectors.
- .9 Replace heating, ventilating and air conditioning filters if units were operated during construction.
- .10 Do not start air-handling systems unless the systems and associated ductwork are clean. Failure to properly clean the equipment and ductwork shall make the Contractor responsible to clean, repair or replace equipment and ductwork rendered deficient.
- .11 Coordinate Green Globes related IAQ building flushing requirements with mechanical system cleaning.
- .12 At the end of construction all systems shall be left ready for operation.
- .13 This Section shall be responsible for repair work as may be necessary to remove dents and touch-up of factory finishes.

1.23 Sustainable and Local Requirements

- .1 Refer to Division 01 requirements for compliance requirements affecting all mechanical divisions, particularly:
 - .1 Section 01 74 19 – Waste Management and Disposal
- .2 Adhesives and sealants used in interior locations shall contain a low proportion of volatile organic compounds (VOCs) and shall meet the South Coast Air Quality Management District (SCAQMD) Rule 1168. Shop drawings shall be provided indicating compliance with the VOC limits.
- .3 Comply with the contract's waste management, waste diversion and recycling requirements and goal tracking.

1.24 Manufacturer's Written Instructions

- .1 Unless otherwise indicated in the specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.25 Quality of Work

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site any workers deemed incompetent or careless.

- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.
- .4 Assume full responsibility for layout of own work and for any damage caused to property of others through improper location or poor workmanship.
- .5 ACCESSIBILITY OF EQUIPMENT
 - .1 The City places a high priority on being able to safely and efficiently gain access to systems and equipment for replacement and repair. All equipment must be accessible, as defined as follows:
 - .1 Ceiling mounted equipment shall only be considered accessible if a tradesman can place both hands on the equipment components which requires services (ie: fan motor, belt, pulley, bearing, fire damper linkages, valve/control valve, strainer or any other equipment component which requires periodic maintenance). The component must be in clear view, and access must be gained from an 8 or 10 foot step ladder. Access panels provided in drywall shall be sized and placed in such a manner that trades personnel can place two hands on the equipment components as stated above. Equipment located above acoustic tile ceiling shall be positioned in such a manner that equipment and its components can be accessed through a full tile which does not contain any devices such as light fixtures, speakers, smoke detectors or sprinkler heads. If this is not possible, it should be reviewed by the Contract Administrator/The City before deemed acceptable.
 - .2 Conduit, pipe, ducting and support racking or any other obstruction to accessibility shall be relocated at the contractor's expense by the contractor's forces.
- .6 COORDINATION
 - .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
 - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
 - .3 Check levels shown before commencement to ensure adequate falls for sewers and pipes and report discrepancies immediately. Failure to so check and report does not relieve this section from responsibility for consequent extra expenditures.
 - .4 Where space is indicated as reserve for future equipment, leave clear and install piping and other work so that connections can be made to future equipment.
 - .5 Secure approval where necessary to cut holes in either finished or unfinished work, employ section whose work is involved, cut openings no larger than necessary and without damage to adjoining work and carefully repair all damage to match adjacent work. Note the Mechanical Division is responsible for all required cutting and patching relating to this Contract, except as specifically noted otherwise.

- .6 Provide and set bolts, templates, sleeves and fixing materials for fixing work under this section securely to work provided under other sections, in advance of other work, where required.
- .7 Locate all openings in walls, partitions, beams, etc. required for installation of ducts, pipes and equipment, etc. specified in this section of the specifications and frame all openings as required.
- .8 Installation of all equipment shall allow sufficient space to facilitate ease of maintenance. Clearance space shall allow for the removal of all components of equipment without hindrance. Where clearance requirements are not shown on the mechanical plans, manufacturer clearances must be maintained at a minimum.

.7 FASTENINGS

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

.8 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.26 Wor For Ot er Trades

- .1 The Mechanical Contractor shall install rough-ins and/or connections for all equipment requiring mechanical services, as shown on drawings or mentioned elsewhere in the specifications.
- .2 Supply other trades with all necessary details, rough-in drawings, wiring diagrams, etc. as required.

1.27 Electrical Re uire ents

- .1 Motors and electrical equipment supplied under Mechanical Division shall comply with Electrical Section and electrical characteristics scheduled or shown.

- .2 See "Installation and Wiring Controls" in Electrical Section for equipment supplied under Electrical Section.
- .3 The Electrical section shall provide starters for all motors and wire from starters to motors, unless otherwise indicated.
- .4 The Electrical section shall wire between starters and switching components such as relays, float switches, and pressure switches.
- .5 Supply to Electrical Section within four weeks after contract award, fully detailed diagrams of power and control wiring required for equipment supplied by Sections 21 – 25.
- .6 Motors shall be squirrel cage induction type 1800 RPM unless otherwise noted. Where dampness occurs, all motors and electrical apparatus such as float switches, etc. supplied integrally with any piece of apparatus, shall be totally enclosed.
- .7 All motors 1 hp and larger shall be high efficiency as defined in CSA C390.

1.28 Concealment

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

1.29 Access Panels

- .1 Provide in ample time for installation under relevant sections all necessary access panels in walls and ceilings to allow access to dampers, valves, etc., size 300 mm x 300 mm (12" x 12") min. or as required for proper maintenance with steel panel and frame, similar to Acudor, type to suit application. Instruct relevant section for proper location of access panels. Final locations subject to Contract Administrator's approval. ULC approved access panels must be provided where access is through or into a fire partition or assembly. If access doors have been specified by architectural sections the architectural specification shall supersede this section.

1.30 Remedial Work

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.31 Alteration Work

- .1 Where work is to be done in existing buildings, accurately survey, provide for avoidance of damage and interference to existing work and rectify any such damage due to work under Mechanical Sections. Accept existing work as it exists at time of tendering.
- .2 Carefully dismantle existing mechanical equipment to be removed or relocated. Temporarily disconnect, remove, and reinstall existing equipment, piping,

- ductwork, conduit, light fixtures, and similar items, which interfere with the new installation after completion of new work or of existing installations to be demolished. Store equipment and materials on the premises as directed by The City.
- .3 All usable salvaged equipment and materials shall remain the property of the The City unless specifically noted otherwise. Such material shall be removed from the building and be safely and neatly stored on the site for removal by The City. The Contractor shall remove all rejected salvage from the site and legally dispose of it off site.
 - .4 Reuse existing equipment in new work after first repairing and reconditioning any defective items where noted. Safely cap and seal disconnected mechanical services within finished surfaces.
 - .5 The abandonment of existing equipment and material in place is not acceptable. All redundant services are to be removed back to active mains, which shall then be capped at existing point of connection.
 - .6 All mechanical equipment conflicting with new equipment being installed shall be moved or disconnected, without damage, by Contractor and shall remain property of The City. Remove ducts and piping not required in revised systems and interfering with new installation. This material shall become property of Contractor.
 - .7 Disconnect existing equipment indicated, intended to be reused, rough-in in new position, and after replacement connect fully, ready for use.
 - .8 Removal and relocation of mechanical equipment by relevant Mechanical Sections.
 - .9 Operation of HVAC equipment serving occupied areas during renovation
 - .1 Protect HVAC air handling equipment from collecting odours and pollutants during demolition & construction by implementing the following measures:
 - .1 Shut-down HVAC equipment in coordination with The City's representative during heavy construction or demolition.
 - .2 Isolate the functional HVAC system from the renovation to prevent intake of pollutants.
 - .3 Seal all return system openings in and immediately adjacent to the construction area where isolation of the renovation area is possible.
 - .4 Install and maintain temporary filters on return air openings from the renovation space when system is in operation and connection to the renovation space is necessary. Replace these filters at the end of the project.
 - .5 Avoid storage of waste and construction materials in the mechanical room.
 - .6 Use high-efficiency filters (MERV 13) for central filtration when operating the system during construction. Inspect filters daily and replace as required over the duration of the project.
 - .7 Protect diffusers, VAV boxes, ducts and other HVAC system components.

- .8 Final cleaning of existing ducts, diffusers, and window units is required upon completion of work if evidence of contamination is found.

1.32 Location of Fixtures

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

1.33 Temporary Use of Equipment

- .1 No portion of any mechanical system or equipment provided under Mechanical Sections may be used for temporary heating without Contract Administrator's written permission and observance of the following procedure:
 - .1 Oil and grease motor, fan and pump bearings, etc. check on a regular basis and maintain as recommended by manufacturer.
 - .2 Maintain and clean when necessary cleanable type filters and clean and oil just prior to take-over of building by The City. Replace throwaway type filters.
 - .3 Ensure that mechanical air handling equipment is not operated during painting.
 - .4 Employ equipment manufacturers and subtrades to ensure and certify that all systems and equipment are in proper condition, and guarantee all work used prior to take-over as for new work, from date of acceptance of building by The City.
 - .5 If permission for temporary use of mechanical equipment is granted, use Canadian Plumbing and Mechanical Contractors Association standard form of agreement as basis of responsibilities. Guarantee on complete installation shall not start until acceptance of building by The City.
- .2 Where air handling systems are permitted to be operated before turnover to The City, all return air grilles/openings shall be equipped with MERV 8 filters to keep return air system clean of dust and dirt. Monitor all filters for dust loading and replace heating, ventilating and air conditioning filters. Replace non-LED lamps if used for more than one month.

1.34 Protection of Work In Progress

- .1 Prevent overloading of any part of the Project.
- .2 Do not cut, drill or sleeve any load bearing structural member unless specifically indicated without written approval of Contract Administrator.

1.35 Equipment Start-Up and Verification Reports

- .1 The contractor shall supply the equipment start-up reports for the mechanical equipment being installed.
 - .1 Forms shall be filled out in full, with all required and suggested fields.
 - .2 Forms shall include tester's signature and the signature by the project manager for the mechanical contractor.

- .2 The controls contractor shall supply a completed sequence verification checklist confirming all points of the system are functioning, reporting, and properly executing the sequence operation.
 - .1 Forms shall be developed and filled out by the contractor
 - .2 Forms shall include tester's signature and the signature by the project manager for the mechanical contractor.

END OF SECTION

Part 1 Pre-Trainin

1.1 General

- .1 Mechanical contractor training record to comply with Section 01 79 00- Demonstration and Training and 21 05 00 – Common Work For Mechanical.

1.2 Pre-Trainin Re uire ents

- .1 Submit pre-training setup and any other required information as defined in Sections 01 79 00 and 21 05 00 to The City’s representative a minimum of two weeks ahead of proposed training date. Training date to be minimum two weeks ahead of substantial performance.
- .2 Mechanical commissioning sign off date determined by The Contract Administrator.
- .3 Acceptable training date and list of personnel will be based on The City’s personnel availability. The City to provide date and personnel list within 3 days of receipt of pre-training setup.

1.3 Pre-Trainin Setu

Mechanical Commissioning Sign Off Date	
Training and Demonstration Date(s) and Time(s) Proposed	
Training and Demonstration Agenda and Schedule	
List of Excluded Systems	

Part 2 Trainin Record

2.1 Trainin Record Closeout

- .1 Submit training close out record within 5 days of completion of training. Attendees listed to sign record verifying attendance and receipt of training and demonstration as scheduled on completion of training.

Training Date(s), Time(s)	
Contractors Attendees	
The City's Attendees	
Training and Demonstration Provided	

Part 1 General

1.1 References

- .1 ASME B16.5 - Pipe Flanges and Flanged Fittings.
- .2 ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
- .3 ASME B16.11 - Forged Fittings Socket Welding and Threaded.
- .4 ASME B16.25 - Buttwelding Ends.
- .5 ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- .6 ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- .7 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- .8 ASTM A135 - Electric-Resistance-Welded Steel Pipe
- .9 ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- .10 ASTM B32 - Solder Metal.
- .11 AWS A5.8 - Filler Metal for Brazing and Braze Welding.
- .12 AWS D10.10 - Recommended Practices for Local Heating of Welds in Piping and Tubing.
- .13 NFPA 13 - Installation of Sprinkler Systems.
- .14 NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances
- .15 NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems
- .16 UL - Fire Resistance Directory.
- .17 UL 262 - Gate Valves for Fire-Protection Service.
- .18 UL 312 - Check Valves for Fire-Protection Service.
- .19 UL 405 - Fire Department Connections.
- .20 Underwriters Laboratories of Canada (ULC)

1.2 Submittals at Project Closeout

- .1 Section: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components and tag numbering.
- .3 Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.3 Qualit□ Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Carbon steel pipe and fittings manufactured in China or India will not be permitted.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, licensed in the Province of Manitoba, member in good standing with the Canadian Automatic Sprinkler Association, and approved by manufacturer.

1.4 Re ulator□ Re uire ents

- .1 Conform to cUL., UL., FM.
- .2 Sprinkler Systems: Conform to NFPA 13.
- .3 Welding Materials and Procedures: Conform to Manitoba Department of Labour and ASME Code requirements.
- .4 Valves: Bear UL/cUL label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- .5 Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.5 Deli er□, Stora e, And Protection

- .1 Section: Transport, handle, store, and protect products.
- .2 Deliver and store valves in shipping containers, with labelling in place.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.6 Extra Materials

- .1 Section: Operation and Maintenance Data.
- .2 Provide two of valve stem packings for each size and type of valve installed.

1.7 Desi n Calculations

- .1 The contractor shall carry out all necessary calculations and shall submit all calculations, data, and drawings in conformance with the requirements of NFPA 13 and the local authority having jurisdiction for Contract Administrator's review prior to proceeding with work. All design calculations are to be sealed by a Professional Engineer and shall be stamped reviewed by the authority having jurisdiction. Calculations shall be completed based on direction and restrictions given on drawings.
- .2 The design shall be based on hazard occupancy as scheduled on drawings.
- .3 The contractor shall be responsible to obtain water supply flow and pressure from the local municipal authority. If this information is not available, the contractor shall include all costs necessary for the testing.

1.8 Inspection and Tests

- .1 All inspections and tests required by the above-mentioned authorities and agencies shall be arranged for and performed by this contractor.
- .2 Inspections and testing to comply with NFPA 25.
- .3 Carry out any necessary flow tests without extra compensation.
- .4 All piping and fittings in the standpipe and sprinkler systems shall be hydrostatically tested at a pressure of 1380 kPa (200psi) for 2 hours without evidence of loss or leakage or as per NFPA 13.

Part 2 Products

2.1 Above Ground Piping and Fittings

- .1 Steel Pipe: ASTM A53; ASTM A135; ASTM A135 UL listed, threadable, light wall; ASTM A795; or ASME B36.10; Schedule 10 black; or ASME B36.10; Schedule 40 black; or ASME B36.10; Schedule 10 galvanized; or ASME B36.10; Schedule 40 galvanized as scheduled below.
 - .1 Steel Fittings: ASME B16.9, wrought steel, buttwelded; ASME B16.25, buttweld ends; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
 - .2 Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.2 Flexible Sprinkler Hose

- .1 Stainless steel braided flexible sprinkler hose
 - .1 Construction: 300 series stainless steel, EPDM gasket seal, nylon isolation ring, zinc plated carbon steel nuts and nipples.
 - .2 Inlet Connections:
 - .1 Grooved
 - .2 NPT threaded to NFPA standards
 - .3 Reducers provided by flexible hose manufacturer.
- .2 cUL listed or FM approval
- .3 Working conditions
 - .1 Maximum temperature: 107°C (225°F)
 - .2 Maximum Working Pressure: 1206 kPa (175 psi) cUL listed
 - .3 Minimum bend radius: 51 mm (2 inch) cULus Listed
- .4 Bracket assemblies by hose manufacturer approved for hose application.

2.3 Backflow Preventers

- .1 Listed Double Check Valve Assemblies:
 - .1 Manufacturers:

- .1 Beeco.
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 ANSI/ASSE 1024 / CSA B64.4

2.4 Gate Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- .2 Over 50 mm (2 Inches):
 - .1 Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged grooved ends.

2.5 Globe or Angle Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.
- .2 Over 50 mm (2 Inches):
 - .1 Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.6 Ball Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze two-piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
- .2 Over 50 mm (2 Inches):
 - .1 Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 250 mm (10 inches) and over, flanged.

2.7 Butterfly Valves

- .1 Bronze Body:
 - .1 Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch.

2.8 Check Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze body and swing disc, rubber seat, threaded ends.

- .2 Over 50 mm (2 Inches):
 - .1 Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

2.9 Drain Valves

- .1 Compression Stop:
 - .1 Bronze with hose thread nipple and cap.
- .2 Ball Valve:
 - .1 Brass with cap and chain, 20 mm (3/4 inch) hose thread unless otherwise noted.

2.10 Floor Plates

- .1 In new construction, where pipes pass through concrete or masonry walls provide steel pipe sleeves full thickness of wall.
- .2 In new construction, risers shall have watertight floor sleeves as recommended in NFPA 13. In renovation or existing construction, cored openings are acceptable provided the penetration is sealed and watertight, and meets all requirements of NFPA 13.
- .3 Provide split or solid round floor plates on all exposed pipes passing through walls, floors, or ceilings.

2.11 Specialties

- .1 Sight glass shall be a combination moisture and liquid indicator with protection cap. Sight glass shall be Alco, Mueller, Sporlan or Henry. Size shall be full line size.
- .2 Pressure gauges shall comply with NFPA 13. Port connection shall not be smaller than 6.4 mm. The pressure limit must not be less than twice the working pressure of the sprinkler/standpipe system.
- .3 Signs
 - .1 Signs indicating valves shall be secured with metal wire or chains
 - .2 Shall identify the portion of building served
 - .3 Sign shall be made of metal or rigid plastic
 - .4 According to NFPA 13

Part 3 Execution

3.1 Preparation

- .1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- .2 Remove scale and foreign material, from inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.2 Installation

- .1 Use grooved mechanical couplings and fasteners only in accessible locations.
- .2 Install piping to NFPA 13 for sprinkler systems.
- .3 Plastic piping systems are not permitted.
- .4 Pipe 38mm (1-1/2") and smaller shall be joined by threaded connections.
- .5 Pipe 50mm (2") and larger may be joined by roll groove mechanical joints.
- .6 Flexible sprinkler hoses acceptable where site conditions permit usage.
- .7 Provide galvanized pipe and fittings for dry and pre-action sprinkler systems.
- .8 Welded pipe sections shall be shop fabricated as far as possible to minimize field welding required.
- .9 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by the same manufacturer.
- .10 Side outlet mechanical tees that are comprised of gasketed cast iron housings that fully encircle the pipe and are secured with through-bolts are acceptable. Mechanical tees that use U-bolts or wire to secure the tee to the pipe will not be accepted.
- .11 Route piping in orderly manner, plumb and parallel to building structure and as instructed on drawings. Maintain gradient.
- .12 Install piping to conserve building space, to not interfere with use of space and other work.
- .13 Group piping whenever practical at common elevations.
- .14 In new construction, sleeve pipes passing through concrete or masonry partitions, walls, and floors.
- .15 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .16 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .17 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .18 Do not penetrate building structural members unless indicated.
- .19 In new construction, provide sleeves when penetrating footings floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required. Sleeve locations shall be noted on shop drawings.
- .20 When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .21 Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- .22 Provide gate, ball or butterfly valves for shut-off or isolating service.

- .23 Provide drain valves at main shut-off valves, low points of piping and apparatus. Obtain written approval from Contract Administrator for final locations of all drain valves not shown on drawings.
- .24 All drains shall be routed to sanitary drainage points. Draining to the storm sewer system or sump pits is not allowed.
- .25 Division 26 to wire monitoring alarm switches for each supervised valve. Alarms shall be connected to the annunciator panel. Coordinate wiring requirements with electrical trade.
- .26 Final inspection and testing to conform to NFPA 25.

END OF SECTION

Part 1 General

1.1 Re erences

- .1 NFPA 13 - Installation of Sprinkler Systems.
- .2 NFPA 1963 – Standard for Fire Hose Connections
- .3 FM - Factory Mutual Approval Guide.
- .4 CSA C22.1 – Canadian Electrical Code.
- .5 UL - Fire Resistance Directory.
- .6 UL 199 - Automatic Sprinklers for Fire-Protection Service.
- .7 Underwriters Laboratories of Canada (ULC)
- .8 City of Winnipeg - Fire Department Connections Requirements

1.2 S□ste Descri tion

- .1 System to provide coverage for entire building.
- .2 Provide system to NFPA 13 and local Authority Having Jurisdiction requirements.
- .3 Determine volume and pressure of incoming water supply from water flow test data.
- .4 Interface system with building fire and smoke alarm system if applicable.
- .5 Provide fire department connections where indicated.

1.3 Su ittals at Pro ect Closeout

- .1 Section: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- .3 Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- .4 Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- .5 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.4 Qualit□ Assurance

- .1 Perform Work to NFPA 13.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.5 Regulator□ Requirements

- .1 Conform to ULC and FM.
- .2 Perform Work to NFPA 13.
- .3 Equipment and Components: Bear ULC, UL, FM label or marking.
- .4 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 Delivery□, Storage, and Protection

- .1 Section: Transport, handle, store, and protect products.
- .2 Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 Extra Materials

- .1 Section: Operation and maintenance data.
- .2 Provide extra sprinklers to NFPA 13.
- .3 Provide suitable wrenches for each sprinkler type.
- .4 Provide metal storage cabinet located adjacent to alarm valve.

Part 2 Products

2.1 Sprinklers

- .1 Suspended Ceiling:
 - .1 Type: Recessed pendant type with matching push-on escutcheon plate.
 - .2 Finish: Chrome plated.
 - .3 Escutcheon Plate Finish: To match sprinkler body.
 - .4 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.

- .5 Provide concealed sprinkler complete with white cover in locations noted on drawings.
- .2 Exposed Area Type:
 - .1 Type: Standard upright type.
 - .2 Finish: Brass.
 - .3 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.
 - .4 Guards: Provide cage guards in exposed and accessible locations and in mechanical/electrical/utility spaces, finish to match sprinkler finish.
- .3 Dry Sprinklers:
 - .1 Type: Standard pendant type with matching push on escutcheon plate.
 - .2 Finish: Chrome plated.
 - .3 Escutcheon Plate Finish: To match sprinkler body.
 - .4 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.
- .4 Guards: Finish to match sprinkler finish.
- .5 Windows sprinklers:
 - .1 Application specific sprinklers designed specifically for protection of glazed surfaces.
 - .2 ULC listed system under testing to ULC/ORD C263.1.
 - .3 Horizontal or vertical sidewall type with frangible bulb, as required by the application.
- .6 All sprinkler shall be permanently marked so as to identify each sprinkler based on type, orifice size, shape, deflector characteristic, pressure rating and thermal sensitivity.

2.2 **Pi in S ecialties**

- .1 Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.
- .2 Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator; with test and drain valve.
- .3 Pressure Gauge: Provide ULC FM approved listed for fire protection, having aluminum cases, bronze geared movements, bronze bourdon type, friction glass cover and precision type pointer. Accuracy to be 1% of full span. Gauges shall be 100mm diam. throughout. Pressure range shall be selected so that needle is approximately vertical at normal system pressure. Gauges shall have dual scale (psi/kPa) with psi more prominent.
- .4 Pressure Reducing Valves: Provide, where required, ULC and FM labelled pressure reducing valves (PRV) with adjustable spring range, sized to suit

required flow and pressure differential, capable of maintaining differential pressure at 138 kPa (20 psi) during both flow and static conditions. Provide all necessary trim: Downstream and upstream pressure gauges, isolation valves, by-pass valves, pressure relief valve on low pressure side to compensate for leakage across the PRV.

.5 Fire Department Connections:

- .1 ULC listed, to NFPA 1963, capable of
 - .1 Pump pressure test at 13.8 bar (200 psi) for 5 minutes
 - .2 Strainer screen force of 100 N from both sides
 - .3 Ability to displace a screen/strainer by hand
- .2 Connection: Single 100mm (4") 2 lug hard coated aluminum Storz type hose connection angled at 30° downward to suit fire department hardware; threaded pipe connection to sprinkler service with National Standard Thread, latchable hose lock, inlet cap with chain of matching material and finish. Hose sealing surface machined and protected against environmental exposure. Corrosion and tamper resistant screen capable of high water flow rates installed in the connection.
- .3 Drain: 19 mm (3/4 inch) automatic drip, outside.
- .4 Label: identification plate, constructed of aluminum or brass, specifying "Auto Sprinkler", "Standpipe", or "Auto Sprinkler & Standpipe" department connection. Contractor shall provide submittal of identification plate and wording to local fire department or AHJ designate for approval.

2.3 Window Sprinkler System

- .1 Window sprinkler systems shall be supplied where indicated on the drawings. A complete manufactured system shall be provided by the sprinkler contractor and installed as per manufacturer's recommendations complete with sealed shop drawings.
- .2 Mechanical drawings will indicate general location of windows to be protected. The exact window system construction and required fire resistance rating shall be determined by the sprinkler contractor by reviewing the architectural drawings and specifications.
- .3 Provide pendent vertical sidewall sprinkler heads.

2.4 Deflectors

- .1 Provide metal deflectors sized to NFPA 13 requirements.
- .2 Brackets, Deflector And Screws Painted To Match Ceiling.

Part 3 Execution

3.1 Installation

- .1 Install to NFPA 13.

□

- .2 Install equipment to manufacturers written instructions.
- .3 Provide approved double backflow preventer assembly at sprinkler system water source connection as required by authority having jurisdiction.
- .4 Fire department connection
 - .1 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent fire department connectors to allow full swing of fire department wrench handle.
 - .2 The fire department connection shall be installed between 760 (30") above grade. Where connection height limitations exist and installation is less than 760 mm (30") above grade, a straight 4" Storz connection and signage on the wall above, may be acceptable on coordination with the Authority Having Jurisdiction.
 - .3 Fire department connection identification plate shall be mounted on the wall at the fire department connection.
- .5 Coordinate location of outside alarm gong on building wall with fire alarm contractor.
- .6 Place pipe runs to minimize obstruction to other work.
- .7 Place piping in concealed spaces above finished ceilings.
- .8 Centre sprinklers in one direction only in ceiling tile with location in other direction at $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of the ceiling tile length, dependent upon spacing and coordination with ceiling elements. Layout instructions provided on the architectural and mechanical drawings override spacing instruction given above.
- .9 Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. The contractor shall bear all responsibility to clean sprinklers of paint or if necessary to replace with new.
- .10 Flush entire piping system of foreign matter.
- .11 Provide protective guards for all sprinkler heads installed:
 - .1 In confined but accessible spaces.
 - .2 In exposed and accessible utility locations such as mechanical, electrical or service spaces
 - .3 Below stairwells located at heights below 2400 mm (8 ft).
 - .4 Where indicated on drawings.
 - .5 As required by NFPA 13.
- .12 Hydrostatically test entire system. Test shall be witnessed by authority having jurisdiction.
- .13 System drains and test connections: run to the nearest open drain in the building or to outdoors through wall away from paved areas. Seal and caulk around

pipng through wall and provide escutcheon and prime paint all metal surfaces exposed to outdoors.

- .14 Before commencement of any work, examine work of other trades and make immediate report to Contract Administrators of any defect or interference affecting work or guarantee of this work.
- .15 If drilling of structural beams or other load bearing members is required by design or by site conditions for passage of piping, obtain Contract Administrator's approval for location and proposed drilling procedure before drilling. Drill only in locations previously approved by Contract Administrator. Where drilling is required by design or existing site conditions, be responsible for carrying out same to approved procedure.
- .16 Allow for expansion and contraction when installing pipe hangers.
- .17 Install horizontal valves with stems upright where space allows.
- .18 Carefully coordinate work with other trades so that unnecessary offsets and revisions to the approved drawings are avoided. Failure to coordinate does not relieve Contractor from meeting performance standards.
- .19 Application specific sprinklers such as window sprinklers shall be installed in accordance with the listing requirements.
- .20 Provide deflectors between sprinkler heads where minimum separation distances between heads does not conform to NFPA 13 or manufacturer's requirements.

3.2 Inter ace Wit Ot er Products

- .1 Ensure required devices are installed and connected as required to fire alarm system.

3.3 Schedules

- .1 Refer to the drawings for sprinkler schedules.

END OF SECTION

Part 1 General

1.1 References

- .1 ASME B31.1 - Power Piping.
- .2 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- .3 ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
- .4 NFPA 17A - Standard on Wet Chemical
- .5 NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- .6 FM - Factory Mutual Approval Guide.
- .7 ULC - Fire Protection Equipment Directory – Canada
- .8 ANSI/CAN/UL/ULC 300 - Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment.

1.2 System Description

- .1 Design, fabrication, and installation: In compliance with requirements and recommendations of NFPA 17A and 96.
- .2 The system shall be an automatic fire suppression system using a wet chemical agent for cooking grease related fires.
 - .1 Capable of suppressing fires in the areas associated with ventilating equipment including hoods, ducts, plenums, and filters as well as auxiliary grease extraction equipment.
 - .2 Capable of suppressing fires in areas associated with cooking equipment, such as fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite or gas-radiant char-broilers; and woks.
 - .3 Pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories (UL/ULC).
 - .4 Installed and serviced by personnel trained by the manufacturer.
 - .5 Capable of protecting cooking appliances by utilizing either dedicated appliance protection and/or overlapping appliance protection

1.3 Design Requirements

- .1 Upon activation of fire-extinguishing system, power source to electric cooking range to be shut off. Shutoff devices require manual reset.

- .2 Provide a manual means of system activation.
- .3 Upon activation of fire-extinguishing system, an audible alarm or visual indicator shall show that the system has activated.
- .4 Provide signal to fire alarm system.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings:
 - .1 To bear stamp of approval of The City's fire insurance underwriter.
 - .2 Indicate layout of system, including piping and location of each component. Include control diagrams, wiring diagrams, and written sequence of operation.
 - .3 Provide data sheets covering each piece of equipment comprising the system including cylinders, manifolds, control panel, nozzles, detectors, alarm bells or horns, switches, and annunciators.
- .3 Manufacturer's Installation Instructions: Indicate installation of equipment and system components.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Accurately record exact location of equipment, equipment identification markings, conduit and piping routing details, and agent storage positions.

1.6 Operation and Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Include schematic description of fire suppression system installed, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
- .3 Include list of recommended spare parts.
- .4 Include checklists and procedures for emergency situations, trouble shooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

1.7 Quality Assurance

- .1 ULC listed, CE marked, all approvals by Authority Having Jurisdiction approved agency.

- .2 Manufactured by a company with demonstrated experience in the design and manufacture of pre-engineered fire suppression systems.
- .3 The manufacturer shall be ISO 9001 registered.

1.8 Quali ications

- .1 Manufacturer: Company specializing in manufacturing of products specified in this Section with minimum ten years documented experience.
- .2 Installer: Company specializing in performing the work of this Section with minimum 3 years documented experience, approved by manufacturer, who is capable of providing replacement charge within 24 hours.

1.9 Re ulator Re uire ents

- .1 Confirm to NFPA 96 and UL300.
- .2 Conform to electrical code for electrical wiring and wiring devices.

1.10 Deli er, Stora e, and Handlin

- .1 Deliver, store, protect and handle products to site to Section 21 05 00.
- .2 Accept materials and components on site in shipping containers. Inspect for damage.
- .3 Deliver and store equipment in shipping containers with labelling in place. Deliver fire suppressant in approved containers.
- .4 Store materials and equipment in clean, dry, non-freezing space.

1.11 Warrant

- .1 Section 21 05 00: Submittals for project closeout.
- .2 The pre-engineered fire suppression system components shall be warranted for five years from date of substantial completion against defects in workmanship and material.

1.12 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide one complete set of special tools required for servicing and maintaining equipment installed, to Section 21 05 00.

Part 2 Products

2.1 Restaurant Fire Suppression Systems

.1 Manufacturers

- .1 Ansul, Product R-102.
- .2 Substitutions: Refer to Section 21 05 00.

.2 Components

- .1 The basic system shall consist of a regulated release assembly which includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles, blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows shall be supplied in separate packages in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station, mechanical and electrical gas valves, and electrical switches for automatic equipment and gas line shut-off, and building fire alarm control panel interface.
- .2 Wet Chemical Agent: The extinguishing agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease related fires.
- .3 Agent Tank: The agent tank shall be installed in a stainless steel enclosure or wall bracket. The tank shall be constructed of stainless steel. Tanks shall be available in two sizes; 1.5 gallon (5.7 L) and 3.0 gal (11.4 L). The tank shall have a working pressure of 110 psi (7.6 bar), a test pressure of 330 psi (22.8 bar), and a minimum burst pressure of 660 psi (45.5 bar). The tank shall include an adaptor/tube assembly containing a burst disc union.
- .4 Regulated Release Mechanism: The regulated release mechanism shall be a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one or two agent tanks depending on the capacity of the gas cartridge used or three 3.0 gallon (11.4 L) agent storage tanks in certain applications. It shall contain a factory installed regulator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). It shall have the following actuation capabilities: automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station. The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure shall contain knock-outs for 1/2 in. conduit. The cover shall contain an opening for a visual status indicator. It shall be compatible with mechanical gas shutoff devices; or, when equipped with a field or factory-installed switch(es), it shall be compatible with electric gas line or appliance shut-off devices, or connections to a building fire alarm control panel.
- .5 Regulated Actuator Assembly: When more than two agent tanks or three agent tanks in certain applications are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver outlet of the regulated release

mechanism providing simultaneous agent discharge. The regulator shall be deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). The regulated actuator assembly shall contain an actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.

- .6 Discharge Nozzles: Each discharge nozzle shall be tested and listed with the R-102 system for a specific application. Nozzles tips shall be stamped with the flow number designation (1/2, 1, 2, or 3). Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.
- .7 Distribution Piping: Distribution piping shall be Schedule 40 black iron, chrome-plated, or stainless steel conforming to ASTM A120, A53, or A106.
- .8 Detectors: The detectors shall be the fusible link style designed to separate at a specific temperature, or shall be electric thermal detectors designed to operate at a factory preset temperature.
- .9 Cartridges: The cartridge shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.
- .10 Flexible Conduit: The manufacturer supplying the Restaurant Fire Suppression System shall offer flexible conduit as an option to rigid EMT conduit for the installation of pull stations and/or mechanical gas valves. The flexible conduit shall be UL Listed and include all approved components for proper installation.
- .11 Pull Station Assembly: The Fire Suppression System shall include a remote pull station for manual system actuation. The pull station shall be designed to include a built-in guard to protect the pull handle. The pull station shall also be designed with a pull handle to allow for three finger operation and shall be red in color for quick visibility
- .12 Pipe Hangers: ASME B31.1, UL or FM approved for sprinkler systems, split clamp up to 60 mm (2-1/2 inch) size, riser clamps over 60 mm (2-1/2 inch) size, adequate to offset discharge thrust.
- .13 Escutcheons: Chrome plated pressed or stamped brass, one piece or split pattern, minimum 50 mm (2 inches) larger than opening.

Part 3 Execution

3.1 Examination

- .1 Section 21 05 00: Procedures for execution of work. Verify that spaces are ready to receive work.

3.2 Installation

- .1 Install to manufacturer's written instructions and NFPA 17A.

- .2 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.
- .3 Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.
- .4 Prepare pipe, fittings, supports, and accessories for finish painting, to Section 09 91 00 - Painting.
- .5 Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.

3.3 Testin

- .1 Provide testing and test reports to Section 01 45 00 – Quality Control.
- .2 Test distribution piping and valving, prior to nozzle installation. Inspect joints as directed by the manufacturer. Repair leaks and retest. Maintain test pressure for four hours.
- .3 Confirm electric power is isolated from cooking equipment when fire suppression system is activated.
- .4 Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised. Testing and demonstration may be done concurrently where feasible to The City.
- .5 Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.
- .6 Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

3.4 Manu acturer s Field Ser ices

- .1 Prepare and start systems to Section 21 05 00 – Common Work for Mechanical.
- .2 Provide experienced manufacturer's trained personnel to supervise installation and performance testing of the system.

3.5 De onstration

- .1 Section 21 05 00: Submittals for project closeout.

- .2 Training shall be conducted by representatives of the manufacturer.
- .3 Demonstrate that components except cylinder discharge assembly, are functioning properly and in conjunction with controls system.
- .4 Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration based on manufacturer's instructions.
 - .1 Arrange meeting prior to demonstration with representatives of The City, the The City's Underwriter (where required by The City), and the installer.
 - .2 Perform visual inspection and overall review of system installed.
- .5 Where discharge testing is required, leave system will full wet chemical agents and ready for The City's use.

END OF SECTION

Part 1 General

1.1 Res onsi ilities

- .1 The Contractor shall:
 - .1 Attend mandatory site commissioning meetings to review completed forms.
 - .2 Provide all coordination required to schedule, coordinate, and complete all commissioning activities. Due to interdependency of the various systems and items of equipment, significant coordination will be required to facilitate commissioning.
 - .3 Complete all Equipment commissioning Forms specific to the actual equipment involved on this project. Forms are included in the specifications package.
 - .4 The Contractor is responsible for the sub-trades and their respective specialists and suppliers in participating in commissioning work and in providing the services required for the commissioning.
 - .5 Complete forms and sign off when each form is satisfactorily completed.
 - .6 Provide instruction and training on all components to The City.

- .2 The Contract Administration Team shall:
 - .1 Review and verify completed Equipment and Installation Forms
 - .2 Attend mandatory site commissioning meetings to review completed forms.
 - .3 Sign off Forms when satisfactorily completed by the Contractor.
 - .4 Maintain Master Deficiency List

1.2 Descri tion

- .1 Commissioning activities to be performed by the contractor include but are not limited to the following:
 - .1 Verification that all equipment has been supplied to the project in accordance with the specification. Every piece of equipment requires the satisfactory completion of a Static Verification Forms. Static verification shall be done shortly after equipment delivery to site and well in advance of the functional testing to allow time to resolve deficiencies that may be identified at this stage.
 - .2 Verification of equipment startup, and completion of Start-Up Forms.
 - .3 Verification that each system has been functionally tested and that the system components act and react interdependently and as per design. The Contractor(s) perform the testing as required to allow the Contract Administrator and The City to verify systems operation. The Contractor is responsible to record the information and results of this work in the Functional Performance Test Forms.

- .4 All deficiencies are to be satisfactorily completed prior to substantial completion.

END OF SECTION

Part 1 General

1.1 References

- .1 AWWA B300-04 - Hypochlorites.
- .2 AWWA B301-04 - Liquid Chlorine.
- .3 AWWA B302-05 - Ammonium Sulfate.
- .4 AWWA B303-05 - Sodium Chlorite.
- .5 ANSI/AWWA C651-14 - Disinfecting Water Mains.

1.2 Submittals or Information

- .1 Section 21 05 00: Submission procedures.
- .2 Test Reports: Indicate results comparative to specified requirements.

1.3 Closeout Submittals

- .1 Section 21 05 00: Submission procedures.
- .2 Record Documentation:
 - .1 Disinfection report:
 - .1 Type and form of disinfectant used.
 - .2 Date and time of disinfectant injection start and time of completion.
 - .3 Test locations.
 - .4 Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - .5 Date and time of flushing start and completion.
 - .6 Disinfectant residual after flushing in ppm for each outlet tested.
 - .2 Bacteriological report:
 - .1 Date issued, project name, and testing laboratory name, address, and telephone number.
 - .2 Time and date of water sample collection.
 - .3 Name of person collecting samples.
 - .4 Test locations.
 - .5 Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - .6 Coliform bacteria test results for each outlet tested.
 - .7 Certification that water conforms, or fails to conform, to bacterial standards.

1.4 Quality Assurance

- .1 Perform Work in accordance with AWWA C651.
- .2 Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.

- .3 Testing Firm: Company specializing in testing potable water systems, approved by the Province of Manitoba.
- .4 Submit bacteriologist's signature and authority associated with testing.

1.5 Regulator Requirements

- .1 Conform to applicable code or regulation for performing the work of this Section.
- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

Part 2 Products

2.1 Disinfection Chemicals

- .1 Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

Part 3 Execution

3.1 Examination

- .1 Section 21 05 00: Verify existing conditions before starting work.
- .2 Verify that piping system has been cleaned, inspected, and pressure tested.
- .3 Perform scheduling and disinfecting activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 Execution

- .1 Provide and attach required equipment to perform the work of this Section.
- .2 Introduce treatment into piping system.
- .3 Maintain disinfectant in system for 24 hours.
- .4 Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- .5 Replace permanent system devices removed for disinfection.
- .6 Pressure test system to 690 kPa (100 psi) plus the system height in water column pressure for a period of twelve hours. Repair leaks and re-test.
- .7 Test samples for coliform bacteria at each outlet tested.

3.3 Field Quality Control

- .1 Section 01 45 00: Field inspection and testing.
- .2 Test samples in accordance with AWWA C651.

END OF SECTION

Part 1 General

1.1 References

- .1 CAN/ULC-S102.2 - Standard method of test for surface burning characteristics of flooring, floor covering and miscellaneous materials and assemblies
- .2 CAN/CSA-B1800 - Thermoplastic non-pressure piping
- .3 CSA B137 Thermoplastic Pressure Piping Standards
- .4 NSF/ANSI 61 – Drinking Water System Components – Health Effects
- .5 ANSI/NSF 372 - Drinking Water System Components - Lead Content
- .6 ASME B31.9 - Building Services Piping.
- .7 ASME SEC IV - Construction of Heating Boilers.
- .8 ASME SEC IX - Welding and Brazing Qualifications.
- .9 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- .10 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- .11 ASME B16.22-2001 (R2005) - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .12 ASME B16.26 - Copper Alloy Bronze Fittings for Flared Copper Tubes.
- .13 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .14 ASTM B42 - Seamless Copper Pipe, Standard Sizes.
- .15 ASTM B43 - Seamless Red Brass Pipe, Standard Sizes.
- .16 ASTM B68 - Seamless Copper Tube, Bright Annealed.
- .17 ASTM B75 - Seamless Copper Tube.
- .18 ASTM B22.18-03 - Seamless Copper Water Tube.
- .19 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .20 ASTM B302 - Threadless Copper Pipe, Standard Sizes.
- .21 ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

- .22 ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- .23 ASTM D2855-96 (2002) - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- .24 ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .25 ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- .26 ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .27 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- .28 AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch - 48 inch (350 mm - 1200mm).
- .29 CAN/CSA B137.9-17 - Polyethylene/aluminum/polyethylene (PE- AL-PE) composite pressure-pipe systems
- .30 CSA 6.32/ANSI LC-4 - Press-connect metallic fittings for use in fuel gas distribution systems
- .31 CAN/CSA B149.1 – Natural Gas and Propane Installation Code.
- .32 AGA Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- .33 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .34 Government of Manitoba – Inspection and Technical Services technical bulletins.

1.2 Closeout Submittals

- .1 Section 21 05 00: Submission procedures.
- .2 Record Documentation: Record actual locations of valves on record drawings.

1.3 Quality Assurance

- .1 Perform Work to the standards of the Province and Municipality of Jurisdiction.
- .2 Valves: Manufacturer's name and pressure rating marked on valve body.
- .3 Welding Materials and Procedures: Conform to ASME SEC IX and applicable Provincial labour regulations.
- .4 Welder's Certification: To Manitoba Department of Labour standards.
- .5 Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

- .6 Carbon steel pipe and fittings manufactured in China or India will not be permitted.

1.4 Regulator Requirements

- .1 Licensed in the jurisdiction of work where licencing is legislated.
- .2 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements
- .3 Perform natural gas and propane work to the latest version of the CSA B149.1 gas code, Manitoba Gas Notices and local Municipal requirements.
- .4 Conform to applicable code for installation of backflow prevention devices.
- .5 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.5 Delivery, Storage, and Protection

- .1 Refer to specification section Product Requirements: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 Environmental Requirements

- .1 Refer to specification section Environmental Protection: Environmental conditions affecting products on site.
- .2 Do not install underground piping when bedding is wet or frozen.

Part 2 Products

2.1 Sanitary Sewer Piping, Buried Within 1500 (5 Feet) of Building

- .1 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.2 Sanitary Sewer Piping, Above Grade

- .1 PVC Pipe with FSR25/SDC50: CAN/CSA B1800
 - .1 Piping shall be tested and listed in accordance with CAN/ULC-S102.2 and clearly marked with the certification logo indicating a flame spread rating (FSR) not exceeding 25 and a smoke developed classification (SDC) not exceeding 50.
 - .2 Fittings: PVC.
 - .3 Joints: ASTM D2855, solvent weld to ASTM D2564.
 - .4 Manufacturer: IPEX System XFR or equal.

2.3 Sanitary Sewer Piping, Above Grade

- .1 PVC Pipe: CSA B137.3, pipe and fittings
 - .1 Schedule 40 piping, solvent welding to CSA B137.3

2.4 Sanitary Sewer Piping, Below Grade

- .1 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.5 Water Piping, Buried Beyond 1500 (5 Feet) of Building

- .1 Up to 50mm (2"): Soft temper copper, Type K: ASTM B88
 - .1 Fittings: ANSI B22.18 or ANSI B16.18 soldered pressure fittings.
 - .2 Joints: ASTM B32, lead-free solder, Grade 50B.

2.6 Water Piping, Above Grade

- .1 Copper Tubing 50mm (2") and under: ASTM B88, Type L hard drawn.
 - .1 Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - .2 Joints ASTM B32, solder, Grade 95TA.
- .2 Copper Tubing over 50mm (2"): ASTM B88, Type L hard drawn.
 - .1 Fittings: Silver brazed fittings.

2.7 Storm Water Piping, Buried Beyond 1500 (5 Feet) of Building

- .1 PVC Pipe: SDR 35; CAN/CSA B1800.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM F477, elastomeric gaskets.

2.8 Storm Water Piping, Above Grade

- .1 PVC Pipe: CAN/CSA B182.1
 - .1 Manufacturer: IPEX Building Sewer and Drain

- .2 Fittings: PVC.
- .3 Joints: ASTM D2855, solvent weld to ASTM D2564.
- .2 PVC Pipe with FR25: CAN/CSA B182.1
 - .1 Manufacturer: IPEX System 15 or equivalent
 - .2 Fittings: PVC.
 - .3 Joints: ASTM D2855, solvent weld to ASTM D2564.
- .3 PVC Pipe – FR25, SR50: CAN/CSA B182.1
 - .1 Manufacturer: IPEX System XFR or equal
 - .2 Piping shall be tested and listed in accordance with CAN/ULC-S102.2 and clearly marked with the certification logo indicating a flame spread rating of 25 and a smoke developed classification not exceeding 50.
 - .3 Fittings: PVC.
 - .4 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.9 Natural Gas Piping, Buried with in 1500 (5 Feet) Outside Building

- .1 Steel Pipe: ASTM A53/ASTM A106 Schedule 40 black.
 - .1 Fittings: CSA Z662 or ASME B16 series malleable iron or steel, or certified to ANSI LC-4/CSA 6.32
 - .2 Joints: welded to CSA Z662 or otherwise by authority having jurisdiction
 - .3 Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 0.25 mm (10 mil) polyethylene tape. Alternative: factory coated steel pipe suitable for underground burial.
- .2 Polyethylene pipe: CSA B137.4, polyethylene pipe for gas service.
 - .1 Fittings: B137.4 or B137.4.1, fusion welded.
 - .2 Tracing wire – integrated or separate to the piping.

2.10 Natural Gas Piping, Above Grade

- .1 Steel Pipe: ASTM A53/A106 Schedule 40 Black.
 - .1 Fittings: CSA Z662 or ASME B16 series malleable iron or steel, or certified to ANSI LC-4/CSA 6.32
 - .2 Joints: to CSA B149, press fit to CSA 6.32, flanged, threaded to ASME B1.20.1 or welded to CSA Z662 or otherwise by authority having jurisdiction.
 - .1 All joints NPS 2-1/2 or greater to be welded only.

2.11 Flanges, Unions, and Couplings

- .1 Pipe Size 80 mm (3 inches) and under:
 - .1 Ferrous pipe: Class 150 malleable iron threaded unions.
 - .2 Copper tube and pipe: Class 150 bronze unions with soldered joints.
- .2 Pipe Size Over 25 mm (1 inch):

- .1 Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
- .2 Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- .3 Grooved and Shouldered Pipe End Couplings:
 - .1 Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .2 Sealing gasket: "C" shape composition sealing gasket.
- .4 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.12 Glo e Val es

- .1 Construction Up To and Including 50 mm (2 inches), bronze disc:
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.
- .2 Construction Up To and Including 50 mm (2 inches), bronze disc:
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 125, LF bronze body, brass and bronze trim, handwheel, bronze or brass disc, solder ends.
 - .3 LF to NSF 372.
- .3 Construction Up To and Including 50 mm (2 inches), PTFE disc:
 - .1 Manufacturers:
 - .1 Kitz
 - .2 Crane
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 150, bronze body, bronze trim, handwheel, PTFE disc, solder ends.
- .4 Construction: 63 mm (2-1/2 inches) and Larger:
 - .1 Manufacturers:
 - .1 Red-White/Toyo

- .2 Kitz
- .3 Crane
- .4 Substitutions: Refer to Section 21 05 00.
- .2 MSS SP-85, Class 125, cast iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends.

2.13 Ball Val es

- .1 Manufacturers:
 - .1 MAS
 - .2 Kitz
 - .3 Crane.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Construction 63 mm (2.5 inches) and smaller:
 - .1 Class 150, NSF/ANSI 61, MSS SP-110, 4100 kPa (600 psi) CWP
 - .2 Body, Two piece, NSF/ANSI 372 Lead Free:
 - .1 Silicon Bronze Alloy, or
 - .2 Dezincification Resistant (DZR) Brass
 - .3 Full port 316 stainless ball, PTFE seats and packing, blow-out proof stem, lever handle, solder ends.
- .3 Construction 75mm (3 inches) and larger:
 - .1 Ball valves shall be of the floating-ball design capable of providing bi-directional, tight shutoff in accordance with MSS SP-72.
 - .2 The valves shall be rated at 150# WSP/300# WOG.
 - .3 Bodies shall be ductile iron per ASTM A536, With ANSI Class 150 raised-face flanges.
 - .4 The interior and exterior of the body shall be epoxy-coated.
 - .5 The ball shall be PFA infused stainless steel, with a stainless steel blowout-proof stem.
 - .6 The seats and body seals shall be PTFE.
 - .7 The stem seal shall be PTFE, externally adjustable chevron type.
 - .8 Valves shall be equipped with locking handles as standard. If service conditions require, valves may be equipped with 2" square operating nuts, manual gear operators, or pneumatic, electric, or hydraulic actuators.

2.14 Plu Val es

- .1 Manufacturers:
 - .1 Nordstrom Valves, Inc. MSS SP-78, Type II.
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Construction 50 mm (2 inches) and smaller: Figure 114, MSS SP-78, 2700 kPa (400 psi), cast iron body and plug, pressure lubricated, PTFE or Buna N packing, flanged or threaded ends. Provide lever operator with set screw.

- .3 Construction 65 mm (2-1/2 inches) and larger: MSS SP-78, 1200 kPa (175 psi), cast iron body and plug, pressure lubricated, PTFE or Buna N packing, flanged ends. Provide lever operator with set screw.

2.15 Flo Controls

- .1 Manufacturers:
 - .1 Watts.
 - .2 Conbraco.
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Construction: Class 150, brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- .3 Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum pressure 24 kPa (3.5 psi).

2.16 S in C ec Val es

- .1 Construction: Up to and including 80 mm (3 inches):
 - .1 Manufacturers:
 - .1 Kitz.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 150, bronze body and cap, bronze swing disc with rubber seat, solder ends. CSA B62 compliant.
- .2 Construction: 50 mm (2 inches) and Larger:
 - .1 Manufacturers:
 - .1 American Valve, Inc.
 - .2 Kitz Corporation.
 - .3 Watts Regulator ;
 - .4 Zy-Tech Global Industries, Inc.
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged ends. CSA B62 compliant.
- .3 Construction: PVC:
 - .1 CSA B62, ASTM D1784
 - .1 NSF 61 compliant for potable water applications.
 - .2 Manufacturers:
 - .1 IPEX
 - .2 Substitutions: Refer to Section 21 05 00.
 - .3 Material: Valve body, bonnet, swing arm, and disc of PVC to ASTM D1784.
 - .4 Seals: O-ring seals and shutter of EPDM.

- .5 Connections: socket weld with union connection or threaded with union connection
- .6 Swing check valves shall be full flow, gravity operated, full face disc seal, full open disc stop to prevent over-travel, no wetted metal parts.
- .7 Service of the valve shall be possible without removal from the system line.
- .8 Installable in either horizontal or vertical orientations.
- .9 Valve ratings:
 - .1 Up to 75 mm (3") shall be rated at 100 psi at 73°F.
 - .2 +100 mm (+4") shall be rated at 70 psi at 73°F.

2.17 S rin Loaded C ec Val es

- .1 Manufacturers:
 - .1 Class 150: Mueller 72-IHB-3-H (Ductile Iron Body) Moygro &-I515WM5B (SS Disc, Viton Seat)
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Class 150, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.
- .3 Construction: PVC:
 - .1 CSA B62, ASTM D1784
 - .1 NSF 61 compliant for potable water applications.
- .4 Manufacturers:
 - .1 IPEX
 - .2 Substitutions: Refer to Section 21 05 00.
- .5 Material: Valve body, ball, end connectors and unions of PVC to ASTM D1784.
- .6 Seals: O-ring seals and shutter of EPDM.
- .7 Spring Material: Stainless steel
- .8 Connections: socket weld or threaded, union end connection.
- .9 Installable in either horizontal or vertical orientations.
- .10 Valve ratings: 1600 kPa (232 psi) at 23°C (73°F).

2.18 Relie Val es

- .1 Pressure Relief:
 - .1 Manufacturers:
 - .1 Watts
 - .2 Substitutions: Refer to Section 21 05 00.

- .2 AGA Z21.22 certified, bronze body, PTFE seat, steel stem and springs, automatic, direct pressure actuated.
- .2 Temperature and Pressure Relief:
 - .1 Manufacturers:
 - .1 Watts
 - .2 Conbraco
 - .3 Substitutions: Refer to Section 21 05 00
 - .2 AGA Z21.22 certified, bronze body, PTFE seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 98.9 degrees C (210 degrees F), capacity ASME SEC IV certified and labelled.

2.19 Strainers

- .1 Construction: Size 50 mm (2 inch) and under:
 - .1 Manufacturers:
 - .1 Spirax-Sarco
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Threaded bronze body Y pattern 2070 kPa (300 psi) CWP, Y pattern with 0.8 mm 1/32 inch stainless steel perforated screen.
- .2 Construction: Size 40 mm (1-1/2 inch) to 100 mm (4 inch):
 - .1 Manufacturers:
 - .1 Spirax-Sarco
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Class 125, bronze body, Y pattern, flanged ends, with 1.6 mm (1/16 inch) stainless steel perforated screen.

Part 3 Execution

3.1 Examination

- .1 Section 21 05 00: Verify existing conditions before starting work.
- .2 Verify that excavations are to required grade, dry, and not over-excavated.

3.2 Preparation

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and dirt, on inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.3 Installation

- .1 Install to manufacturer's written instructions.

- .2 Install water piping to National Plumbing Code and ASME B31.9.
- .3 Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- .4 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- .5 Install piping to maintain headroom, conserve space, and not interfere with use of space.
- .6 Group piping whenever practical at common elevations.
- .7 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .8 Hangers and support, refer to Section 23 07 19.
 - .1 Provide clearance in hangers, from structure and other equipment for installation of insulation and access to valves and fittings.
 - .2 Support all hangers from top chord of joists, spanning supports or in concrete decking for all piping. Decking clips are acceptable to 25 kg (50 lbs) loads.
 - .3 Roof decking clips to support up to 25 kg (50 lbs) with minimum 1 meter spacing between clips unless otherwise directed by the structural engineer. Roof decking support clip fasteners shall not penetrate the roof membrane. Storm water and waste water to be hung directly from structural members or from spanned supports between structural members only, no attachments to roof decking.
 - .4 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - .5 Provide support for utility meters to requirements of utility companies.
 - .6 Support for buried pipe under concrete structural slabs shall be hung from the slab using epoxy coated or stainless steel hangers, hardware and hanger rod secured to the rebar.
- .9 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.
- .10 Establish elevations of buried piping outside the building to ensure not less than 2.4 m (8 ft) of cover.
- .11 Vents
 - .1 Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
 - .2 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather-proof hood.
- .12 Penetrations and sleeves

- .1 Support Division 07 with materials and coordination to support the firestop requirements as required by Division 07.
- .2 Sleeve pipes passing through partitions, walls and floors. Set sleeves in concrete forms for all pipes passing through concrete walls, beams and slabs.
- .3 Install 100 mm (4 inch) concrete curbs around all pipe penetrations in mechanical rooms.
- .4 Pipe sleeves to extend above floor line as follows:
 - .1 Unfinished areas – 25 mm (1 inches).
 - .2 Finished areas (copper sleeves) – 7 mm (1/4 inches).
 - .3 Mechanical rooms, kitchens and washrooms – 100 mm (4 inches).
- .5 Caulk sleeves to provide watertight installation.
- .6 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated, pressed steel floor plates.
- .7 Install galvanized, oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.
- .8 Sleeves and holes for piping on cold water systems shall be large enough to accommodate pipe insulation. Insulation on piping for hot water systems may stop at walls or floors.
- .9 Prior to installing sleeves in concrete beams, receive final jobsite approval by Contract Administrator
- .13 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .14 Provide support for utility meters to requirements of utility companies.
- .15 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 10.
- .16 Install bell and spigot pipe with bell end upstream.
- .17 Valves
 - .1 Isolation valves shall be provided as follows:
 - .1 At water main take-off, or connection to the building domestic water system for renovations
 - .2 At each fixture group.
 - .3 At every piece of equipment.
 - .4 At each floor level off a riser.
 - .2 Install valves with stems upright or horizontal, not inverted.
- .18 Storm water piping: Install clamps across all no-hub MJ couplings on piping 125 mm (5") and larger for all horizontal piping, including elbows at the base of vertical pipes. Refer to 23 05 29 for supports and anchors on storm water piping.
- .19 Natural gas piping

- .1 Installation to CSA B149.1 and local authority having jurisdiction requirements. Refer to active technical bulletins by ITSM (Inspection and Technical Services Manitoba). Installations to be done by a gas fitter licensed in the jurisdiction of work.
- .2 Pressure test to CSA B139.1.
- .3 Buried piping:
 - .1 Install buried piping with polyethylene or steel piping. Transition to steel piping before entering building or rising above ground. Plastic piping acceptable in buried applications only.
 - .2 Install polyethylene piping with tracer wire with both ends terminating minimum 450 mm (18") above grade. Test wiring before burial.
- .4 Inspections:
 - .1 Buried plastic piping for cuts, scratches and gouges. Replace damaged sections.
 - .2 Inspect buried joints to CSA B149.

3.4 Pipe Pressure Testin

- .1 Do not insulate pipe prior to pressure testing. Pressure test in sections if necessary before concealing or insulating pipe.
- .2 Do not introduce water for testing where freezing conditions exist or where piping systems being tested are located above sensitive areas or equipment that may be damaged or contaminated by water leakage.
- .3 Hydraulically test all pipe. Pneumatic testing not permitted without prior approval from the Contract Administrator and the Authority Having Jurisdiction.
- .4 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings and equipment. Pipe dope, caulking, tape, lead wool, dresser couplings, etc. shall not be used to correct deficiencies. The contractor shall be responsible for all cleanup related to leakage during flushing, testing, and chemical treatment of piping, including original building piping if included in the testing.
- .5 Subject piping to a hydrostatic pressure of at least that 1-□ times the operating pressure of the system for a period of at least 12 hours. If leaks are detected, such leaks shall be repaired and the test started over. Record results and submit witnessed (by Contract Administrator or The City's representative) reports to the Contract Administrator.
- .6 Register pressures at the highest system point.
- .7 Provide at least 48 hours (during working days) notice to Contract Administrator prior to testing to allow the tests to be witnessed.

3.5 Application

- .1 Use grooved mechanical couplings and fasteners only in accessible locations.

- .2 Install unions downstream of valves and at equipment or apparatus connections.
- .3 Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- .4 Valves
 - .1 Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
 - .2 Install globe or ball valves for throttling, bypass, or manual flow control services.
 - .3 Provide spring loaded check valves on discharge of water pumps and domestic water (clean water) systems.
 - .4 Provide plug valves in natural and propane gas systems for shut-off service.
 - .5 Provide flow controls in water recirculating systems where indicated.
- .5 Plastic piping installed in combustible buildings shall have a 25/50 flame and smoke rating when installed in plenums.
- .6 PVC DWV piping installed in non-combustible buildings shall comply with the restrictions in the following table.

COMBUSTIBLE PIPE APPLICATIONS SUITABILITY FOR USE				
Product	NON-COMBUSTIBLE BUILDING			
	General Usage	Air Plenum ¹	Vertical Services Spaces ²	Underground
Combustible Pipe FSR25: (eg. IPEX System 15)	P	N3	N	P
Combustible Pipe FSR25/SDC50: (eg. IPEX XFR, CPVC)	P	P	N	P
MJ Grey Coupling	P	P	N	N
1. Restrictions for air plenums also apply to combustible buildings as well. 2. Certified firestopping devices are required whenever the system penetrates a vertical or horizontal separation, and shall be certified to CAN4-S115 and tested with a pressure differential of 50 Pa. 3. Sizes 20" and 24" are N				

3.6 Erection Tolerances

- .1 Section 01 73 00: Tolerances.
- .2 Establish invert elevations, slopes for drainage to one percent (1/8 inch per foot) minimum, except pipe sized 75 mm (3 inches) or less shall have a slope no less than two percent (1/4 inch per foot). Maintain gradients.
- .3 Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.7 Service Connections

- .1 Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- .2 Provide new water service complete with approved reduced pressure double check backflow preventer and water meter with by-pass valves and pressure reducing valve. Meter and valve arrangement to confirm to the requirements of the Authority Having Jurisdiction.
 - .1 Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
- .3 Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 2 psi. Provide regulators on each line serving gravity type appliances, sized to equipment.

3.8 System Cleanin

- .1 Clean interior and exterior of all systems including strainers.
- .2 Maintain tidiness within work of Mechanical Sections and at completion remove protective paper, labels, etc. and tools and waste materials. Leave clean and in perfect operating condition.
- .3 Remove dirt, rubbish, grease, and dust for which this section is responsible from all exposed surfaces and fixtures.
- .4 Thoroughly clean piping and equipment of dirt, cuttings and other foreign substances within the scope of work area. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions.
- .5 Clean exposed surfaces of mechanical equipment, piping, etc., and polish plated work.
- .6 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.

- .7 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces, infiltrate into occupied areas, or trigger fire alarm smoke or dust detectors.

3.9 Disinfection of Domestic Water Piping System

- .1 Disinfect water distribution system to Section 22 05 81.

END OF SECTION

Part 1 General

1.1 References

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME A112.6.3 - Floor and Trench Drains
 - .2 ASME A112.6.4 – Roof, Deck and Balcony Drains
 - .3 ASME A112.26.1 - Water Hammer Arrestors.
- .2 American Society of Sanitary Engineers (ASSE)
 - .1 ASSE 1010 - Performance Requirements for Water Hammer Arresters
 - .2 ASSE 1011 - Hose Connection Vacuum Breakers.
 - .3 ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
 - .4 ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- .3 American Water Works Association (AWWA)
 - .1 AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- .4 Canadian Standards Association
 - .1 CSA B125.1/ASME A112.18.1 - Plumbing Supply Fittings
 - .2 CSA B125.3 – Plumbing Fittings
 - .3 CSA B125.6/ASME A112.18.6 - Flexible water connectors
 - .4 CAN/CSA-B181.2 - Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings
 - .5 CAN/CSA-B182.1 – Plastic Drain and Sewer Pipe and Pipe Fittings
 - .6 CSA B79 - Commercial and Residential Drains and Cleanouts.
- .5 National Safety Foundation (NSF)
 - .1 NSF/ANSI 61 – Drinking Water System Components – Health Effects
- .6 PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .7 ASME A112.14.3 – Grease Interceptors
- .8 CSA B481.0, Material, design, and construction requirements for grease interceptors;
 - .1 CSA B481.1, Testing and rating of grease interceptors using lard;
 - .2 CSA B481.2, Testing and rating of grease interceptors using oil;
 - .3 CSA B481.3, Sizing, selection, location, and installation of grease interceptors
- .9 PDI WH-201 - Water Hammer Arrestors.

- .10 CSA-B64-2011 Series - Backflow Preventers and Vacuum Breakers.
 - .1 CSA B64.1.1/ANSI/ASSE 1001– Performance requirements for Atmospheric Type Vacuum Breakers (AVB)
 - .2 CSA B64.10 - Selection and installation of backflow preventers/Maintenance and field testing of backflow preventers
- 1.2 Su it tals or Re ie**
 - .1 Section 21 05 00: Submission procedures.
 - .2 Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
 - .3 Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- 1.3 Closeout Su it tals**
 - .1 Section 21 05 00: Submission procedures.
 - .2 Operation Data: Indicate frequency of treatment required for interceptors.
 - .3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
 - .4 Record Documentation: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, trap seal primers.
- 1.4 Maintenance Material Su it tals**
 - .1 Section 01 78 10: Maintenance and extra material requirements.
- 1.5 Qualit Assurance**
 - .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- 1.6 Re ulator Re uire ents**
 - .1 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements.
 - .2 All components installed in domestic water system to be lead free to NSF 61 requirements.
- 1.7 Deli er, Stora e, and Protection**
 - .1 Section 21 05 00: Transport, handle, store, and protect products.
 - .2 Accept specialties on site in original factory packaging. Inspect for damage.

Part 2 Products

2.1 Flexible Pipe Connectors

- .1 Manufacturers:
 - .1 Flextrol
 - .2 Flex Tech Industries
 - .3 Hydro-flex
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Supply and install where shown on the drawings as in details, flexible pipe connectors as manufactured by Flex Tech Industries, selected to meet operating and test pressures of systems served.
- .3 Minimum 450 mm (18") in length unless otherwise noted.
- .4 Domestic Water Services
 - .1 Braided stainless steel outer sheathing with nylon reinforced vinyl tubing, threaded fixture connections, 861 kPa (125 psi) pressure rating, 82°C (180°F) temperature rating, NSF 61 and UPC certified
 - .2 Up to 50 mm (2") - bronze connectors constructed of Phosphor corrugated bronze hose and bronze single braid with brass male ends.
 - .3 63 mm (2½") and larger - Connectors constructed of Phosphor corrugated bronze hose and stainless steel single braid with van stone floating flanges and s.s. sleeve at all wetted areas.

2.2 Roo Drains

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Standard Roof Drains (RD-1):
 - .1 Assembly: AMSE A112.6.4.
 - .2 Body: Lacquered cast iron with sump.
 - .3 Strainer: Removable cast metal dome with vandal proof screws.
 - .4 Accessories: Coordinate with roofing type, refer to Roofing Section:
 - .1 Membrane flange and membrane clamp with integral gravel stop.
 - .2 Adjustable under deck clamp.
 - .3 Roof sump receiver.
 - .4 Waterproofing flange.
 - .5 Parabolic controlled flow weir, 5 gpm per inch of water head, up to 22.5 gpm.
 - .6 Levelling frame.
 - .7 Adjustable extension sleeve for roof insulation.

- .8 Strainer free area of 43 square inches.
- .3 Roof Overflow Drains (RD-2)
 - .1 Manufacturer: MIFAB.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Zurn
 - .2 Watts.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .3 Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 150 mm (6 inches) above flood elevation.
- 2.3 Do ns out No□les (DS-1)**
 - .1 Manufacturer: Zurn Model Z199
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Mifab
 - .2 Watts.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .3 Construction
 - .1 Nickel bronze body,
 - .2 Wall flange
 - .3 Outlet nozzle,
 - .4 Optional threaded or no-hub inlet
- 2.4 Floor Drains**
 - .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Jay R. Smith
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 Floor Drain
 - .1 ASME A112.6.3,
 - .2 Epoxy coated cast iron two piece body with double drainage flange,
 - .3 Weep holes,
 - .4 ½" trap primer connection port,
 - .5 Refer to floor drain schedule below,
 - .6 Funnels shall be supplied in lieu of strainer as noted in schedule below,
 - .7 Floor without Surface Membrane
 - .1 Reversible clamping collar,
 - .2 Primary and secondary weep holes,

- .3 Adjustable 5" (127mm) strainer less membrane clamp, refer to schedule for type.
- .8 Floor with Surface Membrane
 - .1 Reversible clamping collar,
 - .2 Primary and secondary weep holes,
 - .3 Adjustable 5" (127mm) strainer with surface membrane clamp, refer to schedule for type.

Floor Drain Schedule:

Tag	Body Material	Inlet Strainer	Vandal Proof	Sediment Bucket	Trap Seal Primer
FD-1	Epoxy coated Cast Iron	Heavy Duty, Nickel Bronze	No	No	No
FD-2	Epoxy coated Cast Iron	Nickel Bronze, 4"x9" Funnel	No	No	No

Contractor shall provide the floor drain suitable for the finished floor unless otherwise noted on the drawing. Refer to architectural details and plans for membrane requirements. Floors with sheet membranes (vinyl floor, etc) shall have surface membrane clamp.

2.5 Trench Drains (TD-1)

- .1 Manufacturers:
 - .1 Zurn Z882 (basis of design)
 - .2 Mifab
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Modular channel sections shall be made of 0% water absorbent High Density Polyethylene (HDPE).
- .3 Channels shall be 2438mm (96") long, 305mm (12") wide. Assembled trench drains shall be 12192mm (40') total length. Refer to architectural floor plans.
- .4 Positive mechanical connection between channel sections that will not separate during installation and shall mechanically lock into the concrete surround every 305mm (12").
- .5 Channels shall have a smooth, 76mm (3") radiused self cleaning bottom with a Manning's coefficient of 0.009 and 1.04% or neutral 0% built in slope. Channels shall have rebar clips standard to secure trench in its final location.
- .6 Provide with standard DGC grates (heavy duty ductile iron slotted grate) that lock down to frame. Grates conforming to ASTM specification A536-84. Supplied in 608mm (24") nominal lengths with 21mm (13/16") wide slots, and (38mm) 1-1/2" bearing depth. Grate has an open area of 171,027 sq. mm per meter (80.8 sq. in

per ft.) The 6mm (1/4") thick heavy-duty carbon steel frame assembly conforms to ASTM specification

- .7 A36 with 102mm (10 - 4") long concrete anchors per 2438mm (96"). Grate lockdown bars are to be integral to the frame. The frame is supplied with a powder coated finish. All welds must be performed by a certified welder per ASTM standard AWS D1.1. Frames Shall be produced in the U.S.A.

2.6 Cleanout Co ers

.1 Exterior Surfaced Areas:

.1 Manufacturers:

- .1 Mifab
- .2 Zurn.
- .3 Watts.
- .4 Substitutions: Refer to Section 21 05 00.

.2 Round cast nickel bronze access frame and non-skid cover.

.2 Interior Finished Floor Areas:

- .1 Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

.3 Interior Finished Wall Areas:

- .1 Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

.4 Interior Unfinished Accessible Areas:

- .1 Caulked or threaded type.
- .2 Bolted stack cleanouts on vertical rainwater leaders.

2.7 Hose Bi s (HB-)

.1 Interior:

.1 Manufacturers:

- .1 Mifab
- .2 Zurn.
- .3 Watts.
- .4 Substitutions: Refer to Section 21 05 00.

.2 Exposed-type anti-contamination wall faucet with 3/4" (19mm) male hose connection and anti-siphon vacuum breaker.

- .3 Exterior finish to be brass, operating handle to be cast-iron, coloured blue or red (for cold or hot), and inlet connection shall be 1/2" (13mm) F.P.T.

.4 Vacuum breaker to be certified to A.S.S.E. Standard 1011 and listed by I.A.P.M.O.

2.8 Hydrants (WH-)

- .1 Wall Hydrant:
 - .1 Manufacturers:
 - .1 Watts HY-725
 - .2 Mifab
 - .3 Zurn.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Certified exposed type, self draining, non freeze wall hydrant
 - .3 With ANSI/ASSE 1019 approved anti-siphon and vandal resistant integral vacuum breaker, 3/4" (19) male hose connection.
 - .4 Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chrome plated bronze head casting, polished chrome plated face plate and satin finished nickel bronze box with hinged locking cover.

2.9 Was in Machine Recessed Valve Box (WM-1)

- .1 Washing Machine Box - Plastic:
 - .1 Basis of Design: Oatey
 - .1 Other manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Approvals: IAPMO listed: PS-54, ASSE 1010
 - .3 PVC enclosure for recessed wall installation and wall stud mounting suitable for left or right side mounting.
 - .4 Hot and cold water connections with shut off valves. Water connections to be for copper, CPVC, PEX or PE-RT as required.
 - .5 Brass quarter turn or single lever valve handle for hot and cold water connections, comes with temperature indicators.
 - .6 Single knockout for 50 mm (2 inch) waste with aligned knockout above drain for indirect connections.
 - .7 Options:
 - .1 Water hammer arrestor.

2.10 Hose Washer Rinse (WR-1)

- .1 National Fire Equipment Hydro-Wick Hose Washer 70FLHW30PS
 - .1 No Substitutions Permitted
- .2 38mm (1.5 inch) NPSH Connection, cleans up to 76mm (3 inch) coupled hose

2.11 Backwater Valves

- .1 PVC
 - .1 Manufacturers:
 - .1 IPEX
 - .2 Canplus
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 CAN/CSA-B181.2, Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste Vent Pipe and Pipe Fittings
 - .3 Size to match drain pipe, extension sleeve, and access cover.

2.12 Backflow Preventers (BFP)

- .1 Double Check Valve Assemblies:
 - .1 Manufacturers:
 - .1 Beeco.
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI/ASSE 1024 / CSA B64.5
 - .3 Bronze body with corrosion resistant internal parts and stainless steel springs,
 - .4 Two independently operating check valves with intermediate atmospheric vent.
- .2 Atmospheric Vacuum Breaker
 - .1 Manufacturers:
 - .1 Beeco.
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI/ASSE 1001 / CSA B64.1.1
 - .3 Bronze/brass body with heat and water hammer resistant tight sealing disc float.
 - .4 Lead free for all potable water applications.

2.13 Water Hammer Arrestors

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 ASME A112.26.1,

- .1 Stainless steel construction,
- .2 Bellows type sized to PDI WH-201,
- .3 Pre-charged suitable for operation in temperature range -73 to 149 degrees C (-100 to 300 degrees F) and maximum 1700 kPa (250 psi) working pressure.

2.14 Potable Water Automatic Balancing Valves

- .1 Manufacturers:
 - .1 Victaulic/IMI TA (Tour & Andersson) Series 76X
 - .2 Caleffi
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Construction up to and including 19mm (3/4" inch):
 - .1 Lead-free construction, Certified in accordance with NSF/ANSI 61 for commercial cold and hot water service, rated to 83°C (180°F), and NSF/ANSI 372
 - .2 Series 300 stainless steel body, nickel plated brass union nut.
 - .3 One-piece body to include a handle ball valve, a flow control cartridge assembly.
 - .4 Dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes combined with a manual air vent, and a union end.
 - .5 Valve shall be suitable for a flow range of 0.33 GPM/1.50 LPM to 12 GPM/45.4 LPM and flow rate pre-set accuracy variation of +/-5% over 95% of the control range
 - .6 Valves shall be offered with two pressure differential control ranges of 13-220 kPa (2-32 psi) or 35-414 kPa (5-60 psi) differential.
 - .7 Set valves serving plumbing fixtures to 0.5 gpm.
- .3 Valve shall come fully assembled and be permanently marked to show direction of flow; shall have a body tag to indicate flow rate and model number.
- .4 Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring.
- .5 Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance.
- .6 All flow control valve cartridges shall be warranted by the manufacturer for five years from date of sale

2.15 Grease Interceptor (GI-1)

- .1 Manufacturer: Schier GB-50
 - .1 Other acceptable manufacturers offering equivalent products.
 - .1 Mifab
 - .2 Green Turtle

.3 Substitutions: Refer to Section 21 05 00.

.1 Construction:

- .1 Tested and rated by CSA or IAPMO
- .2 Constructed of seamless polyethylene or fiberglass. Other materials by prior approval only.
- .3 Furnished for above or below grade installation as noted on drawings and schedules.
- .4 Interceptor shall be certified to ASME A112.14.3 (type D) and CSA B481.2
- .5 Provide with field adjustable riser system, built-in flow control, built-in test caps and three outlet options.
- .6 Minimum grease removal efficiency: 90% according to CSA B481.2.
- .7 3" inlet/outlets Sch. 40.Plain End (No-Hub)
- .8 Flow rate: 50 gpm (3.2 l/s)
- .9 Liquid capacity: 65 gal (246 l)
- .10 Solids Capacity: 13 gal (49 l)
- .11 Weight: 148 lbs (67 kg)
- .12 Cover shall provide water/gas-tight seal and have minimum 16,000 lbs (7257 kg) load capacity.
- .13

2.16 Oil And Grit Interceptor (OI-1)

.1 Manufacturer: Striem Series OS-100

.2 Other acceptable manufacturers offering equivalent products.

.1 Substitutions: Refer to Section 21 05 00.

.3 Construction:

- .1 4" inlet/outlets Sch. 40.Plain End (No-Hub)
- .2 Integral flow control and vent connections
- .3 Max flow rate: 100 gpm (6.2 l/s)
- .4 Liquid capacity: 250 gal (946 l)
- .5 Max oil capacity: 144 gal (545 l)
- .6 Sand capacity : 95 gal (360 l)
- .7 Unit weight w/std. covers: 346 lbs (157 kg)
- .8 16,000 lb (7257 kg) load rated, bolted, gas/water tight covers.
- .9 Maximum operating temperature 190F (88C) continuous.
- .10 Seamless molded polyethylene tank.

2.17 Hose Reel

.1 Industrial grade hose reel, spring retractable, all steel construction with baked-on powder coat finish. Based on ReelCraft Series 8000, Model D83075 OLP reel with hose, 601034-3 inlet hose, 600980 swing bracket.

- .1 Hose anti latch-out feature ensures hose retracts every time.
- .1 Guide arm is field adjustable for wall or ceiling mounting positions.
- .2 Dual pedestal base and guide arm design are structurally reinforced.
- .2 Five-in-one, heat-treated aluminium casting incorporates main shaft, ratchet, spring arbor and inlet/outlet plumbing in one-piece casting.
- .3 Containerized spring assembly to provide safe and easy handling during maintenance.
- .3 Two sealed ball bearings for smooth rotation of main shaft.
- .4 Unit to be complete with 23m long 19mm I.D. low pressure PVC hose rated to 65 Deg.C at 1724 kPa.
- .4 Wall-Mounted Swing Bracket: Provide bracket matched to hose reel that shall pivot approximately 180° All steel construction with a durable baked on powder coat finish.
- .5 Unit to be complete with 19mm flexible inlet hose assembly to connect from hose bibb to reel inlet.
- .5 Unit to be complete with all required mounting accessories.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer instructions.
- .2 Cleanouts
 - .1 Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
 - .2 Install wall cleanouts serving urinals above the flood plane of the fixture but below the top of the fixture it serves not including the flush valve.
 - .3 Encase exterior cleanouts in concrete flush with grade.
 - .4 Install floor cleanouts at elevation to accommodate finished floor.
- .3 Backflow Devices
 - .1 Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
 - .2 All water cross connection and backflow prevention shall comply with City of Winnipeg By-Law 107 and CSA B64.10. Note that where severe hazards exist, an approved control device must be installed both on service pipe as well as on pipe at source of potential contamination.
 - .3 Expenses for material, installation, testing and approval of cross connection and backflow prevention shall be paid by Section 22 40 10.
 - .4 Provide minimum 1-1/4" (32mm) clearance between backflow preventer body and adjacent structure (wall, ceiling, etc.) and equipment. Clearance space to be sufficient to facilitate easy removal for servicing. The BFP

- shall be located no higher on wall than 48" (1200mm) above the finished floor.
- .5 Backflow preventers shall be sized for the maximum rated flow of the equipment it is serving.
 - .6 All testable backflow prevention devices shall be installed in accessible locations as defined by CSA-B64.10. If this cannot be accomplished, provide access platforms, etc. at no extra cost to The City.
 - .7 Install testable backflow preventers on domestic water outlets to washing machines and dishwashing equipment.
 - .8 Pipe relief from backflow preventer to nearest drain sized to manufacturer's requirements.
- .4 Water Hammer Arrestors
- .1 Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets, banks of flush valve fixtures (eg. Water closets, urinals).
 - .2 Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 20 mm (3/4 inch) minimum, and minimum 450 mm (18 inches) long.

END OF SECTION

Part 1 General

1.1 References

- .1 CSA B45.1 / ASME A112.19.2 - Ceramic plumbing fixtures
- .2 CSA B45.2 / ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures
- .3 CSA B45.4 / ASME A112.19.3 - Stainless Steel Plumbing Fixtures
- .4 CSA B125.1 / ASME A112.18.1 - Plumbing Supply Fittings
- .5 CSA B125.2 / ASME A112.18.2 – Plumbing Waste Fittings
- .6 CSA B125.3 - Plumbing Fittings
- .7 CSA B125.6 / ASME A112.18.6 – Flexible Water Connectors
- .8 CSA B125.14 / ASME A112.4.14 - Manually operated valves for use in plumbing systems
- .9 CSA B125.16/ASSE 1016/ASME A112.1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations
- .10 CSA B125.70 / ASSE 1070/ASME A112.1070 - Performance requirements for water temperature limiting devices
- .11 CSA B651 – Barrier-free Design.
- .12 ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment
- .13 ANSI/ISEA Z358.1 - Emergency Eye Wash and Shower Equipment.
- .14 NPCC 2010 – National Plumbing Code of Canada
- .15 NSF
 - .1 NSF 61 - Drinking Water System Components – Health Effects

1.2 Submittals or Release

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.3 Closeout Submittals

- .1 Section 21 05 00: Submission procedures.

- .2 Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- .3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.4 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by CSA as suitable for the purpose specified and indicated.

1.6 Delivery, Storage, and Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept fixtures on site in factory packaging. Inspect for damage.
- .3 Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

Part 2 Products

2.1 Water Closets – Flush Valve – Floor-Mounted

- .1 WC-1:
 - .1 Manufacturer: American Standard Madera FlowWise Model 6461.001
 - .1 No substitutions.
 - .2 ASME A112.19.2 / CSA B45.1:
 - .1 Floor mounted, vitreous china bowl, with elongated rim, 419 mm (16.5") height
 - .2 4.84 lpf (1.28 gpf)
 - .3 (1-1/2 inch) 38 mm top spud,
 - .4 Bolt caps,
 - .5 Colour: white
 - .6 One year limited warranty
- .2 Exposed Sensor Operated Flush Valve (Battery) – Non-Barrier Free:
 - .1 Manufacturer: American Standard Selectronic Sensor Operated Flush Valve Model 6066.121.002
 - .1 No substitutions
 - .2 Watersense Listed
 - .3 ASME A112.19.2 / CSA B45.1:

- .1 Exposed chrome plated, electronic infrared sensor flush valve
 - .2 Chloramine resistant diaphragm with forged brass diaphragm retainer and renewable seat.
 - .3 Distance measurement based on bowl length for activation setting. Field adjustable.
 - .4 Four AA batteries, factory-installed, low battery indicator, 10-year battery (4000 flushes per month) warranty
 - .5 Integral screwdriver stop and vacuum breaker,
 - .6 Metal non hold open over-ride button,
 - .7 Pressure loss check angle stop with cap,
 - .8 Valve outlet tube 292 mm (11-1/2 inches) height
 - .9 Factory set to 4.8lpf (1.28 gal) flush volume.
- .3 Seat:
- .1 Manufacturer: Bemis Commercial Heavy Duty Plastic Self Sustaining Toilet Seat, Elongated, Model 1055SSC.
 - .1 No substitutions
- .4 Back Rest:
- .1 Manufacturer: Franke CM-16104.
 - .1 Other acceptable manufacturers offering equivalent products.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Stainless steel bar uses #4 gloss with flanges and covers.
 - .3 Antique white solid core plastic laminate 10"x4" panel back.
 - .4 Concealed snap flanges and mounting hardware included.
 - .5 Provide adequate backing in wall for support and comply to local codes for barrier free requirements.

2.2 La tories

- .1 LAV-1: Stainless Steel Drop-In Countertop Basin:
- .1 Manufacturer: Franke Model V1619/6/1
 - .1 No substitutions
 - .2 Construction: CSA B45.1 (ASME A112.19.3):
 - .1 Construction: 18-10 Stainless steel, type 304, 18 gauge,
 - .2 Self-rimming and positive hold-down clamping,
 - .3 Mirror-finished rim, satin-finished bowl, undercoated.
 - .4 32 mm (1-1/4") waste fitting.
 - .5 Overall: 416 x 470 mm (16.5 x 18.5 inches)
 - .6 Basin: 279 x 386 x 152 mm (11 x 15.25 x 6 inches)
 - .7 One faucet hole, 38 mm (1.5" inch) diameter
 - .8 Seal of putty, caulking, or concealed vinyl gasket.
- .2 LAV-2: Vitreous China Wall Hung Basin:

- .1 Manufacturer: American Standard Decorum Wall Hung Lavatory Model 9024.001EC
 - .1 No substitutions.
- .2 ASME A112.19.2 / CSA B45.1:
 - .1 Vitreous china wall hung lavatory,
 - .2 Rectangular basin and splash lip,
 - .3 Overall: 508 x 464 mm (20 x 18-1/4 inch)
 - .4 Basin Depth: 127 mm (5 inch)
 - .5 One faucet hole, center
 - .6 Integral rear overflow
 - .7 Colour: white
- .3 ADA / CSA B651:
 - .1 Barrier-free compliant.
- .1 Lavatory Faucet - Electronic:
 - .1 Manufacturer: Delta Hands Free 591T1220
 - .1 No substitutions
 - .2 Watersense Listed
 - .3 CSA B125.1/ASME A112.18.1;
 - .1 Cast brass, chrome plated one piece body with integral waterproof sensor and connector and metal hold down.
 - .1 Outlet 100 mm (4") above floor rim level
 - .2 Outlet: 1.9L/min (0.5 gpm) vandal resistant, aerated
 - .3 CSA B651 accessibility compliant
 - .2 Serviceable filter upstream of the solenoid valve
 - .3 Adjustable sensing range of 75 to 380 mm (3" to 15") and timeout of 15 to 75 seconds.
 - .4 Hard Wire electronic sensor with transformers and converters as required for conversion from 120V power.
 - .5 Solenoid and controller in plastic surface mount housing
 - .6 NSF 61 Lead Free compliant
 - .7 5-year limited warranty
 - .4 Trim:
 - .1 Mixing valve, Delta R3070-MIXLF
 - .2 Open grid strainer, chrome finish
- .2 Lavatory Pipe Insulation:
 - .1 Manufacturer: TrueBro Lav Guard 2 E-Z
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .3 Material:
 - .1 Molded vinyl Nominal Wall 3 mm (1/8") constant
 - .2 UV Protection

- .3 Trimming (E-Z Series) "Internal, E-Z Tear-To-Fit trim feature"
- .4 Fasteners (E-Z Series) Internal E-Z Grip fasteners (reusable)
- .5 Color - China white, Paintable
- .6 Burning Characteristics ASTM D-635
- .7 "ASTM G21 and G22 - Bacteria/Fungus Resistance"

2.3 Sinks

- .1 SK-1: Single Compartment, Undermount, Stainless Steel
 - .1 Manufacturer: Franke CUX11021-ADA-CA
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.3:
 - .1 18-8 stainless steel sink, 18 gauge, satin finished bowl,
 - .2 Type 304 stainless steel,
 - .3 Basin: 540 x 410 x 127 mm (21.25 x 16.125 x 5 inches) L x W x D
 - .4 89mm (3-1/2") basket strainer waste filling and installation kit
 - .2 Trim:
 - .1 Manufacturer: Delta Model 1959LF.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.18.1:
 - .1 Single-control brass deckmount faucet,
 - .2 One hole installation
 - .3 Cast brass body, tubular swing spout with 120 degree rotation, 150 mm width, 293 mm total height, spout 185 mm above counter
 - .4 5.7 l/m (1.5 gpm) aerator
 - .5 Finish, chrome
 - .3 NSF 61 Lead Free compliant
 - .3 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.
 - .4 SK-2: Sink Integrated in Stainless Steel Counter, Two Compartment
 - .1 Sink provided by Division 05
 - .2 Trim provided by Division 22:
 - .1 Manufacturer: Krowne 12-812L, or equivalent.
 - .2 ASME A112.18.1:
 - .1 2-hole 203 mm (8") deckmount mixing faucet with polished chrome plated brass body

- .2 Add-on faucet with compression cartridge and lever handle (1/4 turn with spring checks), 305 mm (12" tubular swing nozzle with 3.8 l/min (1.8 gpm) VR aerator, 180° rotation
- .3 NSF 61 Lead Free compliant
- .5 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.
- .6 SK-3: Sink Integrated in Stainless Steel Counter, Two Compartment
 - .1 Sink provided by Division 05
 - .2 Trim provided by Division 22:
 - .1 Manufacturer: T&S Model B-0123-12V15-B.
 - .1 No substitutions
 - .2 ASME A112.18.1:
 - .1 2-hole 203 mm (8") deckmount mixing faucet with polished chrome plated brass body
 - .2 Add-on faucet with compression cartridge and lever handle (1/4 turn with spring checks), 305 mm (12" tubular swing nozzle with 5/7 l/min (1.5 gpm) VR aerator, 180° rotation
 - .3 610 mm (24") riser, 1118 mm (44") flexible stainless steel hose with heat resistant handle, 1.15 gpm spray valve, compression cartridges with spring checks, lever handles (1/4 turn with spring check), 13 mm (1/2") NPT female inlets, 152 mm (6") adjustable wall bracket, spray valve holder and overhead spring
 - .3 NSF 61 Lead Free compliant
- .7 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.
- .8 SK-4: Sink Integrated in Stainless Steel Counter, Single Compartment
 - .1 Sink provided by Division 05
 - .2 Trim provided by Division 22:
 - .1 Manufacturer: Delta Trinsic 9159-DST
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.18.1:
 - Single hole deckmount faucet with pull down sprayer, single handle flow/temperature control, polished chrome plated brass body

- .1 Tubular swing spout with 360 degree rotation, 241 mm width, 399 mm total height, spout 214 mm above counter
- .3 6.8 l/m (1.8 gpm) aerator
- .4 NSF 61 Lead Free compliant
- .9 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.
- .10 SK-5: Single Compartment, Top-mount Utility Sink, Stainless Steel
 - .1 Manufacturer: Kohler Ballard Model K-5798-3
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.3:
 - .1 18-8 stainless steel sink, 18 gauge, satin finished bowl,
 - .2 Three faucet holes
 - .3 Type 304 stainless steel,
 - .4 Basin: 540 x 400 x 287 mm (21.25 x 15.75 x 11.25 inches)
 - .5 89mm (3-1/2") basket strainer waste filling and installation kit
- .11 Trim:
 - .1 Manufacturer: Delta Model 27C1234-S7
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.18.1:
 - .1 Two-handle, deck mount faucet, with hose and sprayer
 - .2 Four hole installation (install sprayer in counter next to sink)
 - .3 Cast brass body with 279 mm (11") tubular swing spout, aerator outlet 5.7 l/min (1.5 gpm).
 - .4 102 mm (4") blade handles
 - .5 Comes with deck mount sprayer and hose
 - .6 Colour: polished chrome
 - .3 NSF 61 Lead Free compliant
- .12 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.

2.4 Bat tubs and Showers

- .1 SH-1: Standard Shower
 - .1 Manufacturer: MAAX Camelia SH-4834, Model 105919-S-000-001
 - .1 No Substitutions

- .2 2-piece acrylic shower unit with centre drain, no seat
- .3 Colour: white
- .4 Size: 1219 x 876 x 2007 mm (48 x 34.5 x 79 inches)
- .5 Shower Trim:
 - .1 ASME A112.18.1 / CSA-B125.1 / ASSE 1016
 - .1 Shower Head:
 - .1 Manufacturer: Kohler Model K-10282-AK-CP
 - .1 No substitutions
 - .2 Watersense Listed
 - .3 Single-function showerhead with 66-nozzel 140 mm (5.5") diameter sprayface, wall mount
 - .4 Polished chrome finish
 - .5 ½" NPT connection
 - .6 9.5 l/min (2.5 gpm) maximum
 - .2 Faucet and Valve Controls:
 - .1 Manufacturer: Kohler Model K-TS10276-4-CP and K-8304-K
 - .1 No substitutions
 - .2 Single lever handle with faceplate
 - .3 Pressure-balanced shower valve,
 - .4 Pressure Balancing Cartridge with integral spool and sleeve assembly;
 - .5 Adjustable hot water limit stop.
 - .6 Cartridge shall contain all the movable parts and shall be accessible from the front of the unit.
 - .7 The escutcheon will have a hot and cold coded index.
 - .8 Polished chrome finish
 - .3 Drain:
 - .1 Manufacturer: Kohler K-9132-CP
 - .1 No substitutions
 - .2 Round, perforated strainer drain
 - .3 111 mm (4-3/8") diameter, for use with 50 mm (2") drain pipe
 - .4 Solid brass construction
 - .5 Polished chrome finish
 - .4 Provide with curtain rod, curtain hangers, and shower curtain

2.5 Ser vice Sin s

- .1 MS-1 Mop Sink:
 - .1 Manufacturer: Fiat Product MSB-2424
 - .1 No substitutions.

- .2 Dimensions: 610 x 610 x 254 mm (24 x 24 x 10 inch)
- .3 Molded stone mop service basin
- .2 MS-2:
 - .1 Custom fabricated mop sink provided by Division 03 and Division 05. Refer to architectural detail 6/A510.
- .3 Trim:
 - .1 Faucet:
 - .1 Manufacturer: Fiat 830-AA service faucet
 - .1 No substitutions
 - .2 Chrome plated with vacuum breaker, integral stops, adjustable wall brace, pail hood, and 19 mm (3/4") hose thread on spout
 - .2 Hose and Bracket:
 - .1 Manufacturer: Fiat 832-AA service faucet
 - .1 No substitutions
 - .3 Drain:
 - .1 Stainless steel with dome strainer and lint basket
 - .2 For connection to 3" drain pipe

2.6 E r e n c e E e - W a s / S o e r C o i n e d S t a t i o n

- .1 Manufacturer: Guardian Equipment G1902P and G1902P-SSH.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Haws.
 - .2 Bradley.
 - .3 Substitutions: Not permitted.
- .3 ANSI Z358.1:
 - .1 Combination eye wash/shower safety station with ABS plastic shower head, ABS plastic bowl, powder coated cast aluminum flag handle and floor flange,
 - .2 32 mm (1 1/4") IPS Schedule 40 galvanized pipe and fittings, 25 mm (1") IPS and 13 mm (1/2") IPS U.S. made chrome plated brass stay open ball valves, and polished stainless steel pull rod.
 - .3 Unit shall have two polypropylene 'GS Plus' spray heads with integral "flip-top" dust covers, filters, and 6.8 l/min (1.8 pgm) flow control orifices mounted on a chrome plated brass eyewash assembly.
 - .4 Unit shall include ANSI compliant sign.
- .4 Eye-Wash / Shower Combined Station Thermostatic Mixing Valve:
 - .1 Manufacturer: Guardian Model G3807.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI Z358.1, ASSE 1071:

- .1 Valve has flow rate of 11 to 200 l/min (3 to 53 gallons per minute (GPM).
- .2 Valve has bimetallic thermostat that is preset at 29°C (85°F). High temperature limit stop is set to 32°C (90°F).
- .3 Valve has thermometer on outlet to monitor delivered water temperature.
- .4 Fail Safe: In event of loss of hot water supply, internal bypass allows valve to deliver cold water to safety units. In event of loss of cold water, valve will close and not deliver water.
- .5 Mounting: Unit is mounted in 18 gauge Type 304 stainless steel recessed housing. Cabinet has hinged door with lock.
- .6 Inlets: 25 mm (1") NPT female inlets with integral checkstops and strainers. Union connections permit valve to be installed with supplies from top or rear. Minimum supply pressure required is 40 PSI. Outlet: 32 mm (1 1/4") NPT female outlet.

Part 3 Execution

3.1 Examination

- .1 Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- .2 Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 Preparation

- .1 Rough-in fixture piping connections to minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 Installation

- .1 Install to manufacturer's instructions.
- .2 Install each fixture with trap, easily removable for servicing and cleaning.
- .3 Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons. Install all exposed piping and valves neatly and close to the wall. Supplies should be run as plumb as possible.
- .4 Install components level and plumb.
- .5 All mixing valves serving multiple fixtures shall be installed in recessed cabinets.
- .6 Sanitary pipe serving lavatories shall run fully concealed within plumbing chase and only penetrate wall directly inline with each basin. No lateral offset will be permitted. There shall be one penetration per basin. All exposed sanitary pipe shall be chrome plated complete with echeloned plates at wall. Echeloned plate shall be secured to wall with silicone.

- .7 Install lavatory mixing valves neatly and out of site under millwork unless specified as installed in recessed cabinet. Secure with proper fasteners – galvanized strapping is not acceptable. Where provided on the drawings, refer to mixing valve installation details.
- .8 The temperature of water discharging into a shower shall be set and tested by the contractor to not exceed 49°C (120°F).
- .9 Install and secure fixtures in place with wall supports or wall carriers (as specified in Part 2 Products) and bolt, washer, nut fasteners.
- .10 Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, colour to match fixture.
- .11 Seal sinks and lavatories to the millwork. Install gasket where supplied or recommended by sink or lavatory manufacturer.
- .12 Solidly attach water closets to floor with lag screws.
- .13 Emergency shower / eye-wash stations should be installed so that shower head is at least 82" above floor and 32" from wall or nearest obstruction.
- .14 Thermally insulate and jacket all exposed drain pipe extensions, traps, and trap arms below barrier-free wall-hung lavatories.

3.4 Inter ace Wit Ot er Products

- .1 Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 Ad ustin

- .1 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- .2 Adjust stops or valves to comply with specified flow rates.
- .3 Adjust sensor ranges to allow consistent operation of fixtures.

3.6 Cleanin

- .1 Section 01 74 00: Cleaning installed work.
- .2 Clean plumbing fixtures and equipment.

END OF SECTION

Part 1 General

1.1 References

- .1 ASHRAE 90A - Energy Conservation in New Building Design.
- .2 ASME Section 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.
- .3 CSA
 - .1 CSA B51 - Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA B64 Series Definitions, General Requirements, and Test Methods for Vacuum Breakers and Backflow Preventers
 - .3 CAN/CSA B125.1/ASME A112.18.1 - Plumbing Supply Fittings
 - .4 CAN/CSA-B125.2/ASME A112.18.2 - Plumbing Waste Fittings
 - .5 CSA B149.1 – Natural Gas and Propane Installation Code
 - .6 CSA C22.2 – General requirements - Canadian Electrical Code, Part II (Electrical Safety Standards)
 - .7 CAN/CSA-C191 - Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
 - .8 CSA/ANSI Z21.10.1:19/CSA 4.1 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less
 - .9 CSA 4.3/ANSI Z21.10.3 - Gas water heaters - Volume III, Storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous
- .4 UL
 - .1 UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- .5 NSF
 - .1 NSF/ANSI 42 - Drinking Water Treatment Units – Aesthetic Effects
 - .2 NSF/ANSI 61 - Drinking Water System Components – Health Effects
 - .3 NSF/ANSI 372 - Drinking Water System Components - Lead Content
- .6 Canadian Energy Efficiency Regulations

1.2 Submittals or Review

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data:
 - .1 Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - .2 Indicate pump type, capacity, power requirements.
 - .3 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

- .4 Provide electrical characteristics and connection requirements.
- .3 Shop Drawings:
 - .1 Indicate heat exchanger dimensions, size of tappings, and performance data.
 - .2 Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- 1.3 Closeout Submittals**
 - .1 Section 21 05 00: Submission procedures.
 - .2 Record Documentation: Record actual locations of components and electrical power supply.
 - .3 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
 - .4 Test Results: Provide water hardness results for pre- and post-softened water.
 - .5 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.
- 1.4 Maintenance Material Submittals**
 - .1 Section 01 78 10: Maintenance and extra material requirements.
 - .2 Extra Stock Materials: Provide two spare pump seals for each pump.
- 1.5 Quality Assurance**
 - .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
 - .2 Provide pumps with manufacturer's name, model number, and rating/capacity identified.
 - .3 Ensure products and installation of specified products are to recommendations and requirements of the following organizations:
 - .1 Canadian Gas Association (CGA).
 - .2 National Sanitation Foundation (NSF).
 - .3 American Society of Mechanical Engineers (ASME).
 - .4 International Association of Plumbing and Mechanical Officials (IAPMO)
 - .5 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - .6 National Electrical Manufacturers' Association (NEMA).
 - .7 Underwriters Laboratories (UL).
 - .4 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

- .5 AHRI certification:
 - .1 Residential gas fired water heaters to National Uniform Energy Factor regulations and first hour rating output.

1.6 Regulator Requirements

- .1 Conform to the Canadian Energy Efficiency Regulations for regulated products.
- .2 Conform to CGA / AGS requirements for water heaters.
- .3 Conform to ASME Section 8D for manufacture of pressure vessels for heat exchangers.
- .4 Conform to ASME Section 8D for tanks.
- .5 Certification markings to indicate compliance with Canadian codes and standards.
- .6 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- .7 All wetted surfaces to comply with NSF requirements for low lead content.

1.7 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 Warranty

- .1 Section 21 05 00: Warranties.
- .2 Provide a five (5) year warranty to include coverage for failure to meet specified requirements, for domestic water heaters, water storage tanks, and packaged water heating systems.

Part 2 Products

2.1 Commercial Electric Water Heaters (DWH-)

- .1 Manufacturers:
 - .1 A.O. Smith.
 - .2 Rheem/Ruud.
 - .3 Bradford White.
 - .4 Aerco.
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Type: Factory-assembled and wired, electric, vertical storage.

- .3 Performance - refer to schedules.
- .4 Tank:
 - .1 Glass lined welded steel,
 - .2 100 mm (4 inch) diameter inspection port,
 - .3 Thermally insulated with minimum insulating value of RSI-2.2 (R-12.5), encased in corrosion-resistant steel jacket.
 - .4 Baked-on high-temperature porcelain enamel finish.
 - .5 Working pressure rating of 150 psi.
- .5 Controls:
 - .1 Automatic immersion water thermostat,
 - .2 Externally adjustable temperature range from 16 to 82°C (60 to 180°F),
 - .3 Flanged or screw-in nichrome elements,
 - .4 Integral, manual reset, high temperature limit thermostat.
- .6 Accessories:
 - .1 Brass water connections and dip tube,
 - .2 Drain valve,
 - .3 Magnesium anode, rigidly supported,
 - .4 CSA certified and ASME rated temperature and pressure relief valve.

2.2 Indirect Hot Water Heaters / Storage Tanks (ST-1)

- .1 Manufacturers:
 - .1 Thermo 2000
 - .2 Bradford White
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Performance: Refer to Schedules.
- .3 Heat Exchanger:
 - .1 Double-wall copper piping in the form of parallel helicoidal lines having a maximum operating pressure of 1034 kPa (150 psi).
 - .2 All copper components and assembly will meet the low lead requirements for potable plumbing products and NSF 61.
- .4 Tank:
 - .1 High-density carbon steel.
 - .2 Joints arc-welded using the MIG/Argon method
 - .3 Maximum allowable working pressure of 1034 kPa (150 psi) , hydrostatically tested at 2068 (300 psi).
 - .4 Insulation shall be 50 mm (2") HFC-free polyurethane insulation limiting heat loss to (1/4 °C) (° F) per hour.
 - .5 Outer steel jacket surface coated with baked powder-based paint

- .5 Accessories:
 - .1 ASME rated pressure relief valve set at 207 kPa (30 psi) protecting the tank
 - .2 13mm (½") automatic air vent with a shut-off valve for easy replacement.
 - .3 2 ½" diameter temperature and pressure indicator on the front
 - .4 ¾" drain (ball) valve made of brass, which have a maximum working pressure of 150 psi
 - .5 Adjustable legs for leveling

2.3 Potable Water Expansion Tanks – Diaphragm Type (ET-3)

- .1 Manufacturers:
 - .1 ITT/B & G.
 - .2 Taco.
 - .3 Armstrong.
 - .4 Armtrol
 - .5 Calefactio
 - .6 Substitutions: Refer to Section 21 05 00.
 - .2 Construction: Welded steel, tested and stamped to Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 860 kPa (125 psig), with flexible butyl diaphragm sealed into tank, and steel legs or saddles.
 - .1 Construction: Welded steel, with flexible butyl diaphragm sealed into tank
 - .2 Factory pre-charged to 55 psi.
 - .3 Accessories: Pressure gauge and air-charging fitting, tank drain;
 - .4 Performance:
 - .1 Refer to schedules.
- Potable Water Expansion Tanks – Bladder Type

2.4 Inline Circulator Pumps

- .1 Manufacturers:
 - .1 ITT / B & G.
 - .2 Taco.
 - .3 Armstrong.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Casing: Bronze, rated for 860 kPa (125 psig) working pressure, with stainless steel rotor assembly.
- .3 Impeller: PPE Resin

- .4 Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings or Ceramic.
- .5 Seal: Carbon rotating against a stationary ceramic seat.
- .6 Drive: Flexible coupling.
- .7 Accessories:
 - .1 Automatic Timer Kit
 - .1 Modes: On/off/Intervals.
 - .2 Check Valve
 - .3 Three Speed
- .8 Performance:
 - .1 Refer to schedule.

2.5 Su ersi le Su Pu s

- .1 Manufacturers:
 - .1 Little Giant EC Series.
 - .2 Liberty
 - .3 ITT / Goulds.
 - .4 Barnes.
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Type: Completely submersible, vertical, centrifugal.
- .3 Motor: thermal overload protected, stainless-steel heat-treated shaft, continuous duty oil-free motor, permanently lubricated lip seal.
- .4 Casing: Cast iron pump body.
- .5 Impeller: Glass-reinforced thermoplastic, stainless-steel heat-treated shaft.
- .6 Solids handling capability: 1/2".
- .7 Bearings: Ball bearings.
- .8 Performance:
 - .1 Refer to schedules.
- .9 Sump Pit:
 - .1 Fibreglass basin with perforated steel cover plate
 - .2 762 mm (30 inches) diameter, 1219 mm (48 inches) deep.
- .10 Duplex Sump Controller:
 - .1 Basis of Design: Zoeller 10 series
 - .2 cUL listed
 - .3 Hand-Off-Auto Toggle Switch for each pump

- .4 Green pump run pilot light for each pump
- .5 Alarms:
 - .1 Alarm test and silence switches
 - .2 Audible alarm with 83 to 85 decibel rating for high water condition
 - .3 High Water Alarm
 - .4 Integral auxiliary terminal board connections (dry contact) for remote alarm monitoring
- .6 Single phase - Circuit breaker for each pump. Refer to schedule.
- .7 Magnetic starter for each pump
- .8 Alternating mechanism
- .9 Numbered terminal strip for connecting pumps and variable level float switches
- .11 NEMA 1 - general purpose, indoor
 - .1 Red pilot light
- .12 4 level float switch control operation:
 - .1 Float 1: low level – shut off both pumps
 - .2 Float 2: high level – duty pump on
 - .3 Float 3: high-high level – standby pump on
 - .4 Float 4: critical level alarm
- .5 Floats: corrosion resistant, non-mercury float switch or vertical rod with non-submersible switch.
- .13 Sequence:
 - .1 Duty pump operates on high water level, stops on low water level.
 - .2 Standby pump operates on high-high water level with both pumps operating.
 - .3 Alternator changes designation of duty and standby pumps.
 - .4 Alarm sounds on actuation of float 4.

Part 3 Execution

3.1 Installation

- .1 Install water heaters to manufacturer's instructions and to local regulations and requirements.
- .2 Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.
- .3 Domestic Hot Water Storage Tanks:
 - .1 Provide painted steel frame support, independent of building structural framing members.
 - .2 Clean and flush after installation. Seal until pipe connections are made.
- .4 Pumps:

- .1 Ensure shaft length allows sump pumps to be located minimum 600 mm (24 inches) below lowest invert into sump pit and minimum 150 mm (6 inches) clearance from bottom of sump pit.
- .2 Provide air cock and drain connection on horizontal pump casings.
- .3 Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
- .4 Decrease from line size with long radius reducing elbows or reducers.
- .5 Support piping adjacent to pump such that no weight is carried on pump casings.
- .6 Provide supports under elbows on pump suction and discharge line sizes 100 mm (4 inches) and over.
- .7 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- .8 Align and verify alignment of base mounted pumps prior to start-up.
- .9 Oil sensing probes to be tested for proof of activation during installation.

END OF SECTION

Part 1 General

1.1 References

- .1 MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed.

1.2 Performance Requirements

- .1 Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.
- .2 Expansion Calculations:
 - .1 Installation Temperature (hot water heating, domestic hot water, steam, condensate): 10 degrees C (50 degrees F).
 - .2 Operational Temperatures
 - .1 Hot Water Heating: 99 degrees C (210 degrees F).
 - .2 Domestic Hot Water: 60 degrees C (140 degrees F).
 - .3 Safety Factor: 30 percent.

1.3 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.4 Operation and Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include adjustment instructions.

1.5 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 Delivery, Storage, and Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- .3 Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.7 Warrant □

- .1 Warranty: Include coverage for leak free performance of packed expansion joints.

Part 2 Products

2.1 Flexible Pipe Connectors

- .1 Steel Piping:
 - .1 Manufacturers:
 - .1 HYSPAN.
 - .2 Substitutions: Refer to Section 21 05 00
 - .2 Inner Hose: Stainless Steel.
 - .3 Exterior Sleeve: Double braided stainless steel.
 - .4 Pressure Rating: 1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F).
 - .5 Joint: As specified for pipe joints.
 - .6 Size: Use pipe sized units.
 - .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .2 Copper Piping – domestic water services up to and including 50 mm (2”):
 - .1 Manufacturers:
 - .1 Hydro Flex Inc.
 - .2 HYSPAN.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Inner Hose: Bronze
 - .3 Exterior Sleeve: Single braided bronze.
 - .4 Pressure Rating: 1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F).
 - .5 Joint: As specified for pipe joints.
 - .6 Size: Use pipe sized units
 - .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .3 Copper Piping – domestic water services over 50 mm (2”):
 - .1 Manufacturers:
 - .1 Hydro Flex Inc.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Inner Hose: Bronze
 - .3 Exterior Sleeve: Single braided stainless steel with Van Stone floating flanges and stainless steel sleeve at all wetted areas.
 - .4 Pressure Rating: 1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F).
 - .5 Joint: flanged.

- .6 Size: Use pipe sized units
- .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.

2.2 Expansion Joints

- .1 Stainless Steel Bellows Type:
 - .1 Manufacturers:
 - .1 HYSPAN Model 8503
 - .2 Flextronics.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Pressure Rating: 1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F).
 - .3 Maximum Compression: 45 mm (1-3/4 inch).
 - .4 Maximum Extension: 6 mm (1/4 inch).
 - .5 Joint: As specified for pipe joints.
 - .6 Size: Use pipe sized units.
 - .7 Application: Steel piping 75 mm (3 inch) and under.
- .2 External Ring Controlled Stainless Steel Bellows Type:
 - .1 Manufacturers:
 - .1 HYSPAN Model 3500 series.
 - .2 Flextronics.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Pressure Rating: 1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F).
 - .3 Maximum Compression: 24 mm (15/16 inch).
 - .4 Maximum Extension: 8 mm (5/16 inch).
 - .5 Maximum Offset: 3 mm (1/8 inch).
 - .6 Joint: Flanged.
 - .7 Size: Use pipe sized units.
 - .8 Accessories: Internal flow liner. Externally guided.
 - .9 Application: Steel piping over 75 mm (3 inch).

2.3 Accessories

- .1 Pipe Alignment Guides:
 - .1 Manufacturers:
 - .1 Anvil.
 - .2 HYSPAN.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 25 mm (1 inch) thick insulation, minimum 75 mm (3 inch) travel.

Part 3 Execution

3.1 Installation

- .1 Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required and where indicated on the drawings.
- .2 If not otherwise indicated on the drawings 1200 mm x 1200 mm (4' x 4') expansion loops shall be installed on all copper hot water heating piping having a straight run in excess of 12 m (40'). The expansion loop shall be centred in the straight run, with alignment guides on each side of the loop and anchors at the extreme ends of the pipe run. Similar loops shall be installed on straight runs of steel steam, condensate and hot water piping which exceeds 18 m (60') in length.
- .3 Follow Manufacturer's written instructions in regard to proper length, anchoring and guiding, pre-compression, removal of spacers, and testing.
- .4 When expansion joints are installed at ambient temperatures higher than minimum system operating temperature, they shall be pre-compressed prior to installation, to allow for eventual contraction of piping.
- .5 Construct spool pieces to exact size of flexible connection for future insertion.
- .6 Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- .7 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- .8 Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- .9 Provide Victaulic piping with minimum one joint per 25 mm (1 inch) pipe diameter instead of flexible connector supported by vibration isolation. Victaulic piping need not be anchored.

END OF SECTION

Part 1 General

1.1 References

- .1 ASME B40.100 - Pressure Gauges and Gauge Attachments.
- .2 ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.
- .3 ASME B40.100 - Pressure Gauges and Gauge Attachments
- .4 ASME B40.200 - Thermometers, Direct Reading and Remote Reading
- .5 ASTM E1 - Specification for ASTM Thermometers.
- .6 ASTM E77 - Inspection and Verification of Thermometers.
- .7 ASTM E2251- Standard Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids
- .8 AWWA C700 - Cold Water Meters - Displacement Type, Bronze Main Case.
- .9 AWWA C701 - Cold Water Meters - Turbine Type, for Customer Service.
- .10 AWWA C702 - Cold Water Meters - Compound Type.
- .11 AWWA C706 - Direct-Reading, Remote Registration System for Cold-Water Meters.
- .12 AWWA C707 - Encoder-Type Remote-Registration Systems for Cold-Water Meters
- .13 AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- .14 ISA RP 3.2 - Flange Mounted Sharp Edged Orifice Plates for Flow Measurement.
- .15 UL 393 - Indicating Pressure Gauges for Fire-Protection Services.
- .16 UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.2 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide list which indicates use, operating range, total range and location for manufactured components.

1.3 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.

- .2 Project Record Documents: Record actual locations of components and instrumentation.

1.4 Environmental Requirements

- .1 Section 21 05 00: Environmental conditions affecting products on site.
- .2 Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.5 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two bottles of red gauge oil for static pressure gauges.

Part 2 Products

2.1 Pressure Gauges

- .1 Manufacturers:
 - .1 Winters.
 - .2 Trerice.
 - .3 Ashcroft.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Compliance: ASME B40.100
- .3 Gauge: stainless steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - .1 Case: Steel with bronze or brass bourdon tube.
 - .2 Gauges shall be dry – no glycerine or silicone fill.
 - .3 Size: nominal 100 mm (4 inch) diameter dial - gauges located up to 3000 mm (10'-0") above finished floor.
 - .4 Size: nominal 150 mm (6 inch) diameter dial - gauges located above 3000 mm (10'-0") above finished floor.
 - .5 Range: gauges shall be selected based on the application to show twice the normal operating pressure with indicating needle at 12 o'clock position for normal operating pressure.
 - .6 Mid-Scale Accuracy: One percent (1%) of full span.
 - .7 Scale: Both psi and kPa with psi prominent figure.
 - .8 Gauges for domestic water applications shall conform to NSF 61 and NSF 372.

2.2 Pressure Gauge Taps

- .1 Gauge Cock: Tee or lever handle, brass for maximum 1034 kPa (150 psig).

□

- .2 Needle Valve: Brass 6 mm (1/4 inch) NPT for minimum 1034 kPa (150 psig).
- .3 Pulsation Damper: Pressure snubber, brass with 6 mm (1/4 inch) connections.
- .4 Syphon for gauges on steam systems: Stainless-steel shut-off ball valve complete with 1/4" NPT stainless-steel coil siphon rated minimum 1723 kPa (250 psig) working pressure.

2.3 Ste T er o eters

- .1 Manufacturers:
 - .1 Winters.
 - .2 Terice.
 - .3 Ashcroft.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Compliance: ASME B40.200, ASTM E2251, ASTM E1
- .3 Thermometer: Liquid in glass; adjustable angle, coloured organic fluid, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
- .4 Choice of stem types shall not be made until piping/ductwork and equipment, etc., has been erected. Stem type must be approved by Contract Administrator.
 - .1 Size: 225 mm (9 inch) scale.
 - .2 Window: Clear heavy-duty strength glass or acrylic.
 - .3 Stem:
 - .1 Hydronic: Brass, stainless steel, aluminum. Aluminum only acceptable with thermowell. Stem insertion length to be roughly half the pipe diameter.
 - .2 Air: air duct type with mounting flange
 - .3 Stem length based on pipe/duct size and insulation thickness. For insulation thicknesses exceeding 50 mm (2") use extension neck unless otherwise accounted for in the thermostat construction.
 - .4 Range: select range such that average operating temperature will be nominally between 50-75% of full range.
 - .5 Accuracy: ASTM E77: 2 percent. Calibration: Both $^{\circ}$ F and $^{\circ}$ C.

2.4 Dial T er o eters

- .1 Manufacturers:
 - .1 Winters.
 - .2 Terice.
 - .3 Ashcroft.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Compliance: ASME B40.200

- .3 Thermometer: stainless steel case, adjustable angle with front recalibration, bimetallic actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
- .4 Choice of stem types shall not be made until piping and equipment, etc., has been erected. Stem type must be approved by Contract Administrator.
 - .1 Size: nominal 75 mm (3 inch) diameter dial - thermometers located up to 1500 mm (5'-0") above finished floor.
 - .2 Size: nominal 125 mm (5 inch) diameter dial - thermometers located above 1500 mm (5'-0") above finished floor.
 - .3 Lens: Clear heavy-duty strength glass.
 - .4 Accuracy: 1 percent.
 - .5 Calibration: Both $^{\circ}\text{F}$ and $^{\circ}\text{C}$.
 - .6 Range: select range such that average operating temperature will be nominally between 50-75% of full range.

2.5 Thermometer Supports

- .1 Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
- .2 Flange: 75 mm (3 inch) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.6 Test Plugs

- .1 Test Plug: 6 mm (1/4 inch) or 13 mm (1/2 inch) brass or stainless steel (depending on system) fitting and cap for receiving 3 mm (1/8 inch) outside diameter pressure or temperature probe with neoprene core for temperatures up to 93°C (200°F), Nordel core for temperatures up to 176°C (350°F), Viton core for temperatures up to 204°C (400°F).
- .2 Test Kit: Carrying case, internally padded and fitted containing two 60 mm (2-1/2 inch) diameter pressure gauges, two gauge adapters with 3 mm (1/8 inch) probes, two 38 mm (1-1/2 inch) dial thermometers.

2.7 Static Pressure Gauges

- .1 Manufacturers:
 - .1 Dwyer
 - .2 Winters
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Compliance: ASME B40.100
- .3 Dial gauges: 90 mm (3-1/2 inch) diameter dial in metal case, magnahelic with diaphragm actuation, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

- .4 Inclined manometer, coloured liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.
- .5 Range: select range such that average operating pressure will be nominally between 50-75% of full range.
- .6 Accessories: Static pressure tips with compression fittings for bulkhead mounting, 6 mm (1/4 inch) diameter tubing.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Pressure Gauges
 - .1 Domestic water and hydronic pressure gauges shall be installed where indicated in the drawings and at the following locations:
 - .1 Building water service entrance into building.
 - .2 Inlet and outlet of each pressure reducing valve.
 - .3 Inlet and outlet of each pump and heat exchanger.
 - .1 Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to common gauge with isolation to pipe tap.
 - .2 Static pressure gauges shall be installed where indicated in the drawings and at the following locations:
 - .1 Air handling unit filter banks (differential)
 - .2 Ductwork connected to air handling units.
 - .3 Supply fan discharge.
 - .3 Install pressure gauges with pulsation dampers. Provide needle valve to isolate each gauge. Provide syphon on gauges in steam systems. Extend nipples and syphons to allow clearance from insulation.
 - .4 Gauges subject to vibration shall have copper tube extension and shall be located away from source of vibration; preferably on an adjacent wall or other stable mounting surface.
 - .5 Coil and conceal excess capillary on remote element instruments.
 - .6 Direct mounted pressure gauges shall be installed in piping tees with pressure gauge located on pipe at the most readable position.
 - .7 Valves and snubbers shall be installed in piping for each pressure gauge.
- .3 Thermometers
 - .1 Provide thermometers across all hydronic heating and cooling equipment including but not limited to boilers, cooling towers, heat exchangers, and similar equipment. For air coils, provide thermostats on air handling units only. Provide thermometers at other locations as indicated on the drawings. Hydronic thermometers to be installed with separable wells.

- .2 Provide dial thermometers mounted to air handling unit ductwork on the return, mixed air, supply and outside air.
- .3 Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 60 mm (2-1/2 inch) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- .4 Install thermometers with back or bottom inlet stems, depending on which is better for ease of reading.
- .5 Brass separable wells to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Stems and wells to be immersed in liquid flow, minimum length of stems to be 152mm.
- .6 Where a separable well is mounted in pipe 38mm diam. or less, enlarge pipe to 50mm diam. for well length plus 76mm.
- .7 Install thermometers in air duct systems on flanges.
- .8 Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 25 50 01 and/or 25 50 02.
- .9 Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.
- .4 Install thermometers on supply and return fluid lines serving air handling unit coils.
- .5 Provide instruments with scale ranges selected according to service with largest appropriate scale.
- .6 Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45° off vertical.
- .7 Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- .8 Test plugs:
 - .1 Locate test plugs adjacent to control device sockets.
 - .2 Test plugs shall be installed on the inlet and outlet pipes of all heat exchangers or water heaters serving more than one plumbing fixture.

END OF SECTION

Part 1 General

1.1 References

- .1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.
- .2 CSA B51 - Boiler, pressure vessel, and pressure piping code
- .3 NBCC 2010 - National Building Code of Canada
- .4 NPCC 2010 – National Plumbing Code of Canada
- .5 NFCC 2010 – National Fire Code of Canada

1.2 Project Record Documents

- .1 Section 21 05 00: Submittal Procedures.
- .2 Record actual locations of hydronic specialties.

1.3 Operation and Maintenance Data

- .1 Section 21 05 00: Submittal Procedures.
- .2 Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.4 Quality Assurance

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 Delivery, Storage, and Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 Maintenance Service

- .1 Provide service and maintenance of glycol system for one year from date of substantial completion.
- .2 Provide a monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

Part 2 Products

2.1 Flexible Pipe Connectors

- .1 Manufacturers:
 - .1 Flextrol
 - .2 Flex Tech Industries
 - .3 Hydro-flex
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Supply and install where shown on the drawings as in details, flexible pipe connectors as manufactured by Flex Tech Industries, selected to meet operating and test pressures of systems served.
- .3 Minimum 450 mm (18") in length unless otherwise noted.
- .4 Heating Water Services
 - .1 Up to 50 mm (2") - Stainless steel connectors constructed of 304 series stainless corrugated hose and braid with steel ends to match equipment.
 - .2 Over 50 mm (2") - flexible rubber joint with neoprene and nylon body, cadmium steel flanges, spring wire beading.

2.2 Diaphragm-Type Expansion Tanks (ET-1 and ET-2)

- .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Armtrol
 - .5 Calefactio
 - .6 Substitutions: Refer to Section 21 05 00
- .1 Provide pre-charged, diaphragm expansion tanks meeting current ASME and CSA code requirements designed for a minimum working pressure of 860 kPa (125 psi).
- .2 Tanks to be constructed of mild steel with finish painted surface and complete with all necessary tappings in combination with fill valve and automatic vent, angle cocks and guards.

- .3 Air charging valve connection to be standard Schrader tire valve.
- .4 Diaphragm to be Heavy Duty Butyl Rubber.
- .5 Sizes to be as shown on the drawings and as specified.
- .6 Select expansion tank pressure relief valve as noted in schedule.
- .7 Set pressure reducing valve as noted in schedule.

2.3 Air Vents

- .1 Manual Type:
 - .1 Manufacturers:
 - .1 Dole
 - .2 Bell and Gossett
 - .3 Taco
 - .4 Maid O'Mist
 - .5 Watts
 - .6 Substitutions: Refer to Section 21 05 00
 - .2 Short vertical sections of 50 mm (2 inch) diameter pipe to form air chamber, with 3 mm (1/8 inch) brass needle valve at top of chamber.
 - .3 On aqueous glycol systems, provide with threaded or sweat connection for drainage connection.
- .2 Float Type:
 - .1 Manufacturers:
 - .1 Maid O'Mist
 - .2 Watts
 - .3 Bell and Gossett
 - .4 Taco
 - .5 Armstrong
 - .6 Armtrol
 - .7 Substitutions: Refer to Section 21 05 00
 - .2 Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.4 Air and Air-Sediment Separators (DAS-1)

- .1 Combination Air & Air-Sediment Separators:
 - .1 Manufacturers:
 - .1 Spyrotherm
 - .2 Bell and Gossett
 - .3 Taco
 - .4 Armstrong

- .5 Substitutions: Refer to Section 21 05 00
- .2 Coalescing style in-line dirt and air separator; steel body; tested and stamped to ASME SEC 8-D; for 862 kPa (125 psig) operating pressure.
- .3 Removable Coalescing medium to be stainless steel.
- .4 Unit to be complete with separate venting chamber and shall have top mounted full port float and brass venting mechanism. Venting mechanism shall be threaded to allow for the piping of overflow.
- .5 Unit complete with removable end cover for access to coalescing medium.
- .6 Provide with prefabricated removable insulated jacket, minimum 25 mm (1 inch) thick insulation.

2.5 Strainers

- .1 Manufacturers:
 - .1 Spirax-Sarco
 - .2 Watts
 - .3 Crane
 - .4 Mueller
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 On Liquid heat transfer services,
 - .1 50 mm (2 inch) and under:
 - .1 Screwed brass or iron body for 1200 kPa (175 psig) working pressure, Y pattern with stainless steel or Monel perforated screen.
 - .2 Mesh:
 - .1 0.8 mm (1/32 inch) serving all temperature control valves, automatic flow control devices,
 - .3 Size 63 mm (2-1/2 inch) and larger:
 - .1 Flanged iron body for 1200 kPa (175 psig) working pressure, Y pattern with stainless steel or Monel perforated screen.
 - .2 Mesh:
 - .3 0.8 mm (1/32 inch) serving all temperature control valves, automatic flow control devices,

2.6 Pu Suction Di users

- .1 Manufacturers: Suction diffuser shall match supplied pump manufacturer.
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00

- .2 Fitting: Angle pattern, cast-iron body, threaded for 50 mm (2 inch) and smaller, flanged for 65 mm (2-1/2 inch) and larger, rated for 1200 kPa (175 psig) working pressure.
- .3 Suction diffuser to be complete with inlet vanes, cylinder strainer with 5 mm (3/16 inch) diameter openings, disposable fine mesh strainer to fit over cylinder strainer.
- .4 Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.7 Co ination Pu Disc ar e (Tri le-Dut□) Val es

- .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 1200 kPa (175 psig) operating pressure.
- .3 Valve to be complete with :
 - .1 non-slam check valve with spring-loaded bronze disc and seat,
 - .2 stainless steel stem,
 - .3 calibrated adjustment permitting flow regulation, brass readout,
- .4 Packing to be Teflon-Graphite. NO ASBESTOS PERMITTED.

2.8 Manual Flo Controls

- .1 Manufacturers:
 - .1 Griswold Controls
 - .2 Bell and Gossett
 - .3 Watts.
 - .4 Victaulic/IMI TA (Tour & Andersson)
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Up to and including 50mm (2 inch):
 - .1 Brass or bronze body, rated for 2070 kPa (300 psi) at 120 degrees C (250 degrees F),
 - .2 sweat or NPT end connections,
 - .3 full port nickel-plated brass ball valve with Teflon seats,
 - .4 temperature and pressure test valves and air vent,
 - .5 handle complete with memory stop and graduated markings.
- .3 50mm to 300mm (2 inch to 12 inch):

- .1 Carbon steel body, rated for 1200 kPa (175 psi) at 120 degrees C (250 degrees F),
 - .2 flanged end connections,
 - .3 carbon steel low-loss venturi with Piezon-Ring,
 - .4 bronze disc butterfly valve,
 - .5 temperature and pressure test valves and air vent,
- .4 Calibration: Control flow within 3 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

2.9 Relief Valves

- .1 Manufacturers:
- .1 Kunkle
 - .2 Spirax-Sarco
 - .3 Watts
 - .4 Bell and Gossett
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 ASME Section VIII rated valve:
- .1 Carbon steel body, resilient EPDM or EPR soft seat, stainless steel stem and springs, packed leaver with gag. All wetted parts on leaver and gag screw to be stainless steel.
 - .2 Must be rated and stamped for ASME Section VIII.
 - .3 On 63mm (2 1/2 inch) and larger connections, provide 150# flanges.
- .3 Non-ASME rated valve:
- .1 Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated.
 - .2 Designed for liquid service.

2.10 Glycol Feed System (GFS-1)

- .1 Manufacturers:
- .1 Axiom.
 - .2 Calefactio
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Provide packaged glycol feed system consisting of:
- .1 208 litre (55 US gal.) polyethylene tank with cover;
 - .2 Pump suction hose with inlet strainer;
 - .3 Pressure pump with thermal cut-out;
 - .4 Integral pressure switch;
 - .5 Integral check valve;
 - .6 Cord and plug;
 - .7 Pre-charged accumulator tank with EPDM diaphragm;

- .8 Manual diverter valve for purging air and agitating contents of storage tank;
- .9 Adjustable 35-380 kPa (5-55 psi) pressure regulating valve with pressure gauge;
- .10 Integral replaceable strainer;
- .11 Built-in check valve;
- .12 Union connection; 12 mm (1/2") x 900 mm (36") long flexible connection hose with check valve.
- .13 Low level monitoring and alarm with dry contact for monitoring by BAS.
- .3 Pump shall be capable of running dry without damage.
- .4 Power supply: 3-prong plug and cord, 115v/60/1, 0.7 amps.
- .5 Unit shall be completely assembled and certified to CSA standard C22.2 No 68.

2.11 Glycol Solution

- .1 Glycol Solution:
 - .1 Manufacturers:
 - .1 Dow Model Dowfrost
 - .2 Brenntag Model Stanfrost
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Provide aqueous solution by using propylene glycol and distilled or de-ionized water and shall contain red dye for easy leak detection.
 - .3 All percentage solutions shall be based on percent volume.
 - .4 Following systems to be filled with 35% aqueous glycol solution. Solution shall be blended up 35% glycol and 65% distilled or de-ionized water concentration, with a freezing point of -21.1 degrees C (-6.0 degrees F).
 - .5 Glycol solution supplier shall provide The City and Contract Administrator with written analysis results of tested product after installation.

Part 3 Execution

3.1 Installation

- .1 Install specialties to manufacturer's written instructions.
- .2 Expansion Tanks
 - .1 Adjust expansion tank pressure to suit design criteria and as directed by the Contract Administrator.
 - .2 Install pressure gauge at inlet to tank.
 - .3 Provide valved drain connection on tank side of expansion tank isolation valve.
 - .4 Provide union connection and isolation valve at each tank to allow removal of tank without disrupting service.

- .3 Where large air quantities can accumulate, provide enlarged air collection standpipes.
- .4 Air Vents
 - .1 Provide manual air vents at system high points and as indicated.
 - .2 On aqueous glycol systems, automatic air vents are not permitted.
 - .3 Pipe all air vents on aqueous glycol systems back to glycol fill tank. Piping to be a minimum of 12mm (1/2 inches)
- .5 Strainers
 - .1 Provide valved drain and hose connection on strainer blow down connection.
 - .2 Supply and install strainers ahead of all temperature control valves, pressure reducing valves, pump suction and where indicated on the drawings.
- .6 Pump Suction Fitting
 - .1 Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
- .7 Triple Duty Valve
 - .1 Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.
- .8 Support pump fittings with floor mounted pipe and flange supports.
- .9 Balancing Valves
 - .1 Manual balancing valves shall be sized to flow and selected for 5.98 kPa (2 feet) pressure drop across the valve in the fully open position in accordance with manufactures recommendation. Contractor shall consult with balancing valve manufacturer to ensure correct valve selection.
- .10 Relief Valve
 - .1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
 - .2 Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
 - .3 Pipe relief valve outlet to nearest floor drain.
 - .4 Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- .11 Glycol
 - .1 Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.
 - .2 Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

- .3 Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

Part 1 General

1.1 References

- .1 American Society of Mechanical Engineers
 - .1 ASME B31.1 - Power Piping.
 - .2 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
 - .3 ASME B31.9 - Building Services Piping.
- .2 American Society for Testing and Materials
 - .1 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- .3 Canadian Standards Association
 - .1 CSA B149.1 - Natural gas and propane installation code
- .4 Manufacturers Standardization Society
 - .1 ANSI/MSS SP58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation
- .5 National Fire Protection Association
 - .1 NFPA 13 - Installation of Sprinkler Systems.
- .6 Underwriters Laboratories
 - .1 UL 203 - Pipe Hanger Equipment for Fire protection Service.

1.2 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- .3 Product Data: Provide manufacturers catalogue data including load capacity.
- .4 Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- .5 Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.3 Regulator Requirements

- .1 Conform to applicable code for support of plumbing, and hydronic piping.
- .2 Supports for Sprinkler Piping: To NFPA 13.
- .3 Supports for natural gas pipe to CSA B149.1

Part 2 Products

2.1 Pipe Hangers and Supports

- .1 Manufacturers:
 - .1 Anvil.
 - .2 Grinnel.
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Fire Protection Piping:
 - .1 Conform to NFPA 13.
 - .2 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .3 Hangers for Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .5 Wall Support for Pipe Sizes to 75 mm (3 inches): Cast iron hook.
 - .6 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .7 Vertical Support: Steel riser clamp.
 - .8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .9 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .3 Plumbing Piping - DWV:
 - .1 Conform to ASME B31.9.
 - .2 PVC DWV Pipe Support: to manufacturer's requirements.
- .4 Plumbing Piping - Water:
 - .1 Conform to ASME B31.9.
 - .2 Perforated strap or wire hangers are not permitted.
 - .3 Hangers to be adjustable after pipe is in place.
 - .4 Clevis hangers shall be oversized to suit the outside diameter of insulation and jacket to maintain the integrity of insulation and vapour barrier.
 - .1 Insulation protection
 - .1 On piping 2" and smaller, carry insulation over pipe hangers. On all domestic cold water piping over 1-1/4", use oversized clevis hangers and insulation protection shield (equivalent to Grinnell Fig 167) to maintain integrity of vapour barrier.
 - .2 On copper piping over 2" use at each hanger or support Grinnell Fig. 167 insulation protection shield or equivalent). Shields shall have a minimum length of 12" (305mm) to spread weight. Rectangular solid wood or polyethylene

blocks cut to suit the insulation thickness shall be installed at hanger locations. Wedges are not permitted.

- .5 Hangers for Pipe Sizes 15 to 40 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .6 Hangers for Cold Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .7 Hangers for Hot Pipe Sizes 50 to 100 mm (2 to 4 inches): Carbon steel, adjustable, clevis.
 - .8 Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable steel yoke, cast iron pipe roll, double hanger.
 - .9 Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
 - .10 Multiple or Trapeze Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
 - .11 Wall Support for Pipe Sizes to 80 mm (3 inches): Cast iron hook.
 - .12 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .13 Vertical Support: Steel riser clamp.
 - .14 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .15 Floor Support for Hot Pipe Sizes to 100 mm (4 inches): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
 - .16 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - .17 Isolation: Copper piping shall be isolated from steel supports by appropriate use of copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators.
- .5 Hydronic Piping:
- .1 Conform to ASME B31.9.
 - .2 Perforated strap or wire hangers are not permitted.
 - .3 Hangers to be adjustable after pipe is in place.
 - .4 Clevis hangers shall be oversized to suit the outside diameter of insulation and jacket to maintain the integrity of insulation and vapour barrier.
 - .1 Insulation protection
 - .1 On piping 2" and smaller, carry insulation over pipe hangers. On all chilled water piping use oversized clevis hangers and insulation protection shield (equivalent to Grinnell Fig 167) to maintain integrity of vapour barrier.
 - .2 On insulated steel pipe over 2" use at each hanger or support, Grinnell Fig. 160, 161 or 162 to suit pipe size and insulation thickness. Pack space between saddle and pipe with insulation.

- .3 On copper piping over 2", use at each hanger or support Grinnell Fig. 167 protection shield or equal. Shields shall have a minimum length of 12" (305mm) to spread weight. Rectangular solid wood or polyethylene blocks, cut to suit the insulation thickness, shall be installed at hanger locations. Wedges are not permitted.
- .5 Where pipe expansion in excess of 12mm (1/2") axially occurs or where indicated to be installed on the drawings, provide Grinnell Fig. 171 Adjustable Pipe Roll or Grinnell Fig. 271 Pipe Roll Stand.
- .6 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
- .7 Hangers for Cold Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
- .8 Hangers for Hot Pipe Sizes 50 to 100 mm (2 to 4 inches): Carbon steel, adjustable, clevis.
- .9 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .10 Multiple or Trapeze Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Steel channels with welded spacers and hanger rods, cast iron roll.
- .11 Wall Support for Pipe Sizes to 76 mm (3 inches): Cast iron hook.
- .12 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
- .13 Vertical Support: Steel riser clamp.
- .14 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- .15 Floor Support for Hot Pipe Sizes to 100 mm (4 inches): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- .16 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .17 Isolation: Copper piping shall be isolated from steel supports by appropriate use of copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators.
- .18 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- .19 Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- .6 For roof mounted piping, provide supports equivalent to:
 - .1 Guided or Hung pipe supports
 - .1 PHP Systems portable pipe hanger model PP 10 roof supported strut style with pipe roller guides, channel or hanger.
 - .2 PHP Systems portable pipe hanger Model PSE-2-2 with clevis style hangers or supports with roof mount base for multiple pipes.

- .3 Supports to be galvanized steel with stainless steel clamps and cast iron rollers. Membrane pads to be closed-cell extruded polystyrene insulation equal to Dow Chemical Roofmate. Pipe shall be a minimum of 8" above finished roof level.
- .2 Pipe on roof support:
 - .1 Basis of Design: MIFAB C-Port Series
 - .2 Recycled UV resistant rubber, 165 mm (6.5") high, for pipe or rooftop equipment support. Supports to be selected, sized, and configured to match installation requirements and roof construction. Pipe clamps on supports to be sized for one size larger than pipe for natural gas and propane piping. All metal work including strut or pipe clamps to be stainless steel.

2.2 Duct Hangers and Supports

- .1 Perforated strap or wire hangers not permitted.
- .2 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500mm. Larger ducts to use trapeze hangers.
- .3 Hanger configuration: to SMACNA.
- .4 Hangers: galvanized steel angle with galvanized steel rods to SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .5 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp or steel plate washer.
 - .3 For steel beams: manufactured beam clamps.
- .6 Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .7 Duct Supports – Roof Installations
 - .1 "H" frame constructed of galvanized steel with height adjustment. Frames to sit on roof mount pads of UV resistant rubber or similar load spreading design. Metal on roof pads not acceptable.

2.3 Accessories

- .1 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.4 Inserts

- .1 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 Sleeves

- .1 Sleeves for Pipes Through Non-fire Rated Floors: 1.2 mm thick (18 gauge) galvanized steel.
- .2 Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 1.2mm thick (18 gauge) galvanized steel.
- .3 Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed refer to Section 07 84 00.
- .4 Where pipes pass through floors, walls or ceilings, in finished areas and where exposed to view, supply and install chrome-plated pressed steel floor plates.
- .5 Sleeves for Round Ductwork: Galvanized steel.
- .6 Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- .7 Firestopping Insulation: Glass fibre type, non-combustible; refer to Section 07 84 00.
- .8 Sealant: Acrylic; refer to Section 07 92 00.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Reference ANSI/MSS SP-58 for the selection, application and installation of hangers and supports.

3.2 Inserts

- .1 Provide inserts for placement in concrete formwork.
- .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

- .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 100 mm (4 inches).
- .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .5 Install galvanized oversize pipe sleeves on all pipes passing through walls or partitions, for building into wall construction by other trades.
- .6 All sleeves are to be large enough to accommodate pipe insulation as specified.
- .7 The Mechanical Division shall include in tender price all cost of drilling for sleeves up to 175 mm (7") in precast sections relative to work under Divisions 22 and 23. Prior to drilling all openings/locations must be checked by the Contract Administrator. Drilling shall be done using diamond core drilling machinery.
- .8 All sleeves in mechanical rooms, janitors closets and washrooms shall extend 100 mm (4") above the finished floor level to prevent water seeping down.
- .9 Caulk the space between pipes and floor sleeves or openings, to prevent water seeping down, with an approved caulking compound. The caulking compound and method of application shall be to the Contract Administrator's approval.
- .10 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.3 Pipe Hangers and Supports

- .1 Install to manufacturer's written instructions.
- .2 Install heating glycol piping to ASME B31.9.
- .3 Perforated strap or wire hangers will not be permitted.
- .4 Support horizontal piping as scheduled.
- .5 Support for buried pipe under new slabs or existing shall be hung from the slab using epoxy coated or stainless steel hangers, hardware and hanger rod secured to the rebar.
- .6 Hangers in new concrete structural floor systems shall be supported by inserts placed prior to pouring of concrete. Inserts shall be Grinnell cast iron or wrought steel adjustable type.
- .7 Where the structural system is open web steel joists, piping shall be supported by means of angles spanning the top chords of adjacent joists. The number of joists to be spanned in this way shall be determined by the incident load of piping.
- .8 In no case shall the hanging of piping directly from roof or ceiling decking be allowed, unless special permission is obtained from the Contract Administrator.

- .9 Copper hot water piping in long runs, where expansion may be significant and where hanger rods are less than 600 mm (2") in length may require roller hangers. Any such cases which cannot be avoided shall be referred to the Contract Administrator for a decision. If necessary, roller hangers shall be installed as directed with protection saddles as specified. Expansion and contractions of domestic H.W. piping should not be a problem, as wide fluctuations in temperature are not normal. Piping shall be hung from slabs, rather than from the bottom of beams, in order to keep hanger rods sufficiently long to take up any movement.
- .10 Install hangers to provide minimum 13 mm (1/2 inch) space between finished covering and adjacent work.
- .11 Place hangers within 300 mm (12 inches) of each horizontal elbow.
- .12 Use hangers with 38 mm (1-1/2 inch) minimum vertical adjustment.
- .13 Support all pipe with MJ couplings on both sides of the joint. At multiple fittings or short lengths, support every 300 mm (12").
- .14 Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub or with pipe clamps on hubless pipe.
- .15 Storm water piping:
 - .1 All pipe supports, anchors, clamping, and thrust supports shall support the weight of the pipe and its contents.
 - .2 Provide all necessary support to restrain thrust forces resulting from internal pipe pressures. Refer to CISPI 301 & 310.
 - .3 MJ couplings are not permitted on PVC storm water piping. All joints to be solvent-welded.
 - .4 Restrain all joints on piping 125 mm (5") and larger to prevent horizontal movement. Use sway bracing as needed to restrain sideways movement of the system. Install blocks, rods, bracing or other suitable methods at each branch opening or change in direction.
 - .5 Storm water piping below grade including in the crawlspace shall be adequately supported with thrust blocks or suitable anchors to restrain all sideways movement and thrust forces.
- .16 Natural gas piping:
 - .1 Install piping to CSA B149, refer to additional authority having jurisdiction issued requirements where applicable.
 - .2 On flat rooftops, install piping on rubberized support blocks with pipe clamp sized for one size larger than the pipe.
 - .3 Support spacing to be based on CSA B149. Provide additional supports at threaded joints.
 - .4 Support piping on sloped roofs with 2"x10" treated wood, refer to ITSM technical bulletins for installation requirements.
- .17 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

- .18 Where several pipes are installed at various elevations in the same vertical plane, piping below shall not be supported off the piping above.
- .19 Support riser piping independently of connected horizontal piping.
- .20 Materials
 - .1 Provide copper plated hangers and supports for copper piping.
 - .2 Supports shall be metallic and installed to avoid galvanic action between the piping or tubing and the supports.
- .21 Design hangers for pipe movement without disengagement of supported pipe.
- .22 All hanger rods shall have sufficient threaded length to allow for vertical adjustment of hangers after pipe is in place. Use 2 nuts on each rod, one above the clevis or angle iron and one below.
- .23 Where pipes or equipment are supported from floors or walls, structural steel supports shall be fabricated, using welded joints except where provision is made for adjustment. Where details of construction are not indicated, drawings shall be submitted to Contract Administrator for approval before fabrication.
- .24 Clamps should be located immediately below a coupling if possible. Risers up to 50 mm (2") size shall be braced at intervals not over 2100 mm (7').
- .25 Vertical piping other than risers through floors shall be provided with suitable supports, sway braces, etc.
- .26 Vertical piping shall be supported at the base in an approved manner.
- .27 On insulated piping supported by roller supports or trapeze supports (angle iron) provide at each hanger or support an insulation protection shield of 16 ga. galvanized sheet steel, rolled to match the outside diameter of the insulation. The shield shall cover approximately the bottom one third of the circumference of the insulation. The length shall be at least as long as that recommended by the insulation manufacturer as published in their data.
- .28 On insulated pipe up to and including 50 mm (2") pipe, clevis hangers shall be sized to suit the O.D. of the pipe. On insulated pipe of 63 mm (2½") and above and on pipe systems carrying water below ambient temperature, the hangers shall be sized to suit the O.D. of the insulation and protection saddles.
- .29 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 Duct or Hangers and Supports

- .1 Ductwork is to be securely supported from building structure.
- .2 Do not suspend any ducting or any other mechanical components from formed hollow steel decking.

- .3 Install hanger so that rod or strap is vertical under operating conditions. Repair or replace hangers that are not vertical.
- .4 Strap hangers permitted
- .5 Adjust hangers to equalize load.
- .6 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .7 Size supports to accommodate the thickness of the insulation thickness of the duct type. Refer to 23 07 13 for thickness requirements. Hangers to be located outside of the insulation and insulation should not interfere with the vertical alignment of the hanger.

3.5 E u i e n t Bases and S u o r t s

- .1 Provide housekeeping pads of concrete, minimum 100 mm (4 inches) thick and extending 150 mm (6 inches) beyond supported equipment.
- .2 Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- .3 Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- .4 Provide rigid anchors for pipes after vibration isolation components are installed.

3.6 S l e e v e s

- .1 Set sleeves in position in formwork. Provide reinforcing around sleeves.
- .2 Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- .3 Extend sleeves through floors 25mm (1 inch) above finished floor level. Caulk sleeves.
- .4 All sleeves in mechanical rooms, janitors closets and washrooms shall extend 100 mm (4") above the finished floor level to prevent water seeping down.
- .5 Install galvanized oversize pipe sleeves on all pipes passing through walls or partitions, for building into wall construction by other trades.
- .6 All sleeves are to be large enough to accommodate pipe insulation as specified.
- .7 Division 22 and 23 shall include in tender price all cost of drilling for sleeves up to 175 mm (7") in precast sections relative to mechanical work. Prior to drilling all openings/locations must be checked by the Contract Administrator. Drilling shall be done using diamond core drilling machinery.

- .8 Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with insulation and caulk, air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- .9 Install stainless steel escutcheons at finished surfaces.

3.7 Schedules

- .1 Maximum spacing between pipe supports:
 - .1 Hangers shall be installed not more than 12" (300mm) from each change in direction of pipes.
 - .2 Where there are concentrations of valves and fittings, closer spacing will be necessary.
 - .3 Steel Pipe:
 - .1 Up to 50mm (2") 2.4m (8 ft.)
 - .2 65mm (2½") to 150mm (6") 3.6m (12 ft.)
 - .4 Copper Tubing (Hard):
 - .1 Up to 25mm (1") 1.8m (6 ft.)
 - .2 32mm (1½") to 50mm (2") 2.4m (8 ft.)
 - .3 63mm (2 ½") to 75mm (3") 3.0m (10 ft.)
 - .5 Plastic (PVC, CPVC, PEX)
 - .1 As recommended by manufacturer for corresponding sizes and materials.
 - .2 All sizes – do not exceed 1.2m (4 ft.)

END OF SECTION

Part 1 General

1.1 Performance Requirements

- .1 Provide vibration isolation on motor driven equipment over 0.35 kW (0.5 hp), plus connected piping and ductwork.
- .2 All outdoor mounted equipment shall be restrained for the highest wind speed as specified by the Contract Administrator, the governing building code(s) or the authority having jurisdiction.
- .3 Provide minimum static deflection of isolators for equipment as indicated:
 - .1 400 - 600 rpm: 90 mm (3.5 inch)
 - .2 600 - 800 rpm: 90 mm (3.5 inch)
 - .3 800 - 900 rpm: 50 mm (2 inch)
 - .4 1100 - 1500 rpm: 25 mm (1 inch)
 - .5 Over 1500 rpm: 12 mm (0.5 inch)

1.2 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Locate vibration isolators, with static and dynamic load on each.
- .3 Product Data: Provide schedule of vibration isolator type with location and load on each.
- .4 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

1.3 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 Manufacturers

- .1 Vibro-Acoustics.
- .2 Amber/Booth.
- .3 California Dynamics
- .4 Substitutions: Refer to Section 21 05 00.

2.2 Vibration Isolators

- .1 Open Spring Isolators:
 - .1 Spring Isolators:

- .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
- .2 Code: Colour code springs for load carrying capacity.
- .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .3 Spring Mounts: Provide with levelling devices, minimum 6 mm (0.25 inch) thick neoprene sound pads, and zinc chromate plated hardware.
- .4 Sound Pads: Size for minimum deflection of 1.2 mm (0.05 inch); meet requirements for neoprene pad isolators.
- .2 Restrained Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .3 Spring Mounts: Provide with levelling devices, minimum 6 mm (0.25 inch) thick neoprene sound pads, and zinc chromate plated hardware.
 - .4 Sound Pads: Size for minimum deflection of 1.2 mm (0.05 inch); meet requirements for neoprene pad isolators.
 - .5 Restraint: Provide heavy mounting frame and limit stops.
- .3 Closed Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - .3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm (0.25 inch) clearance.
- .4 Restrained Closed Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.

- .2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
- .3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm (0.25 inch) clearance and limit stops.
- .5 Spring Hanger:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .3 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators or rubber hanger with threaded insert.
 - .4 Misalignment: Capable of 20 degree hanger rod misalignment.
- .6 Neoprene Pad Isolators:
 - .1 Rubber or neoprene waffle pads.
 - .1 30 durometer.
 - .2 Minimum 13 mm (1/2 inch) thick.
 - .3 Maximum loading 275 kPa (40 psi).
 - .4 Height of ribs: maximum 0.7 times width.
 - .2 Configuration: 13 mm (1/2 inch) thick waffle pads bonded each side of 6 mm (1/4 inch) thick galvanized steel plate.
- .7 Rubber Mount or Hanger: Moulded rubber designed for 13 mm (0.5 inches) deflection with threaded insert.
- .8 Glass Fibre Pads: Neoprene jacketed pre-compressed moulded glass fibre.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install isolation for motor driven equipment.
- .3 Bases:
 - .1 Set steel bases for 25 mm (1 inch) clearance between housekeeping pad and base.

- .2 Adjust equipment level.
- .4 Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
- .5 Isolator hangers shall be installed with the housing a minimum of 1/4" (6 mm) below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.
- .6 Install spring hangers without binding.
- .7 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- .8 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- .9 Provide pairs of horizontal limit springs on fans with more than 1.5 kPa (6.0 inch) static pressure, and on hanger supported, horizontally mounted axial fans.
- .10 Support piping connections to isolated equipment resiliently as follows or according to the schedule.
 - .1 Up to 100 mm (4 inch) Diameter: First three points of support.
 - .2 125 to 200 mm (5 to 8 inch) Diameter: First four points of support.
 - .3 250 mm (10 inch) Diameter and Over: First six points of support.
 - .4 Select three hangers closest to vibration source for minimum 25 mm (1.0 inch) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 25 mm (1.0 inch) static deflection or 1/2 static deflection of isolated equipment.
- .11 Connect wiring to isolated equipment with flexible hanging loop.
- .12 All piping and ductwork shall freely pass through walls and floors without rigid connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain a minimum of □" and maximum of 1□" clearance around the outside surfaces. This clearance space shall be tightly packed with 1.58 P.C.F. glass fiber and shall be caulked airtight after installation of the piping or ductwork. Penetrations through fire rated walls and floors shall be sealed to maintain the rating.
- .13 All outdoor equipment, piping and ductwork shall be restrained to resist wind forces per the applicable building code(s) as a minimum. Restraint attachments shall be made by bolts, welds or a positive fastening method. Friction shall not be considered. All attachments shall be proven capable of accepting the required wind load by calculations.

- .14 Install wind restraint devices per the restraint manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.

END OF SECTION

Part 1 General

1.1 References

- .1 ASME A13.1 - Scheme for the Identification of Piping Systems.
- .2 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
- .3 NFPA 13, Standard for the Installation of Sprinkler Systems.

1.2 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of tagged valves.

Part 2 Products

2.1 Nameplates

- .1 Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

2.2 Tags

- .1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm (1-1/2 inch) diameter.
- .2 Chart: Typewritten letter size list in anodized aluminum frame.

2.3 Stencils

- .1 Stencils: With clean cut symbols and letters of following size:
 - .1 20-30 mm (3/4 to 1-1/4 inch) Outside Diameter of Insulation or Pipe: 200 mm (8 inch) long colour field, 15 mm (1/2 inch) high letters.
 - .2 40-50 mm (1-1/2 to 2 inch) Outside Diameter of Insulation or Pipe: 200 mm (8 inch) long colour field, 20 mm (3/4 inch) high letters.
 - .3 65-150 mm (2-1/2 to 6 inch) Outside Diameter of Insulation or Pipe: 300 mm (12 inch) long colour field, 30 mm (1-1/4 inch) high letters.
 - .4 Ductwork and Equipment: 65 mm (2-1/2 inch) high letters.
- .2 Stencil Paint: As specified in Section 09 91 10, semi - Painting.1.

2.4 Pipe Markers

- .1 Colour: Conform to ASME A13.1.

- .2 Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- .3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- .4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm (6 inches) wide by 0.10 mm (4 mil) thick, manufactured for direct burial service.

System	Background Colour	Text
Glycol Heating Supply	Yellow	GHS
Glycol Heating Return	Yellow	GHR
Ground Loop Supply	Yellow	GLS
Ground Loop Return	Yellow	GLR
Domestic Cold Water Supply	Green	DCW
Domestic Hot Water Supply	Green	DHW
Domestic Hot Water Recirculation	Green	DHWR
Sanitary	Green	SAN
Plumbing Vent	Green	VEN
Storm Sewer	Green	SS
Rain Water Leader	Green	RWL
Refrigeration Suction	Yellow	RL
Refrigeration Liquid	Yellow	RS
Natural gas	to Codes	GAS
Fire Protection Water	Red	FIRE
Sprinklers	Red	SPRINKLER
Supply Air	White	SA
Return Air	White	RA
Exhaust Air	White	EA
Outdoor Air	White	OA

2.5 Ad es i e Mar in s

- .1 Colour: Conform to ASME A13.1.

Material	Colour Scheme
Hazardous	Black Text on Yellow Background
Inherently Low Hazard	White text on Green Background
Fire Protection	White Text on Red Background

- .2 Plastic Tape Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

Part 3 Execution

3.1 Preparation

- .1 Degrease and clean surfaces to receive adhesive for identification materials.

□

- .2 Prepare surfaces to Section 09 91 10 for stencil painting.

3.2 Installation

- .1 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- .2 Install tags with corrosion resistant chain.
- .3 Apply stencil painting to Section 09 91 10.
- .4 Install plastic pipe markers to manufacturer's written instructions.
- .5 Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.
- .6 Install underground plastic pipe markers 150 to 200 mm (6 to 8 inches) below finished grade, directly above buried pipe.
- .7 Identify make-up air units, energy recovery ventilators, condensing units, heat pumps, pumps, boilers, expansion tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .8 Identify specialized pipe contents where applicable such as grease interceptor pump out piping.
- .9 Controls:
 - .1 Identify control panels and major control components outside panels with plastic nameplates.
 - .2 Identify thermostats relating to heat pumps or valves with nameplates or adhesive labels.
 - .3 Provide identification on all conduits and junction box covers indicating associated system, panel and circuit numbering using tags or labels.
 - .4 Provide identification on all control points indicating point name, panel #/address and part number using tags or labels.
- .10 Identify valves in main and branch piping with tags.
- .11 Identify air terminal units and radiator valves with numbered tags.
- .12 Tag automatic controls, instruments, and relays. Key to control schematic.
- .13 Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 20 mm (3/4 inch) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 6 m (20 feet) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

- .14 Identify ductwork with stencilled painting or adhesive labels. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

Part 1 General

1.1 References

- .1 AABC - National Standards for Total System Balance.
- .2 CAABC – Canadian Associated Air Balance Council
- .3 ADC - Test Code for Grilles, Registers, and Diffusers.
- .4 ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- .5 CSA B149.1 - Natural Gas And Propane Installation Code
- .6 SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.2 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.
- .3 Submit draft copies of report for review prior to final acceptance of Project. Draft copies shall be submitted in electronic format (Adobe Acrobat PDF file). Provide final copies for Contract Administrator and for inclusion in operating and maintenance manuals.
- .4 Provide final reports in letter size, soft cover or as suitable for insertion in the project Operation and Maintenance manuals, complete with index page and indexing tabs, with cover identification at front and side. Also submit an electronic copy (PDF file) of the same. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- .5 Test Reports: Indicate data on AABC National Standards for Total System Balance forms. Submit data in either S.I. Metric or IP units to match the primary units used on the drawings and schedules.

1.3 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of flow measuring stations, balancing valves, balancing dampers, and fire dampers.

1.4 Quality Assurance

- .1 Perform total system balance to AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

□

1.5 Qualifications

- .1 Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience, and certified by CAABC.
- .2 Perform Work under supervision of CAABC Certified Test and Balance Supervisor.

1.6 Sequencing

- .1 Sequence work to Section 01 10 00.
- .2 Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.7 Scheduling

- .1 Schedule work to Section 21 05 00.
- .2 Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation, and/or smoke control system with Fire Authority.

1.8 Project Closeout

- .1 The Testing, Adjusting and Balancing agency as part of its contract shall act as authorized inspection agency, responsible to list all items that are installed incorrectly, require correction or have not been installed in accordance with contract drawings and/or specifications, pertaining to the air distribution, cooling and heating systems. Contractor shall make good these items.
- .2 Final payment on the building will not be issued until the final air balance report has been submitted to the Contract Administrator and has been approved by the Contract Administrator.

Part 2 Products

- .1 Not used

Part 3 Execution

3.1 Examination

- .1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - .1 Systems are started and operating in a safe and normal condition.
 - .2 Temperature control systems are installed complete and operable.
 - .3 Proper thermal overload protection is in place for electrical equipment.

- .4 Final filters are clean and in place. If required, install temporary media in addition to final filters.
- .5 Duct systems are clean of debris.
- .6 Fans are rotating correctly.
- .7 Fire and volume dampers are in place and open.
- .8 Air coil fins are cleaned and combed.
- .9 Access doors are closed and duct end caps are in place.
- .10 Air outlets are installed and connected.
- .11 Duct system leakage is minimized.
- .12 Hydronic systems are flushed, filled, and vented.
- .13 Pumps are rotating correctly.
- .14 Proper strainer baskets are clean and in place.
- .15 Service and balance valves are open.
- .2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- .3 Beginning of work means acceptance of existing conditions.

3.2 Pre aration

- .1 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Contract Administrator to facilitate spot checks during testing.
- .2 Provide additional balancing devices as required.

3.3 Installation Tolerances

- .1 Refer to maximum balanced pressure drop in equipment schedules. Adjust system pressure drop to be at or below the indicated value.
- .2 Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- .3 Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- .4 Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 Ad ustin

- .1 Ensure recorded data represents actual measured or observed conditions.
- .2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

- .3 Make any changes in pulleys and belts, and add any manual dampers as required for correct balance, at no additional cost to The City.
- .4 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

3.5 Air System Procedure

- .1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- .2 Test and record motor full load amperes.
- .3 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- .4 Measure air quantities at air inlets and outlets.
- .5 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- .6 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- .7 All outlets shall be adjusted to provide proper throw and directional distribution in accordance with the requirements on the drawings and/or schedules.
- .8 Vary total system air quantities by adjustment of fan speeds.
 - .1 Provide drive changes required to set airflows on belt driven units.
 - .2 Adjust fan motor speed using speed control, on electronic commutated (EC) motors and variable speed drives (VSD) serving AC motors. Indicate speed voltage (0-10 DC) on EC motors and hertz (Hz) on VSD
 - .3 Vary branch air quantities by damper regulation.
- .9 Provide system schematic with required and actual air quantities recorded at each outlet or inlet. Each grille, diffuser and register shall be identified as to location and area. Include locations of pitot tube traverse locations, fire damper locations and tags, and balance damper locations.
- .10 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- .11 Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 12.5 Pa (0.05 inches) positive static pressure near the building entries.
- .12 All pitot-tube openings shall have plastic plugs of proper size in uninsulated or internally insulated ductwork. Insulated ductwork shall be provided with rubber

plugs that extend to the face of the insulation. Cover the plugs on insulated ductwork with strip of grey tape.

- .13 After completion of final balance, the Balance Contractor shall permanently fix the damper operator with a strip of contact tape and spray the quadrant with bright paint to permanently mark its balanced position.

3.6 Fire S o e Da er Testin Veri ication

.1 Testing of Fire Dampers, Ceiling Fire Stops and/or Fire/Smoke Dampers

.1 General

- .1 The Testing, Adjusting and Balancing agency shall test this equipment after installation.
- .2 Test and verify operation of all fire dampers and ceiling fire stops in this project.
- .3 Test shall include manually releasing fusible link; allowing damper to close to ensure that it has tight-fit closing operation without binding; opening fire damper and/or closing ceiling fire stop and resetting fusible link connection.
- .4 Instruct Sections 23 31 00 and 23 33 00 to repair all fire dampers and/or ceiling fire stops that have been identified as being faulty.

.2 Identification of Fire Dampers and Ceiling Fire Stops

- .1 At all fire dampers and ceiling fire stops, supply and install tags as approved by the Contract Administrator.
- .2 Tags shall be mechanically fastened to duct fire damper access door, or onto or on structure near fire dampers or ceiling fire stops which have no connecting ductwork.
- .3 After each fire damper has been tested and has been proven to operate satisfactorily as noted in previous clause, a representative of the Testing, Adjusting and Balancing agency shall label unit number and mark date and signature on tag. Tags shall have space for minimum size further dates and signatures for future checking of damper operation by The City's staff.

.3 Test Report for Fire Dampers and Ceiling Fire Stops

- .1 The Testing, Adjusting and Balancing agency shall provide a Test Report.
- .2 The report shall include following for each fire damper:
 - .1 Verification that the unit is fully accessible.
 - .2 Verification that the unit has been successfully tested.
 - .3 Verification that the unit has been reset.
 - .4 Name of tester.
 - .5 Date that the unit tested successfully.
 - .6 Location schedule of all dampers i.e. each damper must be labelled.
- .3 Provide one copy of completed report to the Contract Administrator. After the Contract Administrator has reviewed

report, provide to the Mechanical Subtrade sufficient copies of report to insert one in each Maintenance/Operating Manual.

- .4 Testing of Fire/Smoke Dampers
 - .1 Provide all testing, tagging, and Test Report for all Fire/Smoke Dampers.
 - .2 Follow instruction noted in previous clause as noted for Fire Dampers and Ceiling fire stops.

3.7 Lea Testin o Air Ducts

- .1 Leak test all ductwork.
- .2 Co-ordinate with Section 23 31 00. Section 23 31 00 shall repair all leaks found in ductwork before and after testing of systems.
- .3 Witness above final leak tests and issue report to the Contract Administrator.
- .4 Test shall be performed by this Section.
- .5 Section 23 31 00 shall provide all necessary temporary connections, blank-offs and tees required for testing. This Section shall provide all test fans, equipment and labour required for testing.

Section 23 31 00 shall clean all ducts before testing.

- .6 During installation of ductwork include separate leakage air tests of each complete air riser; each completed horizontal distribution system, and after ductwork is installed and central station apparatus is erected, leakage testing of pressure side of whole system. Include testing of flexible run-outs (where applicable).
- .7 Perform preliminary tests and repair all leaks before notifying the Contract Administrator of final tests.
- .8 Maintain log book of all tests showing dates, personnel observers' initials.
- .9 Be responsible for any damage resulting from failure of items under test.
- .10 Section 23 31 00 shall repair all leaks in duct systems.
- .11 Retest ductwork after leaks have been repaired.
- .12 Coordinate with Section 23 31 00 to ensure that all ductwork is tested:
 - .1 before ducts are insulated.
 - .2 before ducts are concealed.

3.8 Water Syste Procedure

- .1 Adjust water systems to provide required or design quantities.

- .2 Use calibrated fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- .3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- .4 Effect system balance with automatic control valves fully open to heat transfer elements.
- .5 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- .6 Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.9 Schedules

- .1 Equipment requiring testing, adjusting and balancing:
 - .1 Make-Up Air Units
 - .2 Exhaust Fans
 - .3 Energy Recovery Ventilators
 - .4 Heat Pumps (Water-To-Air)
 - .1 Airflow
 - .2 Glycol Fluid Flow
 - .5 Hydronic Pumps
 - .6 Air Inlets and Outlets
- .2 Report Forms
 - .1 Title Page:
 - .1 Name of Testing, Adjusting, and Balancing Agency
 - .2 Address of Testing, Adjusting, and Balancing Agency
 - .3 Telephone number of Testing, Adjusting, and Balancing Agency
 - .4 Project name
 - .5 Project location
 - .6 Project Architect
 - .7 Project Engineer
 - .8 Project Contractor
 - .9 Project altitude
 - .10 Report date
 - .2 Summary Comments:
 - .1 Design versus final performance
 - .2 Notable characteristics of system

- .3 Description of systems operation sequence
- .4 Summary of outdoor and exhaust flows to indicate amount of building pressurization
- .5 Nomenclature used throughout report
- .6 Test conditions
- .3 Instrument List:
 - .1 Instrument
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Range
 - .6 Calibration date
- .4 Pump Data:
 - .1 Identification/number
 - .2 Manufacturer
 - .3 Size/model
 - .4 Impeller
 - .5 Service
 - .6 Design flow rate, pressure drop, BHP
 - .7 Actual flow rate, pressure drop, BHP
 - .8 Discharge pressure
 - .9 Suction pressure
 - .10 Total operating head pressure
 - .11 Shut off, discharge and suction pressures
 - .12 Shut off, total head pressure
- .5 Air Moving Equipment
 - .1 Location
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Arrangement/Class/Discharge
 - .6 Air flow, specified and actual
 - .7 Return air flow, specified and actual
 - .8 Outside air flow, specified and actual
 - .9 Total static pressure (total external), specified and actual
 - .10 Inlet pressure
 - .11 Discharge pressure
 - .12 Sheave Make/Size/Bore
 - .13 Number of Belts/Make/Size
 - .14 Fan RPM
- .6 Return Air/Outside Air Data:
 - .1 Identification/location

- .2 Design air flow
- .3 Actual air flow
- .4 Design return air flow
- .5 Actual return air flow
- .6 Design outside air flow
- .7 Actual outside air flow
- .8 Return air temperature
- .9 Outside air temperature
- .10 Required mixed air temperature
- .11 Actual mixed air temperature
- .12 Design outside/return air ratio
- .13 Actual outside/return air ratio
- .7 Exhaust Fan Data:
 - .1 Location
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Air flow, specified and actual
 - .6 Total static pressure (total external), specified and actual
 - .7 Inlet pressure
 - .8 Discharge pressure
 - .9 Sheave Make/Size/Bore
 - .10 Number of Belts/Make/Size
 - .11 Fan RPM
- .8 Duct Traverse:
 - .1 System zone/branch
 - .2 Duct size
 - .3 Area
 - .4 Design velocity
 - .5 Design air flow
 - .6 Test velocity
 - .7 Test air flow
 - .8 Duct static pressure
 - .9 Air temperature
 - .10 Air correction factor
- .9 Duct Leak Test:
 - .1 Description of ductwork under test
 - .2 Duct design operating pressure
 - .3 Duct design test static pressure
 - .4 Duct capacity, air flow
 - .5 Maximum allowable leakage duct capacity times leak factor
 - .6 Test apparatus

- .1 Blower
- .2 Orifice, tube size
- .3 Orifice size
- .4 Calibrated
- .7 Test static pressure
- .8 Test orifice differential pressure
- .9 Leakage
- .10 Terminal Unit Data:
 - .1 Manufacturer
 - .2 Type, constant, variable, single, dual duct
 - .3 Identification/number
 - .4 Location
 - .5 Model number
 - .6 Size
 - .7 Minimum static pressure
 - .8 Minimum design air flow
 - .9 Maximum design air flow
 - .10 Maximum actual air flow
 - .11 Inlet static pressure
- .11 Air Distribution Test Sheet:
 - .1 Air terminal number
 - .2 Room number/location
 - .3 Terminal type
 - .4 Terminal size
 - .5 Area factor
 - .6 Design velocity
 - .7 Design air flow
 - .8 Test (final) velocity
 - .9 Test (final) air flow
 - .10 Percent of design air flow

END OF SECTION

Part 1 General

1.1 References

- .1 ASTM
 - .1 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .3 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
 - .4 ASTM C553 - Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .5 ASTM C612 - Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
 - .6 ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation
 - .7 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
 - .8 ASTM C1071 - Fibrous Glass Duct Lining Insulation(Thermal Sound Absorbing Material).
 - .9 ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
 - .10 ASTM E96 - Water Vapour Transmission of Materials.
 - .11 ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
 - .12 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 NAIMA: North American Insulation Manufacturers Association
 - .1 National Insulation Standards.
- .3 NFPA: National Fire Protection Association
 - .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
- .4 South Coast Air Quality Management District
 - .1 SCAQMD Rule 1113 – Architectural Coatings
 - .2 SCAQMD Rule 1168 - Adhesive and Sealant Applications
- .5 SMACNA: Sheet Metal & Air Conditioning Contractors' National Association
 - .1 HVAC Duct Construction Standards - Metal and Flexible.
- .6 Standards Council of Canada

- .1 CAN/ULC S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .2 CAN/ULC-S701 - Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .7 Thermal Insulation Association of Canada (TIAC):
 - .1 National Insulation Standards.

1.2 **Quality Assurance**

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Applicator Qualifications: Company specializing in performing the work of this section minimum three years documented experience.

1.3 **Regulatory Requirements**

- .1 Materials:
 - .1 Flame spread/smoke developed rating of 25/50 to CAN/ULC S102.
 - .2 Where in contact with or exposed to temperatures greater than 120°C, combustible materials must comply with ASTM C411.

1.4 **Delivery, Storage, and Protection**

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 **Environmental Requirements**

- .1 Section 21 05 00: Environmental conditions affecting products on site.
- .2 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .3 Maintain temperature during and after installation for minimum period of 24 hours.

Part 2 **Products**

2.1 **General Requirements**

- .1 Fire and Smoke Rating
 - .1 To CAN/ULC-S102:

□

- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.
- .2 Biological Resistance to ASTM G21, ASTM G22, ULC 181

2.2 Vapour Barrier External Duct Wrapping, Glass Fibre, Flexible

- .1 Manufacturers:
 - .1 Johns Manville Microlite FSK
 - .2 Owens Corning SoftR Duct Wrap.
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: ASTM C553; flexible, non-combustible blanket.
 - .1 'ksi' ('K') value: ASTM C518, 0.045 W/m-K at 24°C (0.31 Btu-in/(hr ft²°F) at 75°F).
 - .2 Maximum service temperature: 121 °C (250°F).
 - .3 Maximum moisture absorption: 0.20 percent by volume.
 - .4 Density 12 kg/cu. meter (0.75 lb/cu. Foot).
- .3 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film (FRK).
 - .2 Moisture vapour transmission: ASTM E96; ASTM C1136: 0.02 perm.
 - .3 Secure with pressure sensitive tape.
- .4 Vapour Barrier Tape:
 - .1 Kraft paper reinforced with glass fibre yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- .5 Outdoor Vapour Barrier Mastic:
 - .1 Vinyl emulsion type acrylic or mastic, compatible with insulation, black colour.
- .6 Tie Wire: Annealed steel, 1.5 mm (16 gauge).

2.3 Vapour Barrier External Glass Fibre Rigid Insulation Board

- .1 Manufacturers:
 - .1 Johns Manville 800 Series
 - .2 Owens Corning Series 700
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: ASTM C612; rigid, noncombustible blanket.
 - .1 'ksi' ('K') value : ASTM C518, 0.045 W/mK at 24°C (0.31 Btu/hr ft²°F inch at 75°F).
 - .2 Maximum service temperature: 121°C (250°F).

- .3 Maximum moisture absorption: 0.20 percent by volume.
- .4 Density: 48 kg/cu m (3.0 lb/cu ft).
- .3 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture vapour transmission: ASTM E96; ASTM C1136: 0.04 perm.
 - .3 Secure with pressure sensitive tape.
- .4 Vapour Barrier Tape:
 - .1 Kraft paper reinforced with glass fibre yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- .5 Indoor Vapour Barrier Finish:
 - .1 Cloth: Untreated; 305 g/sq m (9 oz/sq yd) weight, glass fabric.
 - .2 Vinyl emulsion type acrylic, compatible with insulation, black colour.

2.4 Jac ets

- .1 Canvas Jacket: UL listed.
 - .1 Fabric: ASTM C921, 220 g/sq m (6 oz/sq yd), plain weave cotton treated with dilute fire retardant lagging adhesive.
 - .2 Lagging Adhesive:
 - .1 Compatible with insulation.
- .2 Aluminum Flexible Self Adhesive Insulation Jacket: UL listed
 - .1 Manufacturers:
 - .1 VentureClad 1577CW
 - .2 Bakor Foilskin
 - .3 Polyguard Alumaguard
 - .2 Tensile Strength: 316.5 N/25 mm (70 lb/in)
 - .3 Puncture: 111 N (25 lbs)
 - .4 Service Temperature: -50 to 70°C (-58°C to 160°F)
 - .5 Finish: Embossed
 - .6 Aluminum foil exterior surface over multilayer laminate, vapour barriered jacket with pressure sensitive adhesive integral to jacket application surface with peel off release liner.
 - .7 Permeation (ASTM E96): 0.05 perm (maximum)
 - .8 UV resistant.
 - .9 Flame based application not acceptable.
- .3 Sheet Aluminum Jacket: ASTM B209M.
 - .1 Thickness: 0.40 mm (0.016 inch) sheet.
 - .2 Finish: Smooth.
 - .3 Joining: Longitudinal slip joints and 50 mm (2 inch) laps.
 - .4 Fittings: 0.4mm (0.016 inch) thick die shaped fitting covers with factory attached protective liner.

- .5 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.015 mm thick aluminum.

2.5 Glass Fi re Duct Liner, Flexi le

- .1 Manufacturers:

- .1 Johns Manville LinaTex
- .2 Owens Corning QuietR Textile Duct Liner.
- .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.

- .2 Insulation: ASTM C1071; flexible, noncombustible blanket with poly vinyl acetate polymer impregnated surface and edge coat.

- .1 'ksi' ('K') Value: ASTM C518, maximum 0.045 W/m K at 24°C (0.31 Btu/ft ft°F inch at 75°F).
- .2 Maximum Service Temperature: 121°C (250°F).
- .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
- .4 Minimum Noise Reduction Criteria: ASTM C1071

Thickness		NRC
12 mm	1/2"	0.30
25 mm	1"	0.45
38mm	1.5"	0.60
50 mm	2"	0.70

- .5 Minimum 55% Certified Recycled Content.

- .3 Adhesive:

- .1 Waterproof , ASTM E162 fire-retardant type. CAN/ULC S102 25/50 compliant on dried surface.

- .4 Liner Fasteners: Galvanized steel, with press-on head.

2.6 Glass Fi re Duct Liner, Ri id

- .1 Manufacturers:

- .1 Johns Manville Linacoustic R-300
- .2 Owens Corning QuietR Duct Liner Board
- .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.

- .2 Insulation: ASTM C612; rigid, noncombustible board with acrylic polymer meeting ASTM G21 impregnated surface and edge coat.

- .1 'ksi' ('K') value : ASTM C518, maximum 0.27 W/m K at 24°C (75°F).
- .2 Maximum service temperature: 121°C (250°F).
- .3 Maximum Velocity on Coated Air Side: 24.5 m/s (5,000 fpm).
- .4 Minimum Noise Reduction Criteria: ASTM C1071

Thickness	NRC
-----------	-----

25 mm	1"	0.55
38mm	1.5"	0.75
50 mm	2"	0.9

- .5 Minimum 20% Certified Recycled Content.
- .3 Adhesive:
 - .1 Waterproof , ASTM E162 fire-retardant type. CAN/ULC S102 25/50 compliant on dried surface.
- .4 Liner Fasteners: Galvanized steel, with press-on head.

2.7 Glass Fi re Round Duct Liner

- .1 Manufacturers:
 - .1 Johns Manville Spiracoustic Plus
 - .2 Owens Corning QuietZone Spiral Duct Liner.
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: Round, preformed in cylindrical sections with acrylic polymer meeting ASTM G21 impregnated surface coat.
 - .1 'ksi' ('K') value : ASTM C1071, 0.033 W/m K at 24°C (0.23 Btu/hr ft²F inch at 75°F).
 - .2 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
 - .3 Maximum service temperature: 121°C (250°F).
 - .4 Sound Absorption Coefficients based on type A mounting, frequency (Hz), minimum values

Thickness		125	250	500	1000	2000	4000	NRC
25 mm	1"	0.05	0.21	0.71	1.01	1.07	1.09	0.75
38mm	1.5"	0.1	0.39	1.02	1.08	1.04	1.00	0.85
50 mm	2"	0.17	0.63	1.10	1.05	1.09	1.06	0.95

- .3 Adhesive:
 - .1 Waterproof , ASTM E162 fire-retardant type. CAN/ULC S102 25/50 compliant on dried surface.

2.8

2.8 Fire Wra External Duct Flexi le

- .1 Manufacturers:
 - .1 3M Canada
 - .2 Other acceptable manufacturers offering equivalent products.
- .2 Listing
 - .1 Underwriters' Laboratories of Canada (ULC)

- .1 Grease Duct Enclosures – Fire Resistant Ducts Guide No. (40 U21) Design No. FRD 4
- .2 Ventilation / Pressurization Duct Enclosures – ISO 6944 Fire Resistant Ducts Guide No. (40 U21) Design No. FRD 3 and FRD 5
- .3 Insulation:
 - .1 'ksi' ('K') value: ASTM C518, 0.045 at 24°C (0.31 at 75°F).
 - .2 Density 96 kg/cu. meter (6 lb/cu. Foot).
- .4 Flammability (CAN/ULC S102)
 - .1 Foil:
 - .1 Flame spread 5 & Smoke developed 5
 - .2 Blanket:
 - .1 Flame spread & 0 Smoke Developed 0
- .5 Application chart

Application	Fire Resistive Rating	Enclosure System	Through-Penetration System
Grease Ducts	1 or 2 hours	2 layers - 3" (7,6 cm) perimeter and longitudinal overlap	ULC-FRD-4
Air Ventilation Duct Systems	1 hour	1 layer - 3" (7,6 cm) perimeter and longitudinal overlap or optional butt joint plus collar wrap method	ULC-FRD-3
Air Ventilation Duct Systems (2 or 3 Sides)	1 hour	1 layer - 3" (7,6 cm) perimeter and longitudinal overlap	ULC-FRD-5
Air Ventilation Duct Systems	2 hours	2 layers - 3" (7,6 cm) perimeter and longitudinal overlap or first layer butt joint with second layer overlap method	ULC-FRD-3
Air Ventilation Duct Systems (2 or 3 Sides)	2 hour	2 layers - 3" (7,6 cm) perimeter and longitudinal overlap OR first layer butt joint with second layer overlap 3" (7,6 cm)	ULC-FRD-5

Part 3 Execution

3.1 Examination

- .1 Section 01 70 00 - Examination and Preparation: Verification of existing conditions before starting work.
- .2 Verify that duct work has been tested before applying insulation materials.
- .3 Verify that surfaces are clean, foreign material removed, and dry.

3.2 Installation

- .1 Insulation to be applied in applications as specified regardless of whether shown on the drawings. Insulation shown on drawings is for reference, clarification or to indicate conditions not in the specifications.
- .2 Silencers are considered integral to ductwork system and shall have insulation applied to match performance of connected ductwork.
- .3 Section 01 45 00 - Quality Control: Manufacturer's written instructions.
- .4 Install to NAIMA National Insulation Standards.
- .5 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .6 All duct sizes on the drawings refer to inside duct dimensions. On all acoustically lined ductwork, the external duct dimensions shall be increased by the thickness of the lining.
- .7 Insulated duct work conveying air below ambient temperature:
 - .1 Provide insulation with vapour barrier jackets.
 - .2 Finish with tape and vapour barrier jacket.
 - .3 Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - .4 Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- .8 Insulated duct work conveying air above ambient temperature:
 - .1 Provide with or without standard vapour barrier jacket.
 - .2 Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- .9 External insulation on duct work exposed in Mechanical Equipment Rooms or Finished Spaces below 3 metres (10 feet) above finished floor: Provide canvas jacket ready for finish painting
- .10 Exterior Applications: Provide insulation with vapour barrier jacket. Cover the insulation with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
- .11 Where ducts are acoustically lined to the equivalent R-value, no exterior duct insulation is required, except where exposed to outside temperature and weather.
- .12 External Duct Insulation Application:
 - .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
 - .2 Secure insulation without vapour barrier with staples, tape, or wires.

- .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct work off trapeze hangers and insert spacers.
- .4 Seal vapour barrier penetrations by mechanical fasteners with vapour barrier adhesive.
- .5 Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- .13 Duct and Plenum Liner Application:
 - .1 Adhere insulation with adhesive for 90 percent coverage with adhesive complying with ASTM C916.
 - .2 Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
 - .3 Seal and smooth joints. Seal and coat transverse joints.
 - .4 Seal liner surface penetrations with adhesive.
 - .5 Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
- .14 Install Elastomeric Cellular Thermal Duct Liner as per manufacturer's recommendations.
- .15 External Fire Wrap Duct Insulation Application:
 - .1 Install in accordance to manufactures published installation manual.

3.3 Schedules

- .1 Duct insulation shall follow the Schedules below as a minimum requirement. These requirements shall apply regardless of whether or not duct insulation is shown on the drawings.
- .2 Where duct insulation is shown on the drawings (either with the hatching convention or by means of a key note) and exceeds the requirements of the schedules below, the additional insulation requirements shall be met.

3.4 External Duct Wrap, Glass Fibre, Flexible

DUCT SERVICE	DUCT SIZE		THICKNESS	
	Inch	mm	mm	Inch
All conditioned air supply ductwork in return plenums or unconditioned interior space or mechanical rooms or electrical rooms (all supply ductwork in building should be insulated if following NECB prescriptive path)	=< 400 mm (16") per side, or round duct		29mm (1 1/8") Installed 38mm (1 1/2") Nominal	
Round exhaust ducts, relief ducts from external wall or roof back for length of 3000mm (10 feet) or to	All		57mm (2 1/4") Installed 75mm (3") Nominal	

□

DUCT SERVICE	DUCT SIZE		THICKNESS	
	Inch	mm	mm	Inch
insulated damper, whichever is greater				
Round duct from insulated damper for length of up the 3000mm (10 feet)	All		38mm (1 1/2") Installed 50mm (2") Nominal	
Round ducting to centrifugal exhaust fans on roofs.	All		38mm (1 1/2") Installed 50mm (2") Nominal	

3.5 External Glass Fibre Rigid Insulation Board

DUCT SERVICE	DUCT SIZE		THICKNESS	
	Inch	mm	mm	Inch
Air conditioning supply plenums, before, including, and after cooling coils	all		50mm (2")	
All conditioned air supply ductwork in return plenums or unconditioned interior space or mechanical rooms or electrical rooms (all supply ductwork in building should be insulated if following NECB prescriptive path)	> 400 mm (16")	per side	25mm (1")	
Rectangular exhaust ducts, relief ducts from external wall or roof back for length of 3000mm (10 feet) or to insulated damper, whichever is greater	All		75mm (3")	
Rectangular duct from insulated damper for length of up the 3000mm (10 feet)	All		50mm (2")	
Outdoor air ducts located in conditioned space from the intake louver at outside wall or roof to the air handler or mixed air plenum	All		75mm (3")	
Rectangular conditioned air ducts located outdoors or where exposed to outdoor temperatures (eg. Attics, roofs).	All		125mm (5")	
Rectangular ducting to centrifugal exhaust fans on roofs.	All		50mm (2")	

3.6 Glass Fi re Duct Liner, Ri id

DUCT SERVICE	DUCT SIZE		THICKNESS	
	Inch	mm	mm	Inch
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All		25mm (1")	

3.7 Glass Fi re Duct Liner, Flexi le

DUCT SERVICE	DUCT SIZE		THICKNESS	
	Inch	mm	mm	Inch
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All		25mm (1")	
Rooftop goosenecks - exhaust	All		50mm (2")	

END OF SECTION

Part 1 General

1.1 References

- .1 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .3 ASTM C195 - Mineral Fibre Thermal Insulating Cement.
- .4 ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- .5 ASTM C411 - Hot-Surface Performance of High-Temperature Thermal Insulation
- .6 ASTM C449/C449M - Mineral Fibre Hydraulic-setting Thermal Insulating and Finishing Cement.
- .7 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .8 ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- .9 ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .10 ASTM C547 - Mineral Fibre Pipe Insulation.
- .11 ASTM C552 - Cellular Glass Thermal Insulation.
- .12 ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.
- .13 ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- .14 ASTM C591 - Unfaced Preformed Cellular Polyisocyanurate Thermal Insulation.
- .15 ASTM C610 - Moulded Expanded Perlite Block and Pipe Thermal Insulation.
- .16 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .17 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- .18 ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- .19 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

- .20 ASTM E96 - Water Vapour Transmission of Materials.
- .21 CAN/ULC-S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 **Quality Assurance**

- .1 **Materials**
 - .1 Flame spread/smoke developed rating of 25/50 or less to CAN/ULC S102.
 - .2 Where in contact with or exposed to temperatures greater than 120°C, all materials shall comply with ASTM C411 or be of non-combustible materials.

1.3 **Qualifications**

- .1 **Applicator:** Company specializing in performing the work of this section with minimum three years documented experience.

1.4 **Delivery, Storage, and Handling**

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Store insulation in original wrapping and protect from weather and construction traffic.
- .4 Protect insulation against dirt, water, chemical, and mechanical damage.

1.5 **Environmental Requirements**

- .1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .2 Maintain temperature during and after installation for minimum period of 24 hours.

Part 2 **Products**

2.1 **Glass Fibre Pre-Formed Pipe Insulation - All-Service Jacket**

- .1 **Manufacturers:**
 - .1 Johns Manville Micro-Lok.
 - .2 Knauf Earthwool 1000.
 - .3 Owens Corning FIBREGLAS.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 **Insulation:** ASTM C547; rigid moulded, non-combustible.

- .1 'ksi' ('K') value : ASTM C335, 0.035 at 24°C (0.24 at 75°F).
- .2 Minimum Service Temperature: -28.9°C (-20°F).
- .3 Maximum Service Temperature: 454°C (850°F).
- .4 Maximum Moisture Absorption: 0.2 percent by volume.
- .3 Vapour Barrier Jacket
 - .1 ASTM C921, White kraft paper reinforced with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture Vapour Transmission: ASTM E96; 0.03 ng/(Pa s sq m) (0.02 perm inches).
 - .3 Secure with self sealing longitudinal laps and butt strips.
 - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Tie Wire: 1.3 mm (18 gauge) stainless steel with twisted ends on maximum 300 mm (12 inch) centres.
- .5 Vapour Barrier Lap Adhesive
 - .1 Compatible with insulation.

2.2 JACKETS

- .1 PVC Plastic
 - .1 Jacket: ASTM C921, One piece moulded type fitting covers and sheet material, off white colour.
 - .1 Thickness
 - .1 Indoor inaccessible: 0.5 mm (0.02")
 - .2 Indoor accessible, mechanical rooms: 0.75 mm (0.03")
 - .3 Exterior use: 1 mm (0.04")
 - .2 Service temperature
 - .1 Minimum: -40°C (-40°F).
 - .2 Maximum: 66°C (150°F).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.002 perm inches.
 - .4 Maximum Flame Spread: ULC-S102; 25.
 - .5 Maximum Smoke Developed: ULC-S102; 50.
 - .6 Connections: installed in accordance with manufacturer's recommendations using PVC adhesive to seal joints, and tape or butt strips where joined to adjacent pipe covering. Use staples and insulation coating as specified at circumferential joints.
 - .2 Covering Adhesive Mastic
 - .1 Compatible with insulation.
- .2 Canvas Jacket: UL listed
 - .1 Fabric: ASTM C921, 220 g/sq m (6 oz/sq yd), plain weave cotton treated with dilute fire retardant lagging adhesive.
 - .2 Lagging Adhesive
 - .1 Bakelite 120-18 white fire retardant lagging adhesive.

- .3 Coating
 - .1 Finish with two full brush coats of Bakelite 120-09 white fire retardant paint.
- .3 Aluminum Jacket: ASTM B209.
 - .1 Generators: Type T-3003 H-14
 - .2 Thickness: 0.40 mm (0.016 inch) sheet.
 - .3 Finish: Embossed.
 - .4 Joining: Longitudinal slip joints and 50 mm (2 inch) laps.
 - .5 Fittings: 0.4 mm (0.016 inch) thick die shaped fitting covers with factory attached protective liner.
 - .6 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.38 mm (0.015 inch) thick aluminum.
- .4 Aluminum Flexible Self Adhesive Insulation Jacket
 - .1 Approvals: UL listed
 - .2 Manufacturers:
 - .1 VentureClad 1577CW
 - .2 Bakor Foilskin
 - .3 Polyguard Alumaguard
 - .3 Tensile Strength: 316.5 N/25 mm (70 lb/in)
 - .4 Puncture: 111 N (25 lbs)
 - .5 Service Temperature: -50 to 70°C (-58°C to 160°F)
 - .6 Finish: Embossed
 - .7 Aluminum foil exterior surface over multilayer laminate, vapour barriered jacket with pressure sensitive adhesive integral to jacket application surface with peel off release liner.
 - .8 Permeation (ASTM E96): 0.05 perm (maximum)
 - .9 UV resistant.
 - .10 Flame based application not acceptable.

Part 3 Execution

3.1 Examination

- .1 Verify that piping has been tested before applying insulation materials.
- .2 Verify that surfaces are clean, foreign material removed, and dry.

3.2 Installation

- .1 Install materials to manufacturer's written instructions.
- .2 On exposed piping, locate insulation and cover seams in least visible locations.

- .3 Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - .1 Provide vapour barrier jackets, factory applied or field applied.
 - .2 Insulate fittings, joints, and valves with moulded insulation of like material and thickness as adjacent pipe.
 - .3 Finish with glass cloth and vapour barrier adhesive.
 - .4 PVC fitting covers may be used.
 - .5 Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - .6 Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- .4 For insulated pipes conveying fluids above ambient temperature:
 - .1 Provide standard jackets, with or without vapour barrier, factory applied or field applied.
 - .2 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - .3 Finish with glass cloth and adhesive.
 - .4 PVC fitting covers may be used, except on steam and condensate piping systems.
 - .5 For hot piping conveying fluids 60°C (140°F) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - .6 For hot piping conveying fluids over 60°C (140°F), insulate flanges and unions at equipment.
- .5 Inserts and Shields:
 - .1 Application: Piping 40 mm (1-1/2 inches) diameter or larger.
 - .2 Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - .3 Insert Location: Between support shield and piping and under the finish jacket.
 - .4 Insert Configuration: Minimum 150 mm (6 inches) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - .5 Insert Material: hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- .6 Finish insulation at supports, protrusions, and interruptions.
- .7 At penetrations through fire rated walls, provide firestopping at walls and run insulation to firestopping. Seal insulation ends. Where voids exist between fire stop seals within the cavity, fill void with mineral wool or alternative non-combustible insulation.
- .8 Pipe supports:
 - .1 All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that the

- circumferential joint may be made outside the hanger. On cold systems, vapor barrier shall be continuous, including material covered by the hanger saddle.
- .2 Piping systems 3" (75 mm) in diameter or less may be supported by placing saddles of the proper length and spacing under the insulation as designated by the insulation manufacturer.
 - .3 For hot piping systems larger than 3" (75 mm) in diameter, operating at temperatures less than +200F (93C) and insulated with fiber glass, high density inserts such as fiberglass or foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding +200F (93C), high temperature pipe insulation shall be used for high density inserts.
 - .4 For piping conveying fluids below ambient temperature and larger than 3" (75 mm) in diameter provide CFC and HFCF free phenolic insulation supports with sufficient compressive strength shall be used to support the weight of the piping system and with appropriate thickness for the required insulation values.
 - .5 Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
 - .6 On vertical runs, insulation support rings shall be used as required.
 - .9 For pipe exposed in mechanical equipment rooms or in finished spaces below 3 metres (10 feet) above finished floor, finish with canvas jacket sized for finish painting.
 - .10 For all pipe in exposed in occupied areas, finish with PVC jacket.
 - .11 Exterior piping applications:
 - .1 For exterior piping applications, provide weather and UV resistant vapour barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - .2 On outdoor chilled water and refrigerant lines, the insulation system shall be completely vapor sealed before the weather-resistant jacket is applied where jacket is not part of the vapour sealing barrier. The outer jacket shall not compromise the vapor barrier by penetration of fasteners, etc. Vapor stops at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion.
 - .12 Insulate all roof hoppers and storm drain pipe in ceiling spaces or walls of finished areas, and all vent piping and exposed horizontal and vertical storm drain pipe within 3000 mm (10'-0") developed length from roof opening or located in vented attics and soffits.
 - .13 Where internal roof drains discharge to grade, insulate all piping within 3000 mm (10'-0") developed length from the exterior wall termination. If the pipe is exposed within the building, continue insulation for all exposed lengths of pipe.
 - .14 Fittings and Valves

- .1 Shall be insulated with pre-formed fiberglass fittings, fabricated sections of fiberglass pipe insulation. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings.
- .2 Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with suitable weather or vapor resistant mastic as dictated by the system location and service. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.
- .3 On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems shall be sealed with caulking to allow free movement of the stem but provide a seal against moisture incursion. Valve handle extensions are recommended.

.15 ACCESSORY MATERIALS

- .1 All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

3.3 Tolerance

- .1 Substituted insulation materials: Thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 Fibrous Glass Insulation Schedule

	PIPING SYSTEMS	PIPE SIZE		THICKNESS	
		Inch	mm	Inch	mm
Plumbing Systems					
	Domestic Hot Water Supply & Domestic Hot Water Recirc	≤ 2" (50mm)		1" (25mm)	
	Domestic Hot Water Supply & Domestic Hot Water Recirc	> 2" (50mm)		1 ½" (38mm)	
	Tempered Domestic Water Supply	≤ 2" (50mm)		1" (25mm)	
	Tempered Domestic Water Supply	> 2" (50mm)		1 ½" (38mm)	
	Domestic Cold Water	≤ 2" (50mm)		1" (25mm)	
	Domestic Cold Water	> 2" (50mm)		1 ½" (38mm)	
	Roof Drain Bodies	all		2" (50mm)	
	Roof Drain piping above floor	all		2" (50mm)	

	PIPING SYSTEMS	PIPE SIZE		THICKNESS	
		Inch	mm	Inch	mm
	within 10 Feet (3 Metres) of the Exterior. Entire length of pipe where not trapped.				
	Plumbing Vents Within 10 Feet (3 Metres) of the Exterior	all		2" (50mm)	
Heating Systems					
	Heating water & glycol supply and return, low pressure steam, pumped and gravity steam condensate	=< 2" (50mm)		1" (25mm)	
	Heating water & glycol supply and return, low pressure steam, pumped and gravity steam condensate	> 2" (50mm)		1-1/2" (38mm)	
	Boiler Feed Water	=< 2" (50mm)		1" (25mm)	
Cooling Systems					
	Chilled water & glycol	all		1" (25mm)	
	Condenser water	all		1" (25mm)	
	Dual Temperature Water	all		Match heating water	
	Heat Recovery Water	all		1" (25mm)	
	Glycol Cooling Supply and Return	all		1" (25mm)	
	Cold Condensate Drains	all		1" (25mm)	
	Condensate Drains from Cooling Coils	all		1" (25mm)	

END OF SECTION

Part 1 General

1.1 References

- .1 ASME
 - .1 ASME -Welding and Brazing Qualifications.
 - .2 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ASME B31.1 - Power Piping
 - .5 ASME B31.3 – Process Piping
 - .6 ASME B31.9 - Building Services Piping.
- .2 ASTM
 - .1 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - .2 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - .3 ASTM B32 - Solder Metal.
 - .4 ASTM B88 - Seamless Copper Water Tube.
 - .5 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS A5.8 - Filler Metals for Brazing and Braze Welding.
 - .2 AWS D1.1 - Structural Welding Code - Steel.
- .4 Canadian Standards Association
 - .1 CSA B51-2019, Boiler and Pressure Vessel Code
 - .2 CSA B214-2016, Installation code for hydronic heating systems
 - .3 CSA B149.1, Natural Gas and Propane Installation Code
 - .4 CSA C282, Emergency Electrical Power Supply for Buildings
- .5 Manufacturers Standardization Society
 - .1 ANSI/MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

1.2 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of valves.

1.3 Operation and Maintenance Data

- .1 Submit to Section 21 05 00.

- .2 Include valve schedule complete with valve tags, location, service, normally open/normally closed.
- .3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.4 Quali ications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Carbon steel pipe and fittings manufactured in China or India will not be permitted.
- .3 Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.
- .4 Welders: Certify to ASME SEC 9 and applicable provincial public safety regulations.

1.5 Re ulator Re uire ents

- .1 All pressure piping systems for use in Manitoba shall be designed and constructed in accordance with the applicable ANSI/ASME Piping Codes, ITSM (Inspection and Technical Services Manitoba) and Steam and Pressure Plants Act.
- .2 Conform to CSA B51 and ASME B31.9 code for installation of piping system.
- .3 Welding Materials and Procedures: Conform to ASME SEC 9 and applicable provincial public safety regulations.
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.6 Deli er, Stora e, and Handlin

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 En iron ental Re uire ents

- .1 Do not install underground piping when bedding is wet or frozen.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two repacking kits for each size and valve type.

Part 2 Products

2.1 Buried Geot er al Ground Loo Pi in

- .1 Refer to Section 23 24 00 – Geothermal Ground Loop.

2.2 Heatin Water and Gl col Pi in , A o e Ground

- .1 Steel Pipe: ASTM A53, Schedule 40, black.
 - .1 Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
 - .2 Joints: Threaded, or AWS D1.1, welded.
 - .2 Copper Tubing: ASTM B88, Type L hard drawn. Up to 50mm (2”) diameter only.
 - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
 - .2 Joints: Up to 50mm (2”) diameter: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 220 to 280 degrees C (430 to 535 degrees F).
 - .3 Hose: Composite hose with nitrile liner, braided fibre reinforcing, neoprene cover, 1034 kPa (150 psig) operating pressure at 96 degrees C (205 degrees F).
 - .1 Fittings: Copper.
 - .2 Joints: Nipple with stainless steel clamp.
- Chilled Water Piping, Above Grade

2.3 E ui ent Drains and O er lo s

- .1 Steel Pipe: ASTM A53, Schedule 40 galvanized.
 - .1 Fittings: Galvanized cast iron, or ASTM B16.3 malleable iron.
 - .2 Joints: Threaded, or grooved mechanical couplings.
- .2 Copper Tubing: ASTM B88, Type L, annealed.
 - .1 Fittings: ASME B16.22, wrought copper.
 - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 220 to 280 degrees C (430 to 535 degrees F).

2.4 Unions, Flanges, and Couplings

- .1 Unions for Pipe 50 mm (2 inches) and Under:
 - .1 Ferrous Piping: 1034 kPa (150 psig) malleable iron, threaded.
 - .2 Copper Pipe: Bronze, soldered joints.
- .2 Flanges for Pipe Over 50 mm (2 inches):
 - .1 Ferrous Piping: 1034 kPa (150 psig) forged steel, slip-on.
 - .2 Copper Piping: Bronze.
 - .3 Gaskets: 1.6 mm (1/16 inch) thick preformed neoprene.
- .3 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.5 Gate Valves

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo Rising Stem, Union Bonnet, Solid Wedge Disc
Class 125: Threaded: 293 Soldered: Use Adaptors
Class 150: Threaded: 298 Soldered: Use Adaptors
Class 300: Threaded: 318 Soldered: Use Adaptors
 - .2 Kitz Rising Stem, Screwed Bonnet, Solid Wedge Disc
Class 125: Threaded: 24 Soldered: 44
Class 150: Threaded: 25 Soldered: 45
Kitz Rising Stem, Union Bonnet, Solid Wedge Disc
Class 150: Threaded: 42, 42T Soldered: 43
Class 300: Threaded: 37 Soldered: Use Adaptors
 - .3 Red-White/Toyo Non-Rising Stem, Screwed Bonnet, Solid Wedge Disc
Class 125: Threaded: 280 Soldered: 281
Class 150: Threaded: 204 Soldered: Use Adaptors
 - .4 Kitz Non-Rising Stem, Screwed Bonnet, Solid Wedge Disc
Class 125: Threaded: 40 Soldered: 41
Class 150: Threaded: 46 Soldered: 64
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze body, bronze trim, bonnet, rising stem, handwheel, solid wedge disc, solder or threaded ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo 421 Rising Stem, Flanged Ends
 - .2 Kitz 72 Rising Stem, Flanged Ends
 - .3 Red-White/Toyo 415 Non-Rising Stem, Flanged Ends
 - .4 Kitz 75 Non-Rising Stem, Flanged Ends

- .5 Substitutions: Refer to Section 21 05 00.
- .2 Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.6 Glo e or An le Val es

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze body, bronze trim, union bonnet, rising stem and handwheel, renewable composition disc and bronze seat, solder ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.7 Ball Val es

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 MAS
 - .2 Red-White/Toyo
 - .3 Kitz
 - .4 Crane
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze one piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle solder ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Kitz
 - .2 MAS
 - .3 American 4001
 - .4 American 4000
 - .5 Crane
 - .6 Substitutions: Refer to Section 21 05 00.

- .2 Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.8 **Plug Valves**

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Nordstrom Valves, Inc. MSS SP-78, Type II.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Cast-iron or bronze body, bronze tapered plug, full port opening, non-lubricated, teflon packing, threaded ends.
 - .3 Operator: One plug valve wrench for every ten plug valves minimum of one.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Nordstrom Valves, Inc. MSS SP-78, Type II.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Cast iron body and plug, full port opening, pressure lubricated, teflon packing, flanged ends.
 - .3 Operator: Each plug valve with a wrench with set screw.

2.9 **Butterfly Valves**

- .1 Manufacturers:
 - .1 Demco
 - .2 Kitz
 - .3 Mueller
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
- .3 Disc: Stainless Steel.
- .4 Operator: 10 position lever handle. Valves 8" and larger shall have gear operator with position indicator.

2.10 **Swing Check Valves**

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.11 S rin Loaded C ec Val es

- .1 Manufacturers:
 - .1 Mueller 71 Series
 - .2 M.A. Stewart & Sons Moygro W12A-I6V (single plate)
 - .3 Watts ICV
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

Part 3 Execution

3.1 Pre aration

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and dirt on inside and outside before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.
- .4 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- .5 After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install heating water, glycol, chilled water, and condenser water piping to CSA 52 and ASME B31.9.
- .3 Route piping in orderly manner, parallel to building structure, and maintain gradient. Grade hydronic piping up in flow direction or as noted.
- .4 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

- .1 Pipes carrying fluids at temperatures greater than 100°C (212°F) or steam at pressures greater than 103 kPa (1 psig) shall not be routed through patient care areas or in ceiling spaces above patient care areas.
- .2 Install piping to conserve building space, and not interfere with use of space.
- .3 Group piping whenever practical at common elevations.
- .4 Provide piping on glycol systems from air vents to associated glycol fill tank.
- .5 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .6 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.
- .7 Supply and install check valves on steam condensate pump discharges and also where indicated on the drawings.
- .8 Use spring loaded check valves on discharge of pumps.
- .9 Sleeves
 - .1 Sleeve pipe passing through partitions, walls and floors.
- .10 Valves
 - .1 Install drain valves (ball valves) c/w hose and cap and chain on each pump (pipe to nearest floor drain), at system low points so that entire system can be drained, and at each zone or branch / riser isolation valve so branch or riser can be drained down completely.
 - .2 All valves must be installed with stems upright or horizontal; not inverted.
 - .3 Valve body materials shall be compatible with piping system materials. Valves shall meet all pressure, temperature, and fluid handling requirements of the system.
 - .4 A valve drain shall be provided at the base of each riser and at the low points of the system. Manual air vents shall be provided at the top of each riser and at the high points of the system.
 - .5 All valves installed in concealed locations, i.e., ceiling spaces, shall be compactly arranged so that they are easily accessible through common access plates or doors.
 - .6 On cooling coils supply and install drain valves with hose end connections at the top of the coil header of headers to allow the coils to be filled with glycol.
 - .7 Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
 - .8 Use globe or butterfly valves for throttling, bypass, or manual flow control services.
 - .9 Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

- .10 Use butterfly valves in heating, chilled and condenser water systems interchangeably with gate and globe valves providing they meet the pressure, temperature, and fluid handling requirements of the system.
- .11 Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.
- .12 Use lug end butterfly valves to isolate equipment.
- .13 Use 3/4 inch (20 mm) ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain. NOTE: Piping containing glycol or other antifreeze solutions to be piped back to the tank.
- .14 Install valves with stems upright or horizontal, not inverted.
- .15 Each piece of equipment shall have isolation valves at the supply and return connections.
- .16 All hydronic equipment, manifolds, and headers shall be provided with isolation valves at all connections, complete with unions or flanges.
- .17 Isolation valves, complete with unions or flanges, shall be provided at junctions or branches of piped HVAC systems and shall be readily accessible.
- .11 Hangers and Supports
 - .1 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19 – Piping Insulation.
 - .2 Provide pipe hangers and supports to CSA B51 and ASME B31.9 unless indicated otherwise. Refer to Section 23 05 29 – Supports and Anchors.
- .12 Couplings, Fittings, Fasteners and Connections
 - .1 Use grooved mechanical couplings and fasteners only in accessible locations.
 - .2 Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
 - .3 Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
 - .4 Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .13 Coatings and Protection
 - .1 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
 - .2 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 91 10.

3.3 Pressure Testin

- .1 Do not insulate pipe prior to pressure testing. Pressure test in sections if necessary before concealing or insulating pipe.

□

- .2 Do not introduce water for testing where freezing conditions exist or where piping systems being tested are located above sensitive areas or equipment that may be damaged or contaminated by water leakage.
- .3 Hydraulically test all pipe. Pneumatic testing not permitted without prior approval from the Contract Administrator and the Authority Having Jurisdiction.
- .4 Hydronic pipe testing shall be in accordance with the applicable ASME and CSA B51 piping code, the Contractor's registered Quality Assurance Program (for systems where applicable), and all requirements of ITSM.
 - .1 Subject piping to a hydrostatic pressure of at least 1□ times the operating pressure of the system design pressure for a period of at least 12 hours to a minimum 150 psi (1100 kPa). If leaks are detected, such leaks shall be repaired and the test started over. Record results and submit witnessed (by Contract Administrator) reports to the Contract Administrator.
 - .1 Pressure testing to be limited to the maximum test pressure of the valves, equipment, vessels, pumps or other system components
 - .2 For buried piping, subject piping to a hydrostatic pressure of at least 1□ times the operating pressure of the system for a period of at least 24 hours and recorded over the test period.
- .5 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings and equipment. Pipe dope, caulking, tape, lead wool, dresser couplings, etc. shall not be used to correct deficiencies. The contractor shall be responsible for all cleanup related to leakage during flushing, testing, and chemical treatment of piping, including original building piping if included in the testing.
- .6 Test piping system in sections as required by the progress of work.
- .7 Register pressures at the highest system point.
- .8 Provide at least 48 hours (during working days) notice to Contract Administrator or The City's Representative prior to testing to allow the tests to be witnessed.

END OF SECTION

Part 1 General

1.1 References

- .1 UL 778 - Motor-Operated Water Pumps.

1.2 Performance Requirements

- .1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.3 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- .3 Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
- .4 Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.4 Project Record Documents

- .1 Section 21 05 00: Procedures for submittals.
- .2 Record actual locations of hydronic pumps.

1.5 Operation and Maintenance Data

- .1 Section 21 05 00: Procedures for submittals.
- .2 Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.6 Quality Assurance

- .1 Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years documented experience.
- .2 Alignment: Align base mounted pumps by qualified millwright.

1.7 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

□

1.8 Extra Materials

- .1 Section 21 05 00: Procedures for submittals.
- .2 Provide one set of mechanical seals for each pump.

Part 2 Products

2.1 Manufacturers

- .1 Bell & Gossett
- .2 Armstrong
- .3 Taco
- .4 Substitutions: Refer to Section 21 05 00.

2.2 Vertical In-Line Pumps

- .1 Type: Vertical, single stage, close coupled, radially split casing, for in-line mounting, for 1200 kPa (175 psig) working pressure at 107 degrees C (225 degrees F).
- .2 Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- .3 Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
- .4 Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
- .5 Seal: Carbon rotating against a stationary ceramic seat, Buna-Carbon/Ceramic seal 107 degrees C (225 degrees F) maximum continuous operating temperature.
- .6 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
- .7 Each pump shall be factory tested and name-plated before shipment.
- .8 Pumps shall conform to ANSI/HI standard for Preferred Operating Region (POR) unless otherwise approved by the Contract Administrator. The pump NPSH shall conform to the ANSI/HI standards for Centrifugal and Vertical Pumps for NPSH Margin.

Part 3 Execution

3.1 Preparation

- .1 Verify that electric power is available and of the correct characteristics.

□

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Provide the necessary access space around components to allow for servicing, repair, replacement as well as for the balancing technician to take proper readings. Provide no less than minimum as recommended by manufacturer
- .3 Pumps shall be sized on the capacities, heads, motor sizes and RPM specified, impeller size selected shall not be greater than 85% of the maximum size impeller.
- .4 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 102 mm (4 inches) and over.
- .5 Provide line sized shut-off valve, and strainer on pump suction, and line sized soft seat check valve and balancing valve or combination pump discharge valve on pump discharge.
- .6 Provide air cock and drain connection on horizontal pump casings.
- .7 Provide drains for bases and seals, piped to and discharging into floor drains or, in the case of glycol, to a suitable container.
- .8 Provide drain lines with ball valves from strainers and filters to nearest floor drain or, in the case of glycol, to a suitable container.
- .9 Manufacturer approved millwright or agent to check, align, and certify alignment of base mounted pumps prior to start-up.
- .10 Lubricate pumps before start-up.
- .11 Provide flow measurement ports as shown on drawings, on piping schematics, and in locations as directed by the water balancing specialist.
- .12 Provide any pump impeller modifications as recommended by Division 23 05 93 – Testing Adjusting and Balancing.

END OF SECTION

Part 1 General

1.1 References

- .1 ASME B31.9 - Building Services Piping.
- .2 ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .3 ASTM D2513-20 – Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
- .4 CSA C448 – Design and Installation of Earth Energy Systems.
- .5 CSA B137.0 – Definitions, General Requirements, and Methods of Testing for Thermoplastic Pressure Piping.
- .6 CSA B137.1 – Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

1.2 Scope Description

- .1 Supply and install all labour, equipment, and materials to provide a complete vertical geothermal Loop Heat Exchanger (GLHE) to couple the geothermal heat pump units specified, to provide a ground source closed-loop heat pump system. GLHE to be sized according to drawings.

1.3 Submittals

- .1 Submit shop drawings for GLHE configuration and products, including:
 - .1 Site layout indicating borehole locations and routing of piping from boreholes to building.
 - .2 Piping schematic indicating overall arrangement, piping sizes, and location and type of fittings/connections.
 - .3 Details:
 - .1 Borehole:
 - .1 Indicate depth, diameter, fitting/connections.
 - .2 Trench:
 - .1 Indicate depth, bedding, pipe spacing, backfill material type, lifts, and compaction.
 - .3 Manifold:
 - .1 Indicate pipe sizes, fittings, connections, ports, gauges, and supports.
 - .4 Header:
 - .1 Indicate pipe sizes, fittings, connections, general arrangement.
 - .4 Product Data:

- .1 Piping
- .2 Fittings and Valves
- .3 Borehole Grout
- .4 Anti-Freeze Solution
- .5 Manufacturer's installation instructions for joining methods
- .6 Drilling log for a minimum of two boreholes

1.4 Project Record Documents

- .1 Section: Submittals for project closeout.
- .2 Record actual locations of valves.

1.5 Operation and Maintenance Data

- .1 Include valve schedule complete with valve tags, location, service, normally open/normally closed.
- .2 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.6 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.
- .3 GLHE installer shall be certified with MGEA, CGC, and IGSPHA with at least three years of successful installation experience.

1.7 Regulator Requirements

- .1 Conform to CSA-C448 Series-02 "Design and Installation of Earth Energy Systems", Manitoba Water Stewardship Water Licensing Branch, and all other local authorities requirements and standards.

1.8 Delivery, Storage, and Handling

- .1 Section: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Fittings shall be stored in their original container or sealed plastic bags.

- .6 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 En iron ental Re uire ents

- .1 Do not install underground piping when bedding is wet or frozen.

1.10 Extra Materials

- .1 Section: Submittals for project closeout.
- .2 Provide two repacking kits for each size and valve type.

Part 2 Products

2.1 Pi in and Fittin s, Buried

- .1 All underground piping and fitting materials shall meet requirement of CSA Standard B137.1.
- .2 All piping for GLHE to be PE 3408 (high density polyethylene) in accordance with ASTM-2513 sect. 4.1 and 4.2, with minimum cell classification 345434C per ASTM D-3350, "Standard Specification for Polyethylene Plastic Pipe and Fitting Materials." Pipe and fittings to be GEOLINK or approved equal. Only the following sizes of PE 3408 piping are acceptable:
 - .1 3/4" – 1" IPS SDR-11
 - .2 1-1/4" – 1-1/2" IPS Sched. 40 (SDR-13.5)
 - .3 2" IPS Sched. 40
 - .4 3" IPS SDR-11
 - .5 4" IPS SDR-11
- .3 Underground joints shall be butt- or socket-fused in accordance with ASTM Standard D2657 and manufacturer's instructions.
- .4 Fittings joined by fusion shall be manufactured to the same specifications and be of the same resin compound type, with cell classifications 345564C or 345434C.
- .5 Each GLHE shall be closed by means of a single or double elbow style U-bend at the bottom of the loop. The U-bend shall be constructed and attached to the GLHE using the heat fusion bonding method. No other fusion joints are permitted on the vertical portion of the GLHE.

2.2 Pi in and Fittin s, Indoor

- .1 Refer to Section 23 21 00 - Hydronic Piping
- .2 Transition from steel to high density polyethylene in mechanical room.

2.3 Valves

- .1 Valves shall be full port, line size, polyethylene ball valves.
- .2 Designed to minimum pressure of 1024 kPa (150 psi).

2.4 Identification

- .1 Pipe:
 - .1 Label as per CSA C448.
 - .2 Marked in accordance with CSA Standard B137.1 as "Geothermal"
- .2 Fittings:
 - .1 Label as per CSA C448.
 - .2 Marked in accordance with CSA Standard B137.1 for plastic insert type and B137.0 for other types.
 - .3 They shall be marked with CSA Standard Number "C448"

2.5 Bore Hole Grout

- .1 All vertical GLHE bore holes shall be grouted completely with high-solids bentonite clay grout (thermally enhanced) in conformance with IGSHPA standards. Contractor shall monitor each bore hole after initial grouting and continue adding grout as required.
- .2 Grout shall have a thermal conductivity no less than 2.08 W/(m K) (1.2 btu/(hr ft F)).

2.6 Manual

- .1 Each incoming geothermal loop leg shall be complete with manual shut-off valves to isolate the leg. The main loop supply and return lines shall contain manual isolation ball valves of the same diameter as the main lines and shall be equipped with access ports to allow for loop flushing. Valves shall be arranged so that the loop can be flushed through the access ports without having to flush the entire building piping system. Each incoming geothermal loop leg and the main loop shall be complete with pressure/temperature ports.
- .2 Supply and return pipes shall be separated by a minimum distance of 600mm (24").

2.7 Antifreeze

- .1 Refer to Section 23 05 20 for glycol solution.

Part 3 Execution

3.1 Preparation

- .1 Ream pipe and tube ends. Remove burrs.

□

- .2 Remove scale and dirt on inside and outside before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.
- .4 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- .5 After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Each vertical pipe loop shall be filled with water, pressure-tested for leaks and integrity, and then sealed, prior to insertion in borehole. Each subheader shall be tested after it is connected to mechanical room header. The entire systems shall be tested once complete, purged, flushed and backfilled. Refer to CSA C448 for further information.
 - .1 Compressed air shall be used to compress the water to a minimum pressure of 690 kPa (100psi) for at least 15 minutes without any indication of a significant pressure drop or leakage.
 - .2 Pressure shall be maintained in the pipe for 1 hour after completion of grouting of borehole.
 - .3 Contractor shall notify the Contract Administrator the day they are planning to do pressure tests and record. Submit report to Contract Administrator.

BORE HOLE	DATE	TIME OF DAY	DEPTH (meters)	TEST RESULT
1				
2				
3				
4				
5				
6				
7				
8				
10				
11				
12				
Headers				
Entire System				

- .3 A record of the depth of each bore hole must be recorded by the driller and submitted to the Engineer prior to installation of the ground loop heat exchanger. Call 453-1080 and submit report to David Siepman at dsiepman eppsiepman.com.
- .4 Test and balance according to 23 05 93 – Testing, Adjusting, and Balancing.
- .5 Testing and Flushing GLHE shall be as per heat pump manufacturer's instructions.
- .6 Route piping in orderly manner, parallel to building structure, and maintain gradient. Grade hydronic piping up in flow direction or as noted.
- .7 Install piping to conserve building space, and not interfere with use of space.
- .8 Group piping whenever practical at common elevations.
- .9 Sleeve pipe passing through partitions, walls and floors.
- .10 Slope piping and arrange to drain at low points.
- .11 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .12 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.
- .13 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- .14 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .15 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- .16 Install valves with stems upright or horizontal, not inverted.
- .17 Supply and install pumps complete with all controls and electrical. Piping to include manual ball valve and flanged connections before and after pump.
- .18 Supply and install expansion tank sized as per the loop design and operating conditions.
- .19 Install heating water and glycol piping to ASME B31.9.

END OF SECTION

Part 1 General

1.1 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- .3 Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
- .4 Manufacturer's Field Reports: Submit to Section 01 45 00.
- .5 Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- .6 Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

1.2 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

1.3 Operation and Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.4 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience. Company to have local representatives with water analysis laboratories and full time service personnel.
- .2 Installer: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.5 Regulator Requirements

- .1 Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for to public sewage systems.

□

- .2 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 Maintenance Service

- .1 Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.
- .2 Provide regular technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
- .3 Provide laboratory and technical assistance services during this maintenance period.
- .4 Include a training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.
- .5 Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.7 Maintenance Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide sufficient chemicals for treatment and testing during warranty period.
- .3 Provide 10 side-stream filters, 10 micron.

Part 2 Products

2.1 Manufacturers

- .1 GE Water and Process Technologies.
- .2 Substitutions: Refer to Section 21 05 00.

2.2 MATERIALS

- .1 Closed Hot Water, Chilled Water and Glycol Systems Cleaner:
 - .1 Ferroquest FQ7103 (neutral pH cleaner to remove oil, grease, rust and mill scale)
- .2 Closed System Treatment (Hot or Chilled Water):
 - .1 Corrshield MD4102 (molybdate based scale and corrosion inhibitor with pH adjustment)

2.3 Bypass (Pot) Feeder

- .1 Manufacturers:
 - .1 Neptune
 - .2 Axiom
- .2 Closed Hot Water, Chilled Water and Glycol Systems:
 - .1 2 gallon chemical pot feeder

2.4 Side Stream Filter System

- .1 Closed Hot Water, Chilled Water and Glycol Systems:
 - .1 Pal LMO-10 ¾" filter housing
 - .2 STS ¾" Filtermate flow indicator.
- .2 Manufacturers:
 - .1 Pal
 - .2 Axiom
 - .3 General Filtration
 - .4 3M (Cuno).
 - .5 Sumco.
 - .6 Substitutions: Refer to Section 21 05 00.
- .3 System: Flow indicator, filter housing with cartridge filter, shut off valves, and flow control valve.
- .4 Performance: Design flow 0.25 L/s (4 gal/min) with maximum pressure drop of 25.6 kPa (4 psig), based on water.
- .5 Hot Water and Glycol Filter Housing: Stainless steel housing suitable for 105 degrees C (220 degrees F) and 1380 kPa (200 psig) operating conditions.
- .6 Chilled Water Filter Housing: Stainless steel housing suitable for 52 degrees C (125 degrees F) and 860 kPa (125 psig) operating conditions.
- .7 Cartridges: Stringwound cartridge filters
 - .1 Startup: 0.025 mm (25 micron)
 - .2 Operation: 0.010 mm (10 micron)

2.5 Test Equipment

- .1 Closed System (Hot or Chilled Water): Provide complete test kit including L6213 molybdate test kit, pH meter, conductivity tester.

Part 3 Execution

3.1 Pre aration

- .1 Systems to be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- .2 Place terminal control valves in open position during cleaning.
- .3 Section 23 25 00 shall provide
- .4 Verify that electric power is available and of the correct characteristics.

3.2 Cleanin Se uence

- .1 Concentration:
 - .1 As recommended by manufacturer.
- .2 Hot Water, Chilled Water, Glycol Systems
 - .1 Isolate Existing hydronic systems.
 - .2 All systems must be chemically cleaned and flushed before water treatment is added. This includes partial or complete filling for pressure testing.
 - .3 After all components of the piping system have been pressure tested and proven to be in full operational condition and leak free, flush entire system with fresh clean make-up water to remove loose mill scale, sediment and construction debris.
 - .4 Provide drain connections to drain system in one hour. Install totalizing water meter to record capacity in each system
 - .5 All drains for chemical treatment shall be piped to the nearest floor drain.
 - .6 After initial flushing has been completed, clean all strainer screens.
 - .7 Add cleaner to closed systems at concentration levels recommended by the water treatment specialist.
 - .8 After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until tests show pH, iron, TDS and chloride levels of water leaving system are the same as entering the system. Refill and immediately add water treatment to proper level.

3.3 Installation

- .1 Install to manufacturer's written instructions.

3.4 Closed S□ste Treat ent

- .1 Provide one bypass feeder and one side stream filter on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

- .2 Introduce closed system treatment through bypass feeder when required or indicated by test.
- .3 Start system with 25 micron start-up sidestream filter. Change side stream filter cartridges as required or indicated by the flow indicator. After flushing and circulating the system, replace 25 micron start-up filters with 10 micron side stream filters for normal system operation when start-up filter loading indicates minimal debris capture.

3.5 Quality Assurance

- .1 Provide physical or photographic evidence that construction screens have been used during the cleaning and flushing process.
- .2 Provide water test results showing acceptable test results performed by qualified personnel as noted in Qualifications section. Provide to Contract Administrator for pipe cleaning, flushing and inhibitor tests.

END OF SECTION

Part 1 General

1.1 References

- .1 ADC - ADC Flexible Duct Performance and Installation Standards
- .2 ASTM A36/A36M - Carbon Structural Steel.
- .3 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
- .5 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
- .6 ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 AWS D9.1 - Sheet Metal Welding Code.
- .8 CAN/CGSB-19.13 - Sealing Compound, One Component, Elastomeric, Chemical Curing
- .9 CAN/ULC S102 - Test for Surface Burning Characteristics of Building Materials and Assemblies
- .10 CAN/ULC S109 - Flame Tests of Flame-Resistant Fabrics and Films.
- .11 CAN/ULC S110 - Test for Air Ducts
- .12 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .13 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
- .14 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .15 SCAQMD Rule 1113 - Volatile Organic Compound (VOC) Limits
- .16 SCAQMD Rule 1168 - Adhesive and Sealant Applications
- .17 SMACNA - HVAC Air Duct Leakage Test Manual.
- .18 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .19 UL 181 – Standard for Factory-Made Air Ducts and Connectors.
- .20 UL 181A - Standard for Closure Systems for Use With Rigid Air Ducts

.21 UL 181B - Standard for Closure Systems for Use With Flexible Air Ducts and Air Connectors

.22 Furnishings

1.2 Performance Requirements

.1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

1.3 Project Record Documents

.1 Section 21 05 00: Submittals for project closeout.

.2 Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.4 Quality Assurance

.1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.2 Maintain one copy of document on site.

1.5 Qualifications

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.

.2 Installer: Company specializing in performing the work of this section with minimum three years documented experience.

1.6 Regulator Requirements

.1 Construct commercial kitchen exhaust duct work to NFPA 96 standards.

.2 All materials to comply with ULC S102 and ULC S110 requirements for ductwork.

.3 Where combustible materials are in contact with or exposed to temperatures greater than 120°C, materials must comply with ASTM C411.

1.7 Environmental Requirements

.1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

.2 Maintain temperatures during and after installation of duct sealants.

Part 2 Products

2.1 Materials

- .1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating of to ASTM A90.
- .2 Fasteners: Rivets, bolts, or sheet metal screws.
- .3 Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 Sealants

- .1 Duct joints:
 - .1 Basis of Design:
 - .1 Duro-Dyne
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 UL 181 listed, CAN/ULC S102, NFPA 90A/90B
 - .3 Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
 - .4 Water, fire, mold and mildew resistant.
 - .5 Usage to be compatible with low and medium velocity air distributing systems up to 2 w.g.
 - .6 Suitable for use in both indoor and outdoor applications.
 - .7 Exceeds SMACNA pressure and sealing classes for the installed ductwork application.

2.3 Duct Work Fabrication

- .1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Unless otherwise indicated fabrication shall conform to standards for duct pressure class rating of +2" w.g. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- .2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air-foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fibre insulation.
- .3 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- .4 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm (4 inch) cemented slip joint, brazed or electric welded. Prime coat welded joints.
- .5 Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

- .6 All rectangular ducts shall be constructed by breaking the corners and grooving the longitudinal seams using Pittsburgh seam or other approved airtight seam.
- .7 All elbows and transformation pieces shall be constructed using Pittsburgh corner seams or double seam corners. All transverse joints shall be constructed using S-slips, Bar Slips, Drive Slips, etc. where recommended in ASHRAE guide. All slips shall be not less than one gauge heavier than duct material. Open corners will not be accepted.

2.4 Manufactured Duct Work and Fittings

- .1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

2.5 Kitchen Hood Exhaust Duct Work

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- .2 Construct of 1.37 mm (16 gauge) carbon steel or 1.09 mm (18 gauge) stainless steel, using continuous external welded joints to provide a watertight seal.
- .3 All ductwork exposed in the kitchen or serverly areas shall be constructed of brushed stainless steel.
- .4 Cleanout doors of rigid construction using the same gauge of sheet metal as the duct and gaskets to provide a grease tight seal.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Duct sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- .4 No variation of duct sizes will be permitted except by written permission of the Contract Administrator. In the event that additional offsets and changes in direction are required in the duct system, these changes shall be made by the Sheet Metal Trade without additional cost to The City. All ductwork shall be to the recommended practices as laid down by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- .5 Where the width of the duct exceeds 450 mm (18") in its largest dimension such ductwork shall be suitably stiffened by breaking the sheets diagonally.

- .6 If ductwork is insulated, cross breaking may be omitted providing the ducts are 2 gauges heavier than shown on the above schedule.
- .7 All laps shall be in the direction of air flow. Rivets and bolts shall be used throughout. All edges and slips shall be hammered down to leave a smooth interior duct.
- .8 Ductwork Penetrations:
 - .1 Where low pressure ductwork conflicts with mechanical and electrical piping and it is not possible to divert the ductwork or piping to stay within allowable space limitation, provide duct easements.
 - .2 Easements are not required on pipes 100 mm (4") and smaller outside dimension, unless this exceeds 20% of the duct area. Any irregular or flat shaped intrusions require a duct easement. Hangers and straps in the ductwork shall be parallel to air flow. If this is not possible, provide an easement. If the easement exceeds 25% of the duct area, the duct shall be split into two ducts with the original duct area being maintained. All easements shall be approved by the Contract Administrator before installation.
 - .3 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.
 - .4 Locate pitot tube test openings in ductwork at supply fan discharges, on intake of exhaust/and return air fans, in major duct branches and everywhere pitot tube openings are required for proper balancing of air conditioning, ventilation and exhaust systems. Do not place closer than 1829mm (72 inches) to elbows. Space every 150mm (6 inches) across air stream at each location. Refer to drawings for additional opening requirements.
- .9 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .10 Use crimp joints with or without bead for joining round duct sizes 200 mm (8 inch) and smaller with crimp in direction of air flow.
- .11 Duct supports and hanging:
 - .1 Use only threaded rod for duct support in exposed areas. Strapping not allowed.
 - .2 Use double nuts and lock washers on threaded rod supports.
- .12 Connections
 - .1 Connect fan powered terminal units to supply ducts with 300 mm (one foot) maximum length of flexible duct. Do not use flexible duct to change direction.

- .2 Connect diffuser boots or light troffer boots to low pressure ducts with 1.5 m (5 feet) maximum length of insulated flexible duct held in place with strap or clamp.
- .13 Where interior of duct is visible through grilles, registers or diffusers, paint interior of duct with flat black Tremco paint formulated for galvanized surfaces.
- .14 Set plenum doors 150 to 300 mm (6 to 12 inches) above floor. Arrange door swings so that fan static pressure holds door in closed position.
- .15 Kitchen Exhaust Systems:
 - .1 Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for duct work exposed to view and stainless steel or carbon steel for ducts where concealed.
 - .2 For kitchen hood exhaust ducts, access doors shall be installed at every change in direction in the ductwork, and at intervals not exceeding 3000 mm (10') along the duct run. Access doors shall be installed not less than 38 mm (1 1/2") above the bottom of the duct.
- .16 Active construction requirements:
 - .1 During construction provide temporary closures of metal or taped sheet plastic on open duct work to prevent construction dust from entering duct work system.
 - .2 Open ductwork exposed to the outdoors during construction shall also be weather proofed c/w insulation at sealed ends for any ducts exposed to sub-zero temperatures.
- .17 Duct sealing
 - .1 Seal ductwork so that it is sufficiently airtight to ensure economical and quiet performance of the system. All ductwork, except where otherwise indicated, shall have seams and joints sealed with an approved duct sealer. Apply duct sealer and duct tape in strict accordance with manufacturer's recommendations to joints and seams to provide an airtight, watertight installation. Prior to application, ductwork to be dry and free of grease, etc. Use 6mm bead of material along joints. Material, when dry, to have 3.2mm depth extending 25mm on each side of joint or seam.
 - .2 All ductwork located outdoors shall have seams and joints sealed with an approved acrylic UV resistant sealant, applied with caulking gun and levelled with putty knife. Use material in accordance with manufacturer's printed recommendations.
 - .3 Stainless steel ductwork exposed in finished rooms shall not have duct tape application.
- .18 Install ductwork free from pulsation, chatter, vibration or objectionable noises.
- .19 Should any of these defects appear after the system is in operation, correct problems by removing, replacing, or reinforcing the work as directed by the Contract Administrator.

- .20 Tape joints of PVC coated metal duct work with PVC tape.

3.2 Cleanin

- .1 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.3 Sc edules

3.4 Duct Wor Material Sc edule

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Steel
Low Pressure Supply (System with Cooling Coils)	Steel
Return and Relief	Steel
General Exhaust	Steel
Outside Air Intake	Steel
Kitchen Hood Exhaust	Steel, 304 Stainless Steel

3.5 Duct Wor Pressure Class Sc edule

AIR SYSTEM	PRESSURE CLASS
Supply (Heating Systems)	250 Pa (1 inch)
Supply (System with Cooling Coils)	500 Pa (2 inch)
Return and Relief	250 Pa (1 inch)
General Exhaust	125 Pa (1/2 inch)
Outside Air Intake	125 Pa (1/2 inch)
Intake and Exhaust	250 Pa (1 inch)
Kitchen Hood Exhaust	

END OF SECTION

Part 1 General

1.1 References

- .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 92A - Smoke-Control Systems.
- .4 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies
- .5 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .6 UL 33 - Heat Responsive Links for Fire-Protection Service.
- .7 UL 181 - Standard for Factory-Made Air Ducts and Air Connectors
- .8 UL 181A - Standard for Closure Systems for Use With Rigid Air Ducts
- .9 UL 181B - Standard for Closure Systems for Use With Flexible Air Ducts and Air Connectors
- .10 ULC-S505 - Standard For Fusible Links For Fire Protection Service
- .11 UL 555 - Fire Dampers.
- .12 UL 555S - Smoke Dampers.
- .13 CAN/ULC-S112 Standard Method of Fire Test of Fire-Damper Assemblies
- .14 CAN/ULC-S112.2, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.

1.2 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.3 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of access doors.

1.4 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., and testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 Delivery, Storage, and Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect dampers from damage to operating linkages and blades.

Part 2 Products

2.1 Air Turnin Devices/Extractors

- .1 Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.2 Backdraft Dampers

- .1 Gravity Backdraft Dampers, Size 450 x 450 mm (18 x 18 inches) or smaller, provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- .2 Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 1.5 mm (16 gauge) thick galvanized steel, with centre pivoted blades of maximum 150 mm (6 inch) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 Duct Access Doors

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated duct work, install minimum 25 mm (one inch) thick insulation with sheet metal cover.
 - .1 Less than 300 mm (12 inches) Square: Secure with sash locks.
 - .2 Up to 450 mm (18 inches) Square: Provide two hinges and two sash locks.
 - .3 Up to 600 x 1200 mm (24 x 48 inches): Three hinges and two compression latches.
 - .4 Larger Sizes: Provide an additional hinge.

- .3 Access doors shall be minimum 450 x 350 mm where space permits.
- .4 Access doors with sheet metal screw fasteners are not acceptable.
- .5 Doors in insulated ductwork to be double panel construction with a 25mm (1") insulating filler.
- .6 In certain locations where it is inconvenient to swing access doors, removable doors with 4 cam locks will be accepted. However, all such locations shall be approved by the Contract Administrator prior to installation.
- .7 Grease duct access doors shall match the materials used for the grease duct. Manufacture and installation of duct access doors on grease ducts shall comply with all requirements of NFPA 96.

2.4 Duct Test Holes

- .1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- .2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation;

2.5 Fire Dampers

- .1 Manufacturers:
 - .1 Price.
 - .2 Nailor.
 - .3 Ruskin.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Depending on the rating of fire separation, rating, construction and testing of the fire damper will conform to most recent issue of all of following:
 - .1 National Building Code
 - .2 ULC S-112
 - .3 NFPA 252
 - .4 ULC or ULI 10(b)
- .3 Use type 'B' fire dampers, i.e. blades out of air stream, to be used in all ducts passing through fire separations. Combination fire damper-balancing damper, with blades in air stream shall be used on sidewall or return, or floor mounted supply, up to maximum size of 0.372 sq.m (576 sq.in.). For sidewall return above 0.372 sq.m (576 sq.in.) in size, use a type 'A' fire damper, i.e. blades in air stream.
- .4 Ceiling Dampers: Galvanized steel, 0.76 mm(22 gauge) frame and 1.5 mm (16 gauge) flap, two layers 3.2 mm (0.125 inch) ceramic fibre on top side with locking clip.

- .5 Horizontal Dampers: Galvanized steel, 0.76 mm (22 gauge) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- .6 Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except at all locations unless otherwise indicated on the drawings, and for 250 Pa (1.0 inch) pressure class ducts up to 300 mm (12 inches) in height.
- .7 Multiple Blade Dampers: 1.5 mm (16 gauge) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 3.2 x 12.7 mm (1/8 x 1/2 inch) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- .8 Fusible Links: UL 33, separate at 71°C, (160°F) with adjustable link straps for combination fire/balancing dampers.

2.6 Flexible Connectors

- .1 Manufacturers:
 - .1 Duro-Dyne.
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .3 Connector: Fabric crimped into metal edging strip.
 - .1 Fabric: UL listed fire-retardant neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m (30 oz per sq yd).
 - .2 Net Fabric Width: Approximately 75mm (3 inches) wide.
 - .3 Metal: 75 mm (3 inch) wide, 0.6 mm thick (24 gauge) galvanized steel.

2.7 Combination Smoke Dampers

- .1 Manufacturers:
 - .1 Price.
 - .2 Nailor.
 - .3 Ruskin.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Fabricate to NFPA 90A, 92, and UL 555S, and ULC S 112.
- .3 Dampers: UL Class 1 multiple blade type fire damper, normally open automatically operated by electric actuator.
- .4 Electro Thermal Link: Fusible link melting at 74 degrees C (165 degrees F); UL listed and labeled.
- .5 Actuator: 24 volts, single phase, 60 Hz; rated up to 176 degrees C (350 degrees F), Design life of 30,000 full stroke cycles.

2.8 Volume Control Devices

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Splitter Dampers:
 - .1 Material: Same gauge as duct to 600 mm (24 inches) size in either direction, and two gauges heavier for sizes over 600 mm(24 inches).
 - .2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 - .3 Operator: Minimum 6 mm (1/4 inch) diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- .3 Single Blade Dampers: Fabricate for duct sizes up to 150 x 760 mm (6 x 30 inch).
- .4 Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 200 x 1825 mm (8 x 72 inch). Assemble centre and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- .5 End Bearings: Except in round duct work 300 mm (12 inches) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- .6 Quadrants:
 - .1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - .2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - .3 Where rod lengths exceed 750 mm (30 inches) provide regulator at both ends.

2.9 Kitchen Exhaust Hood (Grease Filter Type)

- .1 Manufacturer: Quest Metal Products Limited Overhead Filter Hood Model #QLO
 - .1 Substitutions not permitted.
- .2 Stainless steel low profile overhead range hood, removable washable grease filters, rated for 472 l/s (1000 cfm) airflow
- .3 Finish: 200 Series Polished Stainless Steel
- .4 Size: 1219 mm (48 inch) wide, 914 mm (36 inch) deep, 610 mm (24 inch) height
- .5 Features:
 - .1 Integral fire suppression system (refer to Section 21 23 00 – Wet-Chemical Fire-Extinguishing).
 - .2 Integrated lighting.
- .6 To NFPA 96.

- .7 ULC labelled.

Part 3 Execution

3.1 Preparation

- .1 Verify that electric power is available and of the correct characteristics.

3.2 Installation

- .1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- .2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- .3 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 300 x 300 mm (12 x 12 inch) size for all fire dampers. Enlarge duct if necessary to accommodate properly sized access door.
- .4 Generally access doors at heating coils shall approximate width of coil for ease of cleaning.
- .5 At smoke detectors, provide 450mm x 450mm (18 x 18 inch) access doors.
- .6 Provide duct test holes where indicated and required for testing and balancing purposes.
- .7 Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- .8 Install smoke dampers and combination smoke and fire dampers to NFPA 92A. Coordinate electrical requirements with Electrical Division.
- .9 Demonstrate re-setting of fire dampers to The City's representative.
- .10 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 23 05 48. For fans developing static pressures of 1250 Pa (5.0 inches wg) and over, cover connections with leaded vinyl sheet, held in place with metal straps.
- .11 Use splitter dampers only where indicated.

- .12 Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00.
- .13 Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- .14 Do not locate single blade volume dampers immediately behind diffusers and grilles. This application does not allow uniform airflow across the outlet face.
- .15 To minimize generated duct noise, locate volume dampers at least two duct diameters from a fitting and as far away as possible from the outlet or inlet.

END OF SECTION

Part 1 General

1.1 References

- .1 CAN/ULC S524 - Standard For Installation Of Fire Alarm Systems
- .2 CSA C22.1/C22.2 – Canadian Electrical Code and Sub-Sections
- .3 NFPA 13 - Standard for the Installation of Sprinkler Systems
- .4 UL 507 - Standard for Electric Fans

1.2 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Drawings detailing product dimensions, weight, attachment methods, electrical, controls, air volume and velocities.
- .3 Manufacturer's Installation Instructions.

1.3 Operation and Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include manufacturer's operation and instruction instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 Quality Assurance

- .1 Certifications
 - .1 The fan assembly, as a system, shall be certified by a testing agency recognized by the Authority Having Jurisdiction and built pursuant to the guidelines set forth by UL standard 507 and CSA standard 22.2.
 - .2 The fan shall be compliant with NFPA 13, CAN/ULC S524, and Canadian Electrical Code as specified by Division 28.
 - .3 Ceiling fans comply with 10 C.F.R. Appendix U for energy consumption per Natural Resources Canada Energy Efficiency Regulations.
 - .4 Controllers shall comply with Canadian Electrical Code and Underwriters Laboratory (UL) standards and shall be labeled where required by code.

1.5 Delivery, Storage, and Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect motors, shafts, controls and bearings from weather and construction dust.

1.6 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 Ceilin Fans

- .1 Manufacturers: Basis of Design: Canarm CP60DE11N
 - .1 Alternate manufacturers:
 - .1 Westinghouse
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Construction:
 - .1 Regulatory: CSA labelled, NRCan energy efficiency
 - .2 1524 mm (60 inch) blade sweep.
 - .3 Painted steel blades with curved ends deliver maximum airflow over wide areas.
 - .4 Gasketed with stainless steel hardware.
 - .5 Performance:
 - .1 Refer to schedules.
 - .2 Compliant with minimum cfm/watt requirements meeting Canadian energy efficiency regulations.
 - .6 Variable speed reversible motors
 - .1 All motors thermally protected variable speed ECM or equivalent with permanently lubricated bearings.
 - .3 Controls
 - .1 Variable speed line voltage controller complete with reversing direction (RREM-DCQ-14-W).
 - .4 Ceiling fan and controls supplied and installed by Division 26.

Part 3 Execution

3.1 Ceilin Fan Installation

- .1 Install on structural members noted on drawings to manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 References

- .1 ADC 1062 - Air Distribution and Control Device Test Code.
- .2 AMCA 500 - Method of Testing Louvers for Ratings.
- .3 AMCA 511 – Certified Ratings Program
- .4 AMCA 5000 - Method of Testing Dampers for Ratings.
- .5 ARI 650 - Air Outlets and Inlets.
- .6 ASHRAE 70 - Method of Testing for Rating the Performance of Outlets and Inlets.
- .7 SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- .8 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .9 CAN/ULC S102 - Test for Surface Burning Characteristics of Building Materials and Assemblies
- .10 CAN/ULC S110 – Test for Air Ducts

1.2 Regulator Requirements

- .1 All materials of construction to comply with CAN/ULC S102 requirements for flame and smoke spread and CAN/ULC S110 Class 1 materials.

1.3 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of air outlets and inlets.

1.5 Quality Assurance

- .1 Test and rate air outlet and inlet performance to ADC Equipment Test Code 1062 and ASHRAE 70.

□

- .2 Test and rate louver performance to AMCA 500
- .3 Certified AMCA 511 – Certified Ratings Program

1.6 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

Part 2 Products

2.1 General

- .1 Scheduled products are based on the Price Industries product codes as basis of design. Products supplied to the project to meet or exceed the basis of design.

2.2 Manufacturers

- .1 Unless otherwise listed:
 - .1 Price Industries.
 - .2 Nailor Industries
 - .3 Titus
 - .4 Ventex.
- .2 Substitutions: Refer to Section 21 05 00.

2.3 Square Ceiling Diffusers

- .1 Type: Square, stamped diffuser to discharge air in 360 degree pattern.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.4 Ceiling Grid Core Exhaust and Return Registers/Grilles

- .1 Type: Fixed grilles of 13 x 13 x 13 mm (1/2 x 1/2 x 1/2 inch) louvers.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.5 Ceiling Slot Diffusers Wall Suction Registers/Grilles

- .1 Type: Streamlined and individually adjustable blades, 19 mm (3/4 inch) minimum depth, 19 mm (3/4 inch) maximum spacing with spring or other device to set blades.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.6 Wall Exhaust and Return Registers/Grilles

- .1 Type: Streamlined blades, 19 mm (3/4 inch) minimum depth, 19 mm (3/4 inch) maximum spacing, horizontal face.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.7 Linear Slot Diffusers

- .1 The diffusers shall have 1 discharge slot, slot width as scheduled.
- .2 The supply diffusers shall have aerodynamically curved "ice-tong" shaped pattern controllers for 180 degree air pattern control and airflow dampening, where scheduled.
- .3 The diffuser border shall be extruded aluminum construction with extruded aluminum spacers and mitered end flanges.
- .4 Mounting style as scheduled.
- .5 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.8 Linear Floor Supply/Return Registers/Grilles

- .1 Type: Narrow Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 6 mm (1/4 inch) centres. Refer to schedule for deflection angle.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.9 Louvers

- .1 150 mm (6 inch) Fixed Blade Louver:
 - .1 Type: 150 mm (6 inch) deep with blades on 45 degree slope with centre baffle and return bend, heavy channel frame, aluminum birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake.
 - .2 Fabrication: 2.1 mm (0.081 inch) extruded aluminum, welded assembly, with factory baked enamel finish - custom colour to be selected by the architect.
 - .3 Provide with 38mm mounting flange.
 - .4 Mounting: Refer to schedules for mounting options.
 - .5 Factory baked enamel finish - custom colour to match exterior cladding to be selected by the architect.

2.10 Penthouse Louvers

- .1 150 mm (6 inch) Fixed Blade Louver:

- .1 Type: All welded assembly with 150 mm (6 inch) deep with blades on 45 degree slope, mitred corners, sheet aluminum roof, with factory baked enamel finish - custom colour to be selected by the architect.
- .2 Birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- .3 Install diffusers to duct work with airtight connection.
- .4 All diffusers, grilles and registers shall be free of fluttering, chattering and vibration. A felt or sponge rubber gasket shall be provided behind each outlet or inlet and adequate fastenings provided to prevent leakage between the outlet and duct, wall or ceiling.
- .5 In all cases where linear diffusers are required to run continuous from one wall to another or between bulkheads, beams or other fascia the schedule size of the diffuser shall be confirmed by site measurements prior to final assembly.
- .6 Floor grilles to be set flush with floor coverings except carpet. Frame to lap over carpet.
- .7 Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- .8 Paint ductwork visible behind air outlets and inlets matte black.
- .9 Care should be taken to install diffusers as per the reflected ceiling plans where available so that the diffusers will fit properly in the ceiling suspension system. The sheet metal subcontractor shall co-ordinate this work with the General Contractor, the suspended ceiling subtrade and electrical subtrade.
- .10 Should there be any conflict in the location of grilles, registers and diffusers with lights, etc. the matter shall be referred to the Contract Administrator for directive. If requested by the Contract Administrator, the subcontractor shall relocate grilles, diffusers and registers and ductwork attached, within two feet of locations as indicated on the drawings, without extra cost to The City.
- .11 Clearances from air outlets and inlets – coordinate with other divisions of work:
 - .1 Smoke alarms: edge of grilles, registers and diffusers for supply and return/exhaust to center of smoke alarm: 450 mm or greater.

- .2 Sprinkler heads: to NFPA 13, 762 mm (30 inches) or greater unless otherwise coordinated with the sprinkler contractor or where shown on the drawings.
- .3 Gas detection: supply air GRD throw to not directly affect air movement around the gas sensor.

END OF SECTION

Part 1 General

1.1 References

- .1 AGA - Directory of Certified Appliances and Accessories.
- .2 AGA Z21.13 - Gas-Fired Low-Pressure Steam and Hot Water Boilers.
- .3 ASME SEC 4 - Boiler and Pressure Vessel Codes - Rules for Construction of Heating Boilers.
- .4 ASME SEC 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.
- .5 CSA 4.9/ANSI Z21.13 - Gas Fired Low Pressure Steam and Hot Water Boilers.
- .6 CSA B51 – Boiler, pressure vessel and pressure piping code
- .7 CSA B149 - Natural Gas and Propane Code
- .8 CSA C22.2 – Canadian Electrical Code

1.2 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements.
- .3 Section 21 05 00: Submittals for information.
- .4 Submit manufacturer's installation instructions. Indicate assembly, support details, connection requirements, and include start-up instructions.
- .5 Manufacturer's Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.
- .6 Section 21 05 00: Submittals for project closeout.
- .7 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

1.3 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three year's experience.

1.4 Regulator Requirements

- .1 Conform to CSA C22.2 for internal wiring of factory wired equipment.
- .2 I=B=R Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.
- .3 Conform to ASME SEC 4 for boiler construction.
- .4 Units: ULC labeled. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction. and tested to UL 795 Commercial-Industrial Gas Heating Equipment.
- .5 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.5 Delivery, Storage, and Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.6 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Warranty Period for Fire-Tube Condensing Boilers
 - .1 The pressure vessel/heat exchanger shall carry a 10 year from shipment, non-prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
 - .2 Manufacturer labeled control panels are conditionally warranted against failure for two years from shipment.
 - .3 All other components, with the exception of the igniter and flame detector, are conditionally guaranteed against any failure for 18 months from shipment

Part 2 Products

2.1 Manufacturers

- .1 Basis of Design: Tringle Tube Solo
- .2 IBC
- .3 Navien

- .4 Viessmann
- .5 Substitutions: Refer to Section 21 05 00.

2.2 General

- .1 The boiler shall have a minimum Thermal Efficiency of 95% following the ANSI/AHRI 1500-2015 Standard for Performance Rating of Commercial Space Heating Boilers
- .2 The boiler thermal efficiency shall be verified through a third party testing agency under the guidance of AHRI and listed in the AHRI Certification Directory.
- .3 The boiler shall be assembled by an ISO 9001 registered company and the heat exchanger shall bear the ASME "H" stamp according to Section IV of the ASME Boiler and Pressure Vessel Code.
 - .1 The stainless steel heat exchanger of the boiler is to be hydrostatically pressure tested at the factory in accordance with ASME requirements.
 - .2 The maximum allowable working pressure is 30 psig water as listed on the ASME rating plate.
 - .3 The heat exchanger shall be registered with the National Board and contain a registry number and stamp on the ASME rating plate.
- .4 The boiler shall meet the following regulatory requirements:
 - .1 The boiler shall be ITS / ETL certified and listed to ANSI Z21.13/CSA 4.9 latest edition test standards for U.S. and Canada.
 - .2 Boiler shall meet or exceed the SCAQMD (South Coast Air Quality Management District of California) Low NOx emission requirement of 14 NG/J.

2.3 Boiler

- .1 The heat exchanger shall be a fire tube design constructed with 439 grade stainless steel to provide resistance to corrosion at elevated temperatures.
- .2 The heat exchanger body shall be of welded construction and shall not contain any banding materials, bolts, gaskets or O-rings in the construction.
- .3 The heat exchanger shall be of a counter flow / vertical design to assure that sediment and any potential lime that may form will fall to the bottom.
- .4 The boiler combustion chamber shall be sealed and located at the top of the heat exchanger.
- .5 The boiler flue ways shall be of a vertical design that allows condensate to "wash down" the flue surface preventing potential combustion residue from adhering to the flue ways.
- .6 The boiler shall be supplied with a gas valve designed for negative pressure regulation.

- .7 The gas valve on the boiler shall operate with an inlet gas pressure of a minimum 5" w.c to a maximum of 13" w.c and shall be independent of the type of gas (natural or propane). If the inlet gas pressure exceeds the maximum allowable 13" w.c. a 100% lock-up type gas pressure regulator, properly sized, must be installed in the gas supply piping and adjust as to prevent an inlet gas pressure in excess of 13" w.c.
- .8 The burner shall be a premix combustion type system, made with a burner head constructed of stainless material and able to provide a wide range of modulating firing rates.
- .9 The boiler shall be equipped with a variable speed blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency.
- .10 The boiler shall be constructed with a heavy gauge steel jacket assembly, painted on both sides.
- .11 The boiler control shall have an electronic graphical display for boiler set-up, boiler status and boiler diagnostics.
- .12 The condensate pan, internal flue pipe, and vent/air connections shall be constructed of polypropylene.

2.4 Boiler Controls and Tri

- .1 All electrical components shall be of the highest quality manufacture and bear a CSA, UL, or UL recognized label.
- .2 Supply voltage shall be 120 volt / 60 hertz / single phase.
- .3 Pressure gauge dial that is clearly marked and easy to read.
- .4 ASME certified pressure relief valve, set to relieve at 30 psig.
- .5 Low water protection.
- .6 The boiler shall be furnished with control system that provides:
 - .1 High limit temperature control of 200°F.
 - .2 Operating temperature limit of 60°F to 188°F (refer to control strategies)
 - .3 Flue gas, supply and return water temperature sensors.
 - .4 Outdoor sensor to provide Outdoor Reset Control.
 - .5 Optional freeze protection feature.
 - .6 Capability to control one circulator
 - .7 Alarm and flame status contacts for integration into BMS systems.
 - .8 BACnet interface for integration into BMS system.
 - .9 Capability to accept a 0-10 VDC input signal for external modulation control.

- .10 Graphical display shall have an icon based menu system and use plain text so that error code charts are unnecessary.

2.5 Venting and Combustion Air

- .1 The boiler shall be vented with a direct vent sidewall system with a horizontal sidewall termination of both the vent and combustion air pipes. The vent and combustion air pipes are not required to terminate on the same outside wall.
- .2 The exhaust vent must be UL Listed for use with Category II, III and IV appliances and compatible with operating temperatures up to 230°F, positive pressure, condensing flue gas service. UL listed vents are PVC, CPVC, and AL 29-4C stainless steel. Polypropylene is not permitted due to vent length.

2.6 Condensate Neutralizer

- .1 Provide refillable neutralization unit. Neutralization condensate released by the unit will be non-corrosive, and a safe pH level above 6.5. Standard of Acceptance is AXIOM NC-1.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install to CSA B149.1.
- .3 Install boiler on concrete housekeeping base, sized minimum 150 mm (6 inches) larger than boiler base.
- .4 Provide connection of natural gas service to CSA 149.1.
- .5 Provide piping connections and accessories as indicated; refer to drawings and Section 23 05 20 - Hydronic Specialties..
- .6 Pipe relief valves to glycol fill station.
- .7 Provide for connection to electrical service. Refer to Section 26 05 80 - Equipment Wiring.

3.2 Manufacturer's Field Services

- .1 Perform tests and inspections and prepare test reports.
 - .1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.
- .2 Tests and Inspections
 - .1 Installation and Startup Test: Perform installation and start-up checks according to manufacturer's written instructions.

- .2 Leak Test: Perform hydrostatic test. Repair leaks and retest until no leaks exist.
- .3 Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
- .4 Controls and Safeties: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - .1 Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
 - .2 Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- .3 Remove and replace malfunctioning units and retest as specified above.
- .4 Performance Tests
 - .1 The boiler manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the boiler manufacturer to complete the following performance tests:
 - .2 Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - .3 Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
 - .4 Repeat tests until results comply with requirements indicated.
 - .5 Provide analysis equipment required to determine performance.
 - .6 Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - .7 Notify Contract Administrator in advance of test dates.
 - .8 Document test results in a report and submit to Contract Administrator.
- .5 Prepare and start systems to Section 01 43 00.
- .6 Instruct operating personnel in operation and maintenance of units.

3.3 Schedules

- .1 Refer to schedule on drawing.

END OF SECTION

Part 1 General

1.1 References

- .1 ASHRAE 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers.
- .2 CAN/ULC S605 - Standard for Gas Vents
- .3 CAN/ULC S609 - Standard for Low Temperature Vents Type L and PL
- .4 CAN/ULC S636 - Standard for Type BH Gas Venting Systems
- .5 CSA B149.1 – Natural Gas and Propane Installation Code.
- .6 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .7 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
- .8 NFPA 211 - Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances.

1.2 Submittals or Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- .3 Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.

1.3 Submittals or Information

- .1 Section 21 05 00: Submittals for information.
- .2 Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

1.4 Submittals at Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.
- .3 Warranty: Submit manufacturers warranty and ensure forms have been filled out in The City's name and registered with manufacturer.

1.5 Qualit□ Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 Re ulator□ Re uire ents

- .1 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

1.7 Warrant□

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide five year manufacturers warranty for heat exchangers.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 Gas-Fired Unit Heaters

- .1 Manufacturer:
 - .1 Reznor
 - .2 Sterling
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
 - .1 Heating: Natural gas fired.
 - .2 Discharge Louvres: Individually adjustable horizontal louvres to match cabinet finish.
 - .3 Poly-Tube Outlet Adapter: Transition duct to adapt from unit outlet to round outlet flange for polyethylene tube duct.
 - .4 Air Filters: Filter cabinet with 25 mm (1 inch) type filters.
- .3 Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fibre insulation and reflective liner.
- .4 Supply Fan: Centrifugal forward curved type with belt drive.
- .5 Heat Exchanger: titanium stabilized aluminized steel construction.
- .6 Gas Burner:
 - .1 Atmospheric type with adjustable combustion air supply,

- .2 Gas valve, provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
- .3 Electronic pilot ignition, with electric spark igniter.
- .4 Combustion air damper with synchronous spring return damper motor.
- .5 Non-corrosive combustion air blower with permanently lubricated motor.
- .7 Gas Burner Safety Controls:
 - .1 Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - .2 Flame rollout switch: Installed on burner box and prevents operation.
 - .3 Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
 - .4 Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- .8 Operating Controls
 - .1 Room Thermostat: Cycles burner to maintain room temperature setting.
 - .2 Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.
- .9 Performance:
 - .1 Refer to Schedule. Gas heating capacities are sea level ratings.

2.2 Room Thermostats

- .1 Adjustable Room Thermostat: Low voltage, to control burner operation, heater stages in sequence with delay between stages, and supply fan to maintain temperature setting.

Part 3 Execution

3.1 Examination

- .1 Section 01 10 00: Verification of existing conditions before starting work.
- .2 Verify that space is ready for installation of units and openings are as indicated on shop drawings.
- .3 Verify that proper power supply is available.
- .4 Verify that proper fuel supply is available for connection.

3.2 Installation

- .1 Install to NFPA 90B.
- .2 Install gas fired units to CSA B149.1.

□

- .3 Provide vent connections to CAN/ULC S605.
- .4 Install unit heaters with vibration isolation. Refer to Section 23 05 48

3.3 Schedules

- .1 Refer to schedule on drawing.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment
- .4 AHRI 1060 - Performance rating of Air-to-Air Heat Exchangers for Energy Recovery Equipment.
- .5 CAN/ULC-S102 - Standard Method Of Test For Surface Burning Characteristics Of Building Materials And Assemblies
- .6 CSA C22.2 – Canadian Electrical Code
- .7 CSA 22.2 No 236/UL 1995 – Heating and Cooling Equipment
- .8 CAN/CSA C439 - Standard laboratory methods of test for rating the performance of heat/energy-recovery ventilators
- .9 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.2 SUBMITTALS

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Shop Drawings: Indicate assembly of heat recovery units and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- .3 Manufacturer's Installation Instructions.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 All materials in contact with the air stream to be compliant with acceptable CAN/ULC-S102 surface burning characteristics.

- .3 Electrical to comply with CSA C22.2 requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Protect motors, shafts, and bearings from weather and construction dust.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Do not operate equipment for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.7 EXTRA MATERIALS

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Provide two sets of filters.

Part 2 Products

2.1 DUAL CORE REVERSING ENERGY RECOVERY VENTILATORS

- .1 Manufacturers
 - .1 Tempeff
 - .2 Price
 - .3 Southampton
 - .4 BKM
- .2 Substitutions: Not Permitted
- .3 General
 - .1 Configuration: Fabricate as detailed on drawings.
 - .1 Performance:
 - .1 Conform to ARI 430. Refer to schedules on drawings.
 - .2 Performance shall be based on a maximum 450 fpm face velocity across the heat exchanger.
 - .2 Acoustics: Sound power levels (dB) for the unit shall not exceed levels specified in the schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.
 - .2 Where the unit arrangement differs from the drawings, the mechanical contractor is responsible for any additional structural, architectural, electrical and mechanical work that may be required and ensuring that intakes and outlets are arranged to meet code requirements.
- .4 Unit Construction
 - .1 Fabricate unit with extruded aluminum channel posts and galvanized panels secured with mechanical fasteners.

- .3 Fabricate curb mounted unit with frameless construction with insulated galvanized panels secured with mechanical fasteners.
- .2 Unit shall be capable of having all panels remove simultaneously for servicing without affecting the structural integrity of the unit.
- .4 The unit structure shall be self-supporting.
- .3 All access doors shall be sealed with permanently applied gaskets.
- .5 Panels and access doors shall be constructed as a 50-mm nominal thick; thermal broken double wall assembly, with $U_{SI}=0.0222$ W/mK equivalent insulation.
- .4 The outer panel shall be constructed of 24 gauge G90 galvanized steel. The inner liner shall be constructed of 24 gauge G90 galvanized steel.
- .6 Module to module assembly shall be accomplished with gaskets.
- .5 Access Doors shall be flush mounted to cabinetry, with minimum of two hinges, locking latch and full size handle assembly.
- .5 Fans
 - .1 Provide direct-drive EC motor supply and exhaust fan(s). Fan assemblies including fan, motor shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.
 - .7 Bearings shall be self-aligning, grease lubricated, ball or roller bearings. Grease fittings shall be attached to the fan base assembly near access door.
 - .2 Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on spring vibration type isolators inside cabinetry.
- .6 Bearings And Drives
 - .1 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards, L-50 life at 200,000 hours – heavy duty pillow block type, self-aligning, grease-lubricated ball bearings.
 - .8 Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.
- .7 Particulate Filters
 - .1 Filter section with filter racks and guides with hinged and latching access doors on either, or both sides, for side loading and removal of filters.
 - .9 Filter media shall be UL 900 listed, Class I or Class II.
 - .2 Flat arrangement with 50mm deep pleated disposable panel filters.
 - .10 See schedule for pre-filter and final filter requirements.
- .8 Energy Recovery
 - .1 Reverse Flow Energy Recovery
 - .1 Unit shall be equipped with Dual Core energy recovery technology. The unit shall be 90% temperature efficient (+-5%) in winter and up to 80% in summer. Recovery effectiveness based

- on equal supply and exhaust airflow rates. It shall also provide up to 70% latent recovery. Unit shall accomplish this recovery without a defrost cycle that will reduce the effectiveness of the device.
- .1 Devices employing defrost cycles that bypass the heat recovery device, or reduce the effectiveness are not acceptable. Heat recovery device shall not require frost protection in applications down to -40 degrees C.
 - .2 Cores shall be comprised of precisely corrugated high-grade aluminum.
 - .2 Recovery cycles shall be controlled by internal programmed thermostats measuring both supply and exhaust air and optimizing performance of both heat recovery and free cooling modes.
- .2 Dampers
- .1 Switchover damper section shall be comprised of low leakage dampers with EPDM seals operated by electric damper motors complete with DC braking.
 - .2 Damper blades, rods and axles shall be galvanized for long life expectancy.
- .9 Electrical
- .1 Single point power connection.
 - .11 The ventilators(s) components shall be CSA, UL or CE listed as applicable.
 - .2 Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. All wires shall be number tagged and cross-referenced to the wiring diagram for ease of troubleshooting.
 - .12 Fan motors shall be 1800 rpm, open drip-proof (ODP) type. Motors shall be high efficiency to meet EPEA requirements. Electrical characteristics shall be as shown in schedule.
 - .3 Motors shall be rated for use with variable frequency drives (VFD)
- .10 Controls
- .1 Provide BacNet MSTP communication to building automation system and integrate with Section 25 90 00 as indicated. Provide the following control points:
 - .2 Controls must include self diagnostics with fault and PLC error Code. On board fault detection and diagnostics that senses and alerts when the damper is not operating correctly.
 - .13 Air handler manufacturer shall provide and mount a damper hand-off-auto (HOA) switch.

Part 3 Execution

3.1 INSTALLATION

- .1 Install to manufacturer's written instructions.

- .2 Install flexible connections specified in Section 23 33 00 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm (one inch) flex between ductwork and fan while running.
- .3 Provide backdraft dampers on discharge of exhaust fans and as indicated. Refer to Section 23 33 00.
- .4 Pipe condensate drains to nearest floor drain, as shown in mechanical drawings.
- .5 All heat recovery system to be tested as noted in Specification Section 23 05 93 – Testing, Adjusting, And Balancing.

END OF SECTION

Part 1 General

1.1 References

- .1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
 - .1 ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems.
- .2 Air-Conditioning and Refrigeration Institute (ARI)
 - .1 AHRI/ISO-13256-1, Standard for Water-Source Heat Pumps.
 - .2 AHRI/ISO-13256-1, Standard for Ground Water - Source Heat Pumps.
- .3 CSA And UL International
 - .1 CAN/CSA-C13256, Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.
- .4 ASHRAE/IESNA 90.1 - Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

1.2 Submittals or Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.

1.3 Submittals or Information

- .1 Section 21 05 00: Submittals for information.
- .2 Submit manufacturer's installation instructions. Indicate assembly, support details, connection requirements, and include start-up instructions.

1.4 Submittals or Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 Quality Assurance

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Energy-Efficiency Ratio: Minimum as prescribed by ASHRAE/IESNA 90.1.

- .3 Coefficient of Performance: Minimum as prescribed by ASHRAE/IESNA 90.1.
- .4 Provide equipment that operate using HCFC-free refrigerants.

1.6 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by ULC, CSA, as suitable for the purpose specified and indicated.

1.7 Delivery, Storage, and Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

1.8 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Warranty Period:
 - .1 Manufacturer's standard, minimum one year from date of Substantial Completion, including components and labour.

Part 2 Products

2.1 Water-to-Air Source Heat Pumps

- .1 Manufacturers
 - .1 Basis of Design: Florida Heat Pump
 - .2 Daikin
 - .3 Water Furnace
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 HP-1 to HP-12 (Horizontal)
 - .1 FHP Model LV.
 - .2 Horizontal type, as indicated, consisting of factory-assembled package containing fan, air-to-refrigerant coil, compressor, reversing valve, water-to-refrigerant heat exchanger, controls for use with R410.
- .3 HP-13 (Vertical)
 - .1 FHP Model EC.
 - .2 Vertical type, as indicated, consisting of factory-assembled package containing fan, air-to-refrigerant coil, compressor, reversing valve, water-to-refrigerant heat exchanger, controls for use with R410.
- .4 Cabinet:
 - .1 Heavy gauge G-60 galvanized sheet metal
 - .1 13mm (1/2-inch) thick, 1.5 lb, coated fiberglass insulation. Flame spread of less than 25 and a smoke developed classification of less than 50 per ASTM E-84 and UL 723. Insulation must meet NFPA 90A requirements.

- .5 Filters
 - .1 50mm (2 inch) MERV 8 filter, removable from either side of the unit.
- .6 Refrigerant Circuit
 - .1 R-410A sealed refrigerant circuit
 - .2 Rotary, reciprocating or scroll compressor with thermal overload protection
 - .3 Thermostatic expansion valve
 - .4 Aluminum lanced-fin and rifled copper tube refrigerant-to-air heat exchanger
 - .5 Reversing valve
 - .6 Coaxial, fluted, tube-in-tube, refrigerant-to-water heat exchanger.
 - .1 Copper inner tube
 - .2 Steel outer tube
 - .3 Working pressure of 500 psig waterside and 600 psig refrigerant side
- .7 Compressor
 - .1 Hermetic compressor mounted on rubber grommets.
 - .1 Mass plate under the compressor.
 - .1 Dual material assembly.
 - .1 Top heavy gauge galvanized steel.
 - .2 Bottom is a viscoelastic isolation material with 1/8" thick, 1 lb./sq. ft. with a barrier layer
 - .2 Compressor Safety
 - .1 Safety controls
 - .1 3 safety devices;
 - .2 high refrigerant pressure switch,
 - .3 low refrigerant pressure switch
 - .4 low refrigerant suction temperature sensor
 - .2 Lockout circuit by the thermostat or at the unit disconnect switch.
 - .3 Factory installed Refrigerant gauge access fittings on high and low pressure refrigerant lines.
- .8 Hydronic Connection
 - .1 Flexible stainless steel braiding over fire rated inner tubing, threaded connection to match unit, sizing to match unit pipe connection, minimum 18".
 - .2 Hose package complete with
 - .1 2 way motorized valve wired to compressor circuit, valve opens when compressor starts.
 - .2 Ball valves on supply and return
 - .3 Auto flow control valve
 - .4 Y strainer and blowdown valve.
- .9 Drain Pan

- .1 High density polyethylene (HDPE) plastic
- .2 Sloped on two planes.
- .3 Electronic condensate overflow protection.
- .10 Fan and Motor Assembly:
 - .1 Direct drive centrifugal fan motor assembly.
 - .1 Removable orifice ring to facilitate fan motor and fan wheel removal without removing the fan housing.
 - .2 PSC Motor
- .11 Electrical
 - .1 Internal control box
 - .1 Controls for compressor, reversing valve and fan motor operation and shall have either, a 100VA transformer and a terminal block for low voltage field wiring connections.
 - .2 Heating or cooling as required by the set points of the wall thermostat.
 - .3 Output signal to an LED on the thermostat
 - .4 Central monitoring panel to indicate a "fault" condition from the activation of any one of the safety switches.

2.2 Water-to-Water Source Heat Pu (WSHP-1)

- .1 Manufacturers
 - .1 Florida Heat Pump Model WT
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 General:
 - .1 Factory-tested and assembled single-piece water source heat pump units shall be factory wired, charged with HFC-410A, contain refrigerant to-water heat exchanger, 4-way reversing valve, compressor, metering device, and all internal controls and safety devices.
- .3 Extended Range
 - .1 Unit shall operate at entering water temperature of 54 to 110°F.
 - .2 Extended range adds closed cell isolation to internal water lines and provides insulation on suction side refrigeration tubing including refrigerant-to-water heat exchangers.
- .4 Cabinet:
 - .1 Three panel construction
 - .2 16 gauge G-60 galvanized sheet metal, powder-painted
 - .3 Lined internally with 1/2-in. thick 1-3/4 lb per cu ft density acoustic type fiberglass Insulation must meet NFPA 90A
- .5 Compressor
 - .1 Heat pump duty, scroll compressors with internal and external isolation.
- .6 Heat Exchangers:

- .1 Refrigerant-to-water heat exchanger
 - .1 Steel/copper tube-in-tube type rated for coaxial 625 psig refrigerant, 450 psig water-side pressures.
 - .2 Powder coated
- .7 Refrigerant Circuit
 - .1 Refrigeration circuit components R-410A
 - .1 Liquid line service valve
 - .2 Suction line service valve
 - .3 Reversing valve
 - .4 Full charge of compressor oil
 - .5 Holding charge of refrigerant.
 - .2 Thermostatic expansion valve
- .8 Controls and Safeties:
 - .1 Safety devices
 - .1 Low pressure sensor
 - .2 High-pressure switch
 - .3 Low water temperature sensor.
 - .2 Solid-state control system.
 - .1 Control system microprocessor board protect against building electrical system noise contamination, EMI and RFI interference.
 - .2 Interface with a heat pump type thermostat.
 - .3 The control system features:
 - .1 Anti-short cycle time delay on compressor operation
 - .2 Random start on power-up.
 - .3 Low voltage protection.
 - .4 High voltage protection.
 - .5 Unit shutdown on high or low refrigerant pressures.
 - .6 Unit shutdown on low water temperature
 - .7 Option to reset unit at thermostat or disconnect.
 - .8 Automatic intelligent reset.
 - .9 Unit shall automatically restart 5 minutes after shutdown if the fault has cleared. Should a fault occur 3 times sequentially, then lockout will occur.
 - .10 Ability to defeat time delays for servicing.
 - .11 Light-emitting diode (LED) to indicate high pressure, low pressure, improper voltage, source freeze protection, load freeze.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.
 - .1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied

3.2 Installation

- .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Make duct connections through flexible connections.
- .3 Level unit with fans running. Align duct work. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.
- .4 Make piping connections.
- .5 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.3 Start-Up and Commissioning

- .1 Have manufacturer certify installation.
- .2 Have manufacturer representative present tests and start up units and certify performance.
- .3 Submit written start-up and commissioning reports to Contract Administrator.

END OF SECTION

Part 1 General

1.1 References

- .1 ARI 410 - Forced-Circulation Air-Cooling and Air- Heating Coils.
- .2 SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

1.2 Submittals or Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- .3 Shop Drawings: Indicate coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

1.3 Submittals or Information

- .1 Section 21 05 00: Submittals for information.
- .2 Certificates: Certify that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements and that the coils are tested and rated to ARI 410.

1.4 Submittals at Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.5 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.6 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., CSA, and/or any testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.7 Delivery, Storage, and Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.

- .3 Protect coils from entry of dirt and debris with pipe caps or plugs.

1.8 Warrant

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide five-year manufacturer warranty for all coils.

Part 2 Products

2.1 Electric Duct Heaters

- .1 Description: Duct-mounted electric resistance heater, with terminal and control box, coil, casing, and controls.
- .2 Manufacturer: Thermolec
 - .1 Substitutions: Refer to Section 21 05 00
- .3 Assembly: CSA approved, UL listed and labelled, with terminal control box and accessible cover, splice box, coil, casing, and controls.
- .4 Performance: refer to schedules.
- .5 Construction
 - .1 Duct mounting shall be flange connection.
 - .2 Frame shall be corrosion-resistant and made of galvanized steel of suitable gauge as required by CSA.
- .6 Coils
 - .1 Frame shall be corrosion-resistant and made of galvanized steel of suitable gauge as required by CSA. Coils made of high-grade Nickel-Chrome alloy and shall be insulated by floating ceramic bushings from the galvanized steel frame. Coil terminal pins shall be in stainless steel, mechanically secured and insulated from the frame by means of non-rotating ceramic bushing. Coil support bushing shall be made of ceramic and shall be held in the frame by a lock which will keep it floating and stress-free.
 - .2 Round Tubular: Frame shall be corrosion-resistant and made of galvanized steel of suitable gauge as required by CSA. Heating elements shall be tubular type made of heavy gauge Incoloy 800 filled with compacted magnesium oxide insulating powder. Above 277 Volts or 30KW, each tube shall be of "U" type and shall be removable through the control box without removing the heater from its ductwork.
- .7 Controls:
 - .1 Operating:
 - .1 All duct heaters shall be complete with the following standard built-in controls:
 - .1 High limit cut-outs

- .2 Magnetic contactors (as required)
 - .3 Control transformer
 - .4 Air flow sensor.
 - .5 SCR proportional controller
- .8 Safety:
- .1 High temperature cut-outs
 - .1 Heaters shall be equipped with fail-safe automatic reset disc-type high temperature thermal cut-out(s) located in the top frame component above the heating elements.
 - .2 For heaters of 30 kW and less, rated for voltages below 300 volts, in addition to the automatic reset high temperature cut-out, shall be equipped with a fail-safe manual reset disc-type high temperature thermal cut-out, semi-recessed in the terminal box, facing the heating element hairpin as required by CSA 22.2.
 - .2 The sensing element of the cut-out shall be stream mounted, shall be shielded from mechanical damage and shall face the center portion of the heating section so as to make the heater non-sensitive to air flow direction.
 - .3 Cut-outs shall de-energize the heater in case of insufficient air flow.
 - .4 The heater shall be equipped with a built-in line-voltage disconnect to switch the power off at the heater location and protective screens on both sides (where applicable).
 - .5 Load fuses shall be supplied as required by CSA 22.2.
- .9 Airflow:
- .1 Duct heaters shall be non-sensitive to air flow direction and interchangeable for horizontal or vertical ducts without impairing safety.
 - .2 Heaters shall be CSA approved for zero clearance in horizontal ducts.
- .10 Electrical Characteristics:
- .1 All internal wiring shall terminate on clearly identified terminal blocks.
 - .2 A wiring diagram shall be installed on the control box cover
 - .3 Prior to shipping, all units shall withstand tests as required by CSA/UL.
 - .4 Refer to schedule on drawings for electrical power requirements.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturers written instructions. Refer to drawing details.
- .2 Install in ducts and casings to SMACNA HVAC Duct Construction Standards, Metal and Flexible.
 - .1 Support coil sections independent of piping on steel channel or double angle frames and secure to casings.

- .2 Provide frames for maximum three coil sections.
- .3 Arrange supports to avoid piercing drain pans.
- .4 Provide airtight seal between coil and duct or casing.
- .5 Refer to Section 23 31 00.
- .3 Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- .4 Make connections to coils with unions and flanges.
- .5 Electric Duct Coils:
 - .1 Install to manufacturer's written instructions.
 - .2 Install a minimum 1200mm from any airflow disturbances such as fan outlets, balancing or VAV dampers or duct directional changes.
 - .3 Install unit with sufficient clearance from adjacent construction, piping, ductwork, and other obstructions to allow access for service and maintenance.
 - .4 Connect power and controls to duct heater as specified in Section 26 05 80.
 - .5 Maintain 4 feet straight duct before coil and 2 feet after coil. Reductions in distances specified are acceptable only if acceptable by the manufacturer.
 - .6 Field Quality Control:
 - .1 Verify operation of each electric duct heater by measuring input voltage and current simultaneously for period of ten minutes of continuous operation.
 - .2 Verify supply air temperature control by measuring supply air temperature after the coil.
 - .3 Demonstration: Demonstrate location of circuit breakers and switches serving duct heater branch circuits, and location and setting procedures for thermostats and other heating controls.

END OF SECTION

Part 1 General

1.1 Building Automation System (BAS) Scope

- .1 Contractor to provide control system compatible with The City's Johnson Controls system, including Johnson Advanced Field Equipment Controllers (FACs).
 - .1 Contractor to provide all packaged controls, field controllers, wiring, devices and actuators, and supervisory controller.
 - .2 Contractor to provide all programming and graphics for a complete system. The contractor will migrate the system including graphics into the existing City of Winnipeg Metasys User Interface (MUI).
 - .3 Contractor to commission controls system.
 - .4 The Contractor will connect the supervisory controller to the City of Winnipeg ADX server.
 - .5 An operator work station (OWS) will not be provided as part of this contract.
- .2 Contractor to provide home-run cables from Supervisory Controller to patch panel in IT Room. Cable, conduit, and cable supports to be provided according to Div 26.
- .3 Contractor to provide home-run cable from SCBA Room to patch panel in IT Room for future equipment connection. Cable, conduit, and cable supports to be provided according to Div 26.
- .4 Refer to Controls Schematics, Controls Network Diagram, and Section 25 90 00 – Sequence of Operations.
- .5 The Controls Network Diagram provided on drawings is schematic and is intended to communicate the intent of the system architecture and division of controls work between The City and the Contractor. Actual network architecture and the number of field controllers may vary as shown.

1.2 References

- .1 AMCA 500 - Test Methods for Louvres, Dampers and Shutters.

1.3 Submittals or Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- .3 Shop Drawings:
 - .1 Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of

valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

- .2 As part of shop drawing submittals produce a Controls Network Diagram, floorplan indicating controller locations, narrative sequence of operations, and product data for all BAS components.

1.4 Submittals for Information

- .1 Section 21 05 00: Submittals for information.
- .2 Manufacturer's Instructions: Provide for all manufactured components.

1.5 Submittals at Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
- .3 Revise shop drawings to reflect actual installation and operating sequences.
- .4 Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- .5 Warranty: Submit manufacturer's warranty and ensure forms have been filled out in The City's name and registered with manufacturer.

1.6 Quality Assurance

- .1 All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off-the-shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Contract Administrator in writing. Spare parts shall be available for at least 5 years after completion of this contract.

1.7 Regulator Requirements

- .1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, provincial, and national authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
 - .1 Canadian Electric Code (CEC)
 - .2 National Building Code (NBC)
 - .3 ASHRAE 135
 - .4 Underwriters Laboratories UL916

1.8 Warrant

- .1 Section 21 05 00: Submittals for project closeout.

- .2 Labor and materials for the control system and components provided by the Contractor shall be warranted free from defects for a period of 12 months after final completion and acceptance. Failure of control system and components, provided by the Contractor, during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to The City. The Contractor shall respond to The City's request for warranty service within 24 hours during normal business hours.
- .3 All work shall have a single warranty date, even when The City has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period
- .4 At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Contract Administrator, the Contract Administrator shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.
- .5 Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labour and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Contract Administrator's review.

1.9 Maintenance Service

- .1 Maintenance Service of BAS system to be provided by The City.

1.10 System and Component Performance

- .1 Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
- .2 Graphic Display. A graphic with 20 dynamic points shall display with current data within 2 sec.
- .3 Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
- .4 Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
- .5 Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
- .6 Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds

- .7 Object Scan. All changes of state and change of analog values will be transmitted over the high-speed Ethernet network such that any data used or displayed at a controller or workstation will have been current within the previous 2 seconds
- .8 Performance. Programmable controllers shall be able to completely execute PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
- .9 Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
- .10 Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Dew Point	±1.5°C (±3°F)
Water Temperature	±0.5°C (±1°F)
Delta-T	±0.15°C (±0.25°F)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO 2)	±30 ppm

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	

Part 2 Products

2.1 Control Panels

- .1 Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- .2 NEMA 250, general purpose utility enclosures with enamelled finished face panel.

- .3 Provide common keying for all panels.

2.2 Control Valves and Valve Operators

- .1 Acceptable manufacturers.

- .1 Belimo
- .2 Siemens
- .3 Honeywell
- .4 Schneider Electric
- .5 Johnson Controls
- .6 Substitutions: Refer to Section 21 05 00.

- .2 Where control valves are shown on drawings as provided with a hose package, provide hose package as listed in 23 05 20 – Hydronic Specialties.

- .1 Globe Pattern:

- .1 Manufacturer: Siemens Model Powermite/Flowrite 599.
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .3 Up to 2 inch (50 mm): Bronze body, brass trim, stainless steel rising stem, all metal plug and seat, EDPM packing, screwed ends.
- .4 Over 2 inches (50 mm): Cast Iron body, stainless steel trim, rising stem, plug-type disc, EDPM packing, flanged ends, renewable seat and disc.
- .5 Hydronic Systems:
 - .1 Rate for service pressure of 860 kPa at 121 degrees C (125 psig at 250 degrees F).
 - .2 Replaceable plugs and seats of brass.
 - .3 Size for 20 kPa (3 psig) maximum pressure drop at design flow rate unless otherwise noted.
 - .4 Two way valves with equal percentage characteristics, three way valves with linear characteristics. Size two way valve operators to close valves against pump shut off head.

- .2 Valve Operators:

- .1 General: Provide smooth proportional control with sufficient power for full shut off at maximum pump differential pressure or maximum head pressure development from the pump, elevation and system pressure.
- .2 Spring return to normal position as indicated on freeze, fire, or temperature protection.
- .3 Number: Sufficient to achieve unrestricted movement throughout actuation range.
- .4 Operators (2 Position): Synchronous motor with enclosed gear train, dual return springs, valve position indicator; 24 v DC. Valves: spring return to normal position for temperature protection.
- .5 Operators (Modulating): Self contained, linear motorized actuator with approximately 19 mm (3/4 inch) stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC,.

.6 Accessories

- .1 Identification tags shall be available for all valves; tags shall be indelibly marked with Cv, model number, location; tags shall be 76 x 76mm (3" x 3") aluminum.

2.3 Dampers - Motorized

- .1 Tamco Model 9000 SC (Insulated)
- .2 Other Acceptable Manufacturers:
- .1 Alumavent
- .2 Johnson Controls
- .3 Substitutions: Refer to Tender No. 543-2022B; Part B – Bidding Procedures.
- .3 Performance: Test to AMCA 500.
- .4 Frames: Extruded aluminum, welded or riveted with corner reinforcement, minimum 2.0 mm (0.081 inch) thick. Damper frame is 100mm (4 inch) deep.
- .5 All dampers for duct sizes with a dimension (either width or height) 300 mm (12 inches) or less shall be flanged to the duct. In-duct frames not allowed.
- .6 Blades: Extruded aluminum air foil profile, maximum blade size 150 mm (6 inches) wide, maximum blade length section 1200 mm (48 inches).
- .7 Entire frame shall be thermally broken by means of polyurethane pockets complete with thermal cuts.
- .8 Insulation: Internally insulated with expanded polyurethane foam and are thermally broken. Complete blade has an insulating factor of R-2.29 and a temperature index of 55.
- .9 Blade Seals: Extruded silicone mechanically attached, field replaceable.
- .10 Frame/Jamb Seals: Extruded silicone mechanically attached, field replaceable.
- .11 Bearings: Celcon inner bearing fixed to a 7/16" (11.11 mm) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted in the frame,
- .12 Linkage: Installed in frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
- .13 Leakage: Class 1A at 0.25 kPa (1 in. w.g.) static pressure differential. Class 1 at 1 kPa (4 in. w.g.) static pressure differential. Standard air leakage data is certified under the AMCA Certified Ratings Program.
- .14 Maximum blade length Static Pressure: 1.0 kPa (4 inches wg)
- .15 Temperature Limits: -40 to 100 degrees C (-40 to 212 degrees F).

2.4 Damper Operators

- .1 General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
- .2 Electric Operators:
 - .1 Acceptable manufacturers.
 - .1 Belimo
 - .2 Siemens
 - .3 Honeywell
 - .4 Schneider Electric
 - .5 Johnson Controls
 - .2 Substitutions: Refer to Section 21 05 00.
 - .3 Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch minimum position potentiometer
 - .4 Number: Sufficient to achieve unrestricted movement throughout damper range.

2.5 Flow Switches

- .1 Water flow
 - .1 Basis of design: McDonnell & Miller FS4
 - .2 Flow switch to confirm hydronic fluid flow.
 - .3 Construction: ULc listed. Threaded connection to piping, sensitivity adjustment, stainless steel paddles to accommodate pipe size. Construction suitable for application.
- .2 Air flow
 - .1 Basis of design: Greystone AFS
 - .2 Pressure differential switch to confirm air flow.
 - .3 Construction: CSA approved. Monitors pressure inside and outside duct, adjustable setpoint. Construction suitable for application.

2.6 Humidistats

- .1 Duct Humidistat:
 - .1 Insertion, two position type.
 - .2 Throttling range: Adjustable 2 percent relative humidity.
 - .3 Operating range: 20 to 80 percent.
 - .4 Maximum temperature: 65 degrees C (150 degrees F).

2.7 Carbon Monoxide Nitrogen Dioxide Detection and Control System

- .1 Products:
 - .1 Detectors: E3Point Model E3SA with E3SCO and E3SNO Sensor Cartiges.

- .2 Transmitter will be powered by 24 V AC/DC (E3SA) The gas transmitter must be capable of monitoring a second gas when equipped with an E3SRM remote sensor. The gas transmitter will incorporate an electrochemical cell for toxic gas monitoring and catalytic bead sensor for combustible gases. Unit sensing cell must compensate for variations in relative humidity and temperature to maintain high levels of accuracy.
- .3 The transmitter will be capable of transmitting gas concentrations to a DDC system through its 4-20 mA output. For local activation of fans or louvers (or other equipment), two on-board DPDT relays 5 A, 30 Vdc or 250 Vac (resistive load) will be activated at programmable set points (and programmable time delays). An LCD display will provide local gas concentration readings.
- .4 Transmitter will be capable of operating within relative humidity ranges of 5-95% non-condensing and temperature ranges of -20°C to 40°C (-4°F to 104°F).
- .5 Unit will be certified to ANSI/UL 61010-1 label and CAN/CSA-C22.2 No. 61010-1. Transmitter must be manufactured in an ISO 9001-2000 production environment.
- .6 The transmitter should have a plug-in capability for a gas cartridge with a smart sensor capable of self-testing.
- .7 For local activation of audible alarms, the transmitter shall have an on-board device able to generate an audible output of 85 dBA 10 ft (3m).
- .8 Strobe & Horn unit will be capable of operating within relative humidity ranges of 0-100% and temperature ranges of -30°F to 150°F (-35°C to 66°C). Rating of horn will be no less than 72dBA at 10 feet. Intensity of light will be no less than 40W and will flash at a frequency of 1 per second. Unit will be certified by CSA. Honeywell Analytics.

Detector alarm levels are to be activated and the unit is to be installed in accordance with the following parameters:

GASES	1st ALARM SET POINT (TLV-TWA)	2nd ALARM SET POINT (TLV-STEL)	3rd ALARM SET POINT	MOUNTING HEIGHT	COVERAGE RADIUS
Carbon Monoxide (CO)	10 PPM	100 PPM	200 PPM	5 ft (150 cm) above finished floor	50 ft (15 m)
Nitrogen Dioxide (NO2)	0.7 PPM	2.0 PPM	9.0 PPM	1 ft (30 cm) from ceiling	50 ft (15 m)

.2 Accessories

- .1 Strobe and Horn type STAS for 24Vac, FHS-240 for 24 Vdc or STACKSTAS for 120 Vac
- .1 Strobe & Horn unit will be capable of operating within relative humidity ranges of 0-100% and temperature ranges of -30°F to 150°F (-35°C to 66°C). Rating of horn will be no less than 72dBA at 10 feet. Intensity of light will be no less than 40W and

will flash at a frequency of 1 per second. Unit will be certified by CSA. Honeywell Analytics.

- .2 Power Transformer type T100VA, T200VA, T300VA or Class 2 device type T100VAC2, T200VAC2 or T300VAC2
 - .1 Transformer shall have an input voltage of 120 V AC and an output voltage of 24 Vac with a VA range of 50-300. Operating frequency shall be 60 Hz. Unit will provide insulation systems up to 130°C (50-1300 VA). Unit will operate at sound levels of less than 40 dBA. Transformers shall be of fused type.
- .3 Detector Guards
 - .1 Detector Guards E3PT- GUARD
 - .1 The grid is made of a 9-gauge steel wire. The guard must be designed to allow calibration without removing the guards.

2.8 Ener Monitors

- .1 BTU Metering Devices (Hydronic)
 - .1 Manufacturer: ONICON.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 High Accuracy BTU meter provides a local indication of energy, flow and temperature data through an alphanumeric display. Provide with ultrasonic flow meter and temperature sensors. Provide BACnet MSTP communications with BAS. Refer to Section 25 90 00 – Sequences of Operations and control schematics.

2.9 Thermostats

- .1 Room thermostats shall be provided with water-to-air heat pump packaged controls. Refer to Section 23 81 40 – Water Source Heat Pumps. Line voltage heating and cooling thermostats shall be provided by Division 26.

2.10 Inlet/Outlet Sensors

- .1 Temperature:
 - .1 Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 21 degrees C (70 degrees F), interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
 - .2 Measuring current maximum 5 mA with maximum self-heat of 0.017 degrees C/mW(0.031 degrees F/mW) in fluids and 0.008 degrees C/mW(0.014 degrees F/mW) in air.
 - .3 Provide 3 lead wires and shield for input bridge circuit.
 - .4 Use insertion elements in ducts not affected by temperature stratification or smaller than one square metre. Use averaging elements where larger or prone to stratification sensor length 2.5 m (8 feet) or 5 m (16 feet) as required.

- .5 Insertion elements for liquids: with brass socket, minimum insertion length of 60 mm(2-1/2 inches).
- .6 Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.
- .2 Humidity Sensors:
 - .1 Elements: Accurate within 5 percent full range with linear output.
 - .2 Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- .3 Equipment Operation Sensors:
 - .1 Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 1250 Pa (0 to 5 inches wg).
 - .2 Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 50 to 400 kPa (8 to 60 psi).
 - .3 Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- .4 Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

2.11 Transmitters

- .1 Temperature Transmitters:
 - .1 One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 93 degrees C (200 degree F) span and plus or minus 1 percent for 10 degrees C (50 degree F) span, with 93 degree C (200 degrees F) temperature range, compensated bulb, averaging capillary, or rod and tube operation on 138 kPa (20 psig) input pressure and 20 to 100 kPa (3 to 15 psig) output.
- .2 Humidity Transmitters:
 - .1 One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

2.12 Relays

- .1 Control Relays. Control relays shall be plug-in type, ULC/CSA listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
- .2 Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable $\pm 100\%$ from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

2.13 Current Transformers

- .1 AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
- .2 Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full-scale output.
- .3 Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

2.14 Voltage Transformers

- .1 AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
- .2 Transformers shall be suitable for ambient temperatures of 4°C - 55°C (40°F - 130°F) and shall provide $\pm 0.5\%$ accuracy at 24 Vac and 5 VA load.
- .3 Windings (except for terminals) shall be completely enclosed with metal or plastic.

2.15 Current Switches

- .1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and BAS system output requirements.

Part 3 Execution

3.1 General

- .1 Refer to controls supplied by manufacturer in equipment specifications for integration with Division 25 work.

3.2 Examination

- .1 Verify that systems are ready to receive work.
- .2 Beginning of installation means installer accepts existing conditions.
- .3 Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- .4 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- .5 Ensure installation components are complementary to installation of similar components.
- .6 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

- .7 The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Contract Administrator and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.3 Installation

- .1 Install to manufacturers written instructions.
- .2 Thermostats
 - .1 Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate 1200mm (47") above floor, typical, and 900mm (36") in barrier free rooms. Align with lighting switches.
 - .2 Provide thermostats in locking vented enclosures in the following rooms that are accessible to the public:
 - .1 Vestibule 100
 - .2 Lobby 101
 - .3 Training Classroom 102
 - .4 Universal Toilet Room 103
 - .5 Washroom 104
- .3 Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- .4 Dampers and damper motors
 - .1 Provide isolation (two position) dampers of parallel blade construction.
 - .2 Provide control (modulating position) dampers of opposed blade construction.
 - .3 Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- .5 Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- .6 Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position for equipment not signalled by fire alarm system.
- .7 Provide conduit and electrical wiring to Section 26 05 80. Electrical material and installation to appropriate requirements of Division 26.

- .8 Gas detection installation
 - .1 Locate zone gas sensors away from the throw of supply air grilles, registers and diffusers containing fresh air. Locate gas sensors away from being exposed to air velocities greater than 0.25 m/s (50 fpm).
 - .2 Locate gas sensors minimum 3 meters (10 feet) from sources of combustion and humidity unless otherwise indicated by manufacturer.
 - .3 After installation of gas detection, test and calibrate equipment to demonstrate operation of functions described above under sequence of operation by manufactures certified service technician or authorized agent complete with commissioning reports
 - .4 Provide detection unit guards as indicated on the drawings.

3.4 Manufacturer s Field Ser ices

- .1 Section 21 05 00: Prepare and start systems.
- .2 Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.5 De onstration And Instructions

- .1 Section 21 05 00: Demonstrating installed work.
- .2 Demonstrate complete and operating system to The City.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Sequences of operation for the following:
 - .1 Energy Recovery Ventilators
 - .2 Make-Up Air Units
 - .3 Boiler
 - .4 Pumps
 - .5 Ground Heat Exchanger
 - .6 Water-to-Air Heat Pumps
 - .7 Apparatus Bays Ventilation
 - .8 Water-to-Water Heat Pump / Domestic Hot Water
 - .9 Mechanical Room Exhaust Fan
 - .10 Mechanical Room Heating / Cooling
 - .11 Electric Heaters
 - .12 Sump Pumps

1.2 Syste Descri tion

- .1 This section defines system control functionality.
- .2 Requirements for each type of control system operation are specified.
- .3 Equipment, devices, and system components required for control systems are specified in other Sections.

1.3 Su ittals or Re ie

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate mechanical system controlled and control system components.
 - .1 Label with settings, adjustable range of control and limits. Include written description of control sequence.
 - .2 Include flow diagrams for each control system, graphically depicting control logic.
 - .3 Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.4 Su ittals at Pro ect Closeout

- .1 Section 21 05 00: Submittals for project closeout.

- .2 Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

Part 2 Products

2.1 Not Used

Part 3 Execution

3.1 Energy Recovery Ventilator – ERV-1

- .1 Packaged controls for supply fan, exhaust fan, reversing core dampers, filter section.
- .2 Schedule:
 - .1 ERV to run continuously (user adjustable).
- .3 Operation:
 - .1 Enable ERV according to schedule.
 - .2 Outdoor air dampers (external to ERV) to open whenever ERV is enabled and close whenever ERV is disabled.
- .4 Economizer Control:
 - .1 BAS to provide enable signal to economizer when:
 - .1 Ground heat exchanger entering water temperature is greater than the ground heat exchanger leaving water temperature (building is rejecting heat to ground), and
 - .2 The enthalpy of the outdoor air (BAS calculated using measured temperature and humidity) is less than the enthalpy of the exhaust air, and
 - .3 Outdoor air temperature is greater than 8°C (46°F) (user adjustable).
- .5 Heating/Cooling Coil HCC-1
 - .1 Enable cooling when one or more heat pump (HP-1 to HP-12) thermostats indicate space humidity is greater than 50%. WSHP-1 to modulate to maintain 54°F supply air temperature off coil. Refer to WSHP-1 control strategy.
 - .2 Enable heating when:
 - .1 One or more heat pumps (HP-1 to HP-13) cannot meet room temperature setpoint and auxiliary electric duct heat (where applicable) is enabled, or
 - .2 Building switches to emergency generator power supply.
 - .3 WSHP-1 to modulate to maintain 22°C (72°F) supply air temperature off coil (user adjustable). Refer to WSHP-1 control strategy.

- .6 Alarms shall be provided as follows:
 - .1 Outdoor Air Damper Failure: Commanded open, but the status is closed.
 - .2 Outdoor Air Damper in Hand: Commanded closed, but the status is open.
 - .3 Low Limit Alarm (dry contact on ERV terminal strip)
 - .4 Damper Alarm (dry contact on ERV terminal strip)
 - .5 Supply Fan Alarm (dry contact on ERV terminal strip)
 - .6 Exhaust Fan Alarm (dry contact on ERV terminal strip)
 - .7 ERV Damper Alarm (dry contact on ERV terminal strip)
 - .8 Supply Air Filter: Final differential pressure exceeds limit (user adjustable). (4-20mA signal from ERV terminal strip)
 - .9 Low Supply Air Temp: If the supply air temperature is less than 5°C (41°F) (user adjustable).
 - .7 Monitor:
 - .1 Display the instantaneous temperature and humidity of each airstream (x4)
 - .2 Display the position of outdoor air dampers
 - .3 Display the ERV enable status and alarms
 - .4 Display the ERV economizer enable status
 - .8 Trends/Reporting:
 - .1 Calculate the instantaneous total energy (latent and sensible) recovered using the temperature and humidity sensors on all air paths.
 - .1 Display the instantaneous energy recovered on OWS graphics
 - .2 Sum and log the total daily energy recovered for report exports
 - .2 Calculate the instantaneous latent and sensible recovery efficiency using the temperature and humidity sensors on all air paths.
 - .1 Display the instantaneous recovery efficiency on OWS graphics
 - .2 Sum and log the daily average recovery efficiency for report exports
 - .3 City to store trend and alarm data on remote server.
- 3.2 Ener Reco er Ventilator – ERV-2**
- .1 Packaged controls for supply fan, exhaust fan, reversing core dampers, filter section, and economizing functionality.
 - .2 Schedule:
 - .1 ERV to run continuously (user adjustable).
 - .3 Operation:
 - .1 Enable ERV according to schedule.
 - .2 Outdoor air dampers (external to ERV) to open whenever ERV is enabled and close whenever ERV is disabled.
 - .4 Economizer Control:

- .1 BAS to provide enable signal to economizer when:
 - .1 Ground heat exchanger entering water temperature is greater than the ground heat exchanger leaving water temperature (building is rejecting heat to ground), and
 - .2 The enthalpy of the outdoor air (BAS calculated using measured temperature and humidity) is less than the enthalpy of the exhaust air, and
 - .3 Outdoor air temperature is greater than 8°C (46°F) (user adjustable).
- .5 Duct Heater DH-6:
 - .1 Modulate DH-6 to maintain 22°C (72°F) minimum supply air temperature.
- .6 Alarms shall be provided as follows:
 - .1 Outdoor Air Damper Failure: Commanded open, but the status is closed.
 - .2 Outdoor Air Damper in Hand: Commanded closed, but the status is open.
 - .3 Low Limit Alarm (dry contact on ERV terminal strip)
 - .4 Damper Alarm (dry contact on ERV terminal strip)
 - .5 Supply Fan Alarm (dry contact on ERV terminal strip)
 - .6 Exhaust Fan Alarm (dry contact on ERV terminal strip)
 - .7 ERV Damper Alarm (dry contact on ERV terminal strip)
 - .8 Supply Air Filter: Final differential pressure exceeds limit (user adjustable). (4-20mA signal from ERV terminal strip)
 - .9 Low Supply Air Temp: If the supply air temperature is less than 5°C (41°F) (user adjustable).
- .7 Monitor:
 - .1 Display the instantaneous temperature and humidity of each airstream (x4)
 - .2 Display the position of outdoor air dampers
 - .3 Display the ERV enable status and alarms
 - .4 Display the ERV economizer enable status
- .8 Trends/Reporting:
 - .1 Calculate the instantaneous total energy (latent and sensible) recovered using the temperature and humidity sensors on all air paths.
 - .1 Display the instantaneous energy recovered on OWS graphics
 - .2 Sum and log the total daily energy recovered for report exports
 - .2 Calculate the instantaneous latent and sensible recovery efficiency using the temperature and humidity sensors on all air paths.
 - .1 Display the instantaneous recovery efficiency on OWS graphics
 - .2 Sum and log the daily average recovery efficiency for report exports
 - .3 City to store trend and alarm data on remote server.

3.3 **Boiler B-1**

- .1 Packaged controls for boiler and P-2 circulation.
- .2 Operation:
 - .1 Enable boiler when:
 - .1 At least one water-to-air heat pump is active in heating mode,
 - .2 AND ground heat exchanger leaving temperature falls below -1°C (30°F) for 15 minutes continuous (user adjustable).
 - .2 Boiler enabled:
 - .1 Packaged boiler controls to modulate firing to maintain 60°C (140°F) boiler water supply temperature.
 - .2 Packaged boiler controls to activate boiler circulation pump P-2 whenever boiler is enabled.
 - .3 Modulate three-way injection valve to maintain 2°C (36°F) building water supply temperature (user adjustable). BAS to control adjustable minimum and maximum 3-way valve positions when boiler is enabled.
 - .4 Monitor boiler operation status
 - .5 Monitor circulation pump P-2 status
 - .6 Monitor boiler water supply and return temperatures
 - .3 Packaged controls to ensure minimum boiler runtime of 30 minutes and a minimum off-time of 15 minutes before being re-enabled.
- .3 Alarms shall be provided as follows:
 - .1 Boiler Alarm Status
 - .2 Boiler Failure: Boiler enabled, but the status is off.
 - .3 Pump Failure: Boiler enabled, but Pump P-2 status is off.
- .4 Trends/Reporting:
 - .1 Log daily run time hours and store for report exports
 - .2 City to store trend and alarm data on remote server.

3.4 **Pumps P-1A and P-1B**

- .1 Operation:
 - .1 Pumps P-1A and P-1B to run continuously in duty-standby configuration.
 - .2 Duty pump to rotate daily.
 - .3 Duty pump to automatically vary speed to maintain supply pressure.
 - .4 System bypass valve to modulate open to provide minimum pump flow, as required, measured by pressure sensor installed 2/3 down the longest supply branch
 - .5 Monitor status of each pump.
- .2 Alarms shall be provided as follows:
 - .1 Pump P-1A Failure: Pump enabled, but the status is off.

- .2 Pump P-1A In Hand: Pump disabled, but status is on.
- .3 Pump P-1B Failure: Pump enabled, but the status is off.
- .4 Pump P-1B In Hand: Pump disabled, but status is on.
- .5 Bypass valve failure.

3.5 Ground Heat Exchanger

- .1 Packaged BTU Meter Controller to measure and calculate the energy transferred to the ground (-) and from the ground (+). BAS to monitor the following points at the BTU Meter Controller via BACnet:
 - .1 Ground heat exchanger entering water temperature (°F)
 - .2 Ground heat exchanger leaving water temperature (°F)
 - .3 Ground heat exchanger water flow rate (gpm)
- .2 Calculate:
 - .1 Instantaneous energy transfer to ground (-) or from ground (+) BTU/H:
 - .1 Assume 0.90 BTU/lb°F heat capacity for 35% glycol
- .3 Alarms shall be provided as follows:
 - .1 Low Leaving Water Temperature: water is less than -4°C (25°F)
 - .2 High Leaving Water Temperature: water is greater than 32°C (90°F)
 - .3 Low Building Supply Water Temperature: water is less than -2°C (28°F)
- .4 Trends/Reporting:
 - .1 Calculate the instantaneous total energy transferred to the ground (-) or from ground (+) in BTU/H. Assume 0.90 BTU/lb°F heat capacity for 35% glycol.
 - .1 Display the instantaneous energy transferred on OWS graphics
 - .2 Sum and log the total hourly energy transferred for report exports
 - .2 City to store trend and alarm data on remote server.

3.6 Water-to-Air Heat Pumps HP-1 To 12

- .1 Packaged controls heat pump, including room thermostat with temperature, humidity, and occupancy sensors. Heat pump controller to communicate over BACnet IP with remote server via LAN network. Contractor to provide ethernet cable from heat pump controller to LAN network switch (provided by The City).
- .2 Operation:
 - .1 Supply fan to run continuously.
 - .2 When thermostat detects occupancy:
 - .1 Heat pump to automatically switch between heating and cooling modes to maintain 22°C (72°F) room temperature setpoint (user adjustable).
 - .2 Enable electric duct heater (DH-#), where provided, as auxiliary heat when the heat pump cannot maintain room temperature setpoint.

- .3 When thermostat does not detect occupancy:
 - .1 Heat pump to automatically switch between heating and cooling modes to maintain room temperature within the range of 18°C (65°F) and 25°C (77°F) (user adjustable).
 - .4 For heat pumps with multiple sensors, heat pump controller to average measured space temperatures.
- .3 Automatic flow control valve to open whenever heat pump is in active heating or cooling modes, close otherwise.
- .4 Write the following controller points via BACnet:
 - .1 Occupied Cooling Setpoint
 - .2 Occupied Heating Setpoint
 - .3 Unoccupied Cooling Setpoint
 - .4 Unoccupied Heating Setpoint
- .5 Monitor the following controller points via BACnet:
 - .1 Zone Temperature
 - .2 Zone Humidity
 - .3 Occupancy Status
 - .4 System Status
 - .5 Fan Running Status
 - .6 System Alarm Status
 - .7 Filter Service Alarm
 - .8 Current Alarm Condition Status
 - .9 Leaving Water Temperature
 - .10 Leaving Air Temperature
 - .11 High Supply Temperature Alarm
 - .12 Low Supply Temperature Alarm
- .6 Alarms shall be provided as follows:
 - .1 Heat Pump Alarm Status
 - .2 Heat Pump Failure: Heat pump enabled, but the status is off.
 - .3 High Zone Temperature
 - .4 Low Zone Temperature
- .7 Trends/Reporting:
 - .1 Estimate the instantaneous EER and COP of each heat pump in cooling and heating modes, respectively, by interpolating the manufacturer's performance data tables. Interpolate the tables as follows:
 - .1 Use design water flow on approved shop drawings.
 - .2 Assume 24°C (75°F) entering air temperature in cooling and 21°C (70°F) entering air temperature in heating.
 - .3 Assume the entering water temperature is equal to the building water supply temperature.

- .4 Display the instantaneous energy transferred on OWS graphics
- .5 Sum and log the total hourly energy transferred for report exports
- .2 Display the estimated instantaneous EER and COP.
- .3 Store the average daily EER and COP for each heat pump.
- .4 City to store trend and alarm data on remote server.

3.7 Make-Up Air Unit – MUA-1 (Kitchen)

- .1 Packaged controls for supply fan, gas burner, DX cooling, dampers.
- .2 Operation:
 - .1 Enable/disable by user-controlled wall mount on/off switch.
 - .2 When enabled, packaged controls to activate and modulate heating/cooling elements to maintain 72°F (22°C) supply air temperature (user adjustable on remote control panel)
 - .3 Packaged controls to prevent simultaneous operation of heating and cooling elements.
- .3 Interlocks and Interconnections:
 - .1 Double reverse interlock operation of Make-Up Air Unit with Kitchen Exhaust Hood Fan EF-2.
 - .2 Exhaust fan to start when all make-up air motorized damper end switches prove dampers are open.
 - .3 Upon activation of the automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has activated, according to NFPA 96.
 - .4 Where a fire alarm system is serving the occupancy where the extinguishing system is located, the activation of the automatic fire-extinguishing system shall activate the fire alarm signaling system, according to NFPA 96.
- .4 The following alarms shall be indicated by lights on the remote control panel and monitored by the BAS. Determine fan status by current sensing devices.
 - .1 MUA Alarm Status
 - .2 Supply Fan Failure: fan enabled, but the status is off.
 - .3 Supply Fan in Hand: fan disabled, but the status is on.
 - .4 Filter Change Required: Final differential pressure exceeds limit (user adjustable).
 - .5 Low Supply Air Temp: If the supply air temperature is less than 18°C (67°F) (user adjustable).
 - .6 High Supply Air Temp: If the supply air temperature is greater than 25°C (77°F) (user adjustable).

3.8 Make-Up Air Unit – MUA-2 (Baratus Basins)

- .1 Packaged controls for supply fan, gas burner, DX cooling, dampers.
- .2 Operation:

□

- .1 Make-Up Air Unit to operate at setpoints between 1600 cfm and 4000 cfm, as described in the 'Apparatus Bay Ventilation' control strategy section.
- .2 Packaged controls to activate and modulate heating/cooling elements to maintain 72°F (22°C) supply air temperature (user adjustable on remote control panel) when enabled.
- .3 Packaged controls to prevent simultaneous operation of heating and cooling elements.
- .3 Interlocks and Interconnections:
 - .1 Make-Up Air Unit to enable under a reverse double interlock configuration with the following equipment, according to the 'Apparatus Bay Ventilation' control strategy section provided below.
 - .1 Vehicle Exhaust Fan System 1
 - .2 Vehicle Exhaust Fan System 2
 - .3 General Exhaust Fan F-1
 - .2 Interlock air intake damper with MUA-1 operation.
- .4 The following shall be monitored by the BAS. Determine fan status by current sensing devices.
 - .1 MUA Alarm Status
 - .2 MAU fan speed / airflow status.
 - .3 Intake damper position.
 - .4 Supply Fan Failure: fan enabled, but the status is off.
 - .5 Supply Fan in Hand: fan disabled, but the status is on.
 - .6 Filter Change Required: Final differential pressure exceeds limit (user adjustable).
 - .7 Low Supply Air Temp: If the supply air temperature is less than 18°C (67°F) (user adjustable).
 - .8 High Supply Air Temp: If the supply air temperature is greater than 25°C (77°F) (user adjustable).
- .5 The following alarms shall be indicated by lights on the MUA remote control panel:
 - .1 MUA Alarm Status
 - .2 Supply Fan Failure: fan enabled, but the status is off.
 - .3 Supply Fan in Hand: fan disabled, but the status is on.
 - .4 Filter Change Required: Final differential pressure exceeds limit (user adjustable).
 - .5 Low Supply Air Temp: If the supply air temperature is less than 18°C (67°F) (user adjustable).
 - .6 High Supply Air Temp: If the supply air temperature is greater than 25°C (77°F) (user adjustable).

3.9 Heat Pump HP-13 (Apparatus Bay Heating and Cooling)

- .1 Packaged controls heat pump, including low voltage thermostat with temperature and humidity sensors. Heat pump controller to communicate over BACnet IP with remote server via LAN network. Contractor to provide ethernet cable from heat pump controller to LAN network switch (provided by The City).
- .2 Operation:
 - .1 Supply fan to run continuously, except when disabled during MAU-1 operation. Refer to 'Apparatus Bay Ventilation' control strategy section.
 - .2 Heat pump to automatically switch between heating and cooling modes to maintain 23°C (73 °F) room temperature setpoint (user adjustable) in cooling mode and 20°C (68 °F) room temperature setpoint (user adjustable) in heating mode.
- .2 Write the following controller points via BACnet:
 - .1 Cooling Setpoint
 - .2 Heating Setpoint
- .3 Monitor the following controller points via BACnet:
 - .1 Zone Temperature
 - .2 Zone Humidity
 - .3 System Status
 - .4 Fan Running Status
 - .5 System Alarm Status
 - .6 Filter Service Alarm
 - .7 Current Alarm Condition Status
 - .8 Leaving Water Temperature
 - .9 Leaving Air Temperature
 - .10 High Supply Temperature Alarm
 - .11 Low Supply Temperature Alarm
- .4 Alarms shall be provided as follows:
 - .1 High Zone Temperature
 - .2 Low Zone Temperature
- .5 Trends/Reporting:
 - .1 Estimate the instantaneous EER and COP of the heat pump in cooling and heating modes, respectively, by interpolating the manufacturer's performance data tables. Interpolate the tables as follows:
 - .1 Use design water flow on approved shop drawings.
 - .2 Assume 24°C (75°F) entering air temperature in cooling and 21°C (70°F) entering air temperature in heating.
 - .3 Assume the entering water temperature is equal to the building water supply temperature.

- .4 Display the instantaneous energy transferred on OWS graphics
- .5 Sum and log the total hourly energy transferred for report exports
- .2 Display the estimated instantaneous EER and COP.
- .3 Store the average daily EER and COP for each heat pump.
- .4 City to store trend and alarm data on remote server.

3.10 Gas Detection Syste

- .1 The Gas Detection shall monitor the space and activate the exhaust and makeup air systems when the gas concentrations listed in the table below are exceeded. Refer to 'Apparatus Bay Ventilation' control strategy section. Refer to Section 25 30 00 – Instrumentation and Control Elements for Gas Detection specifications.

GASES	LEVEL
Carbon Monoxide (CO)	10 ppm
Nitrogen Dioxide (NO2)	0.7 ppm

- .2 Alarms:
 - .1 Gas Detector to Alarm Status

3.11 Apparatus Bay Ventilation

- .1 The Apparatus Bays are ventilated by the following equipment:
 - .1 Vehicle Exhaust System Fan 1
 - .1 Supplied and installed by The City with dedicated control panel
 - .2 Expected to operate at 1600 cfm at 5 inch w.c.
 - .3 Contractor to confirm actual airflow with air balance
 - .2 Vehicle Exhaust System Fan 2
 - .1 Supplied and installed by The City with dedicated control panel
 - .2 Expected to operate at 1600 cfm at 5 inch w.c.
 - .3 Contractor to confirm actual airflow with air balance
 - .3 General Exhaust Fan EF-1
 - .1 Supplied and installed by Contractor
 - .2 Serves to provide exhaust air for CO/NO2 detection system and general ventilation exhaust when manually activated by occupants
 - .3 Activated by either of the following (in parallel):
 - .1 Low voltage twist timer (60 minute max without hold),
 - .2 CO/NO Gas Detection System
 - .4 Make-Up Air Unit MUA-2
 - .1 Supplied and installed by Contractor.

- .2 Provides make-up air for Vehicle Exhaust Fans and General Exhaust Fans, varying rate depending on exhaust devices active.
- .5 Heat Pump HP-13
 - .1 Heat pump to heat and cool the Apparatus Bays under normal operating conditions. Supply air duct is shared with MUA-2, therefore HP-13 to disable any time MUA-2 is enabled. Refer to HVAC schematic.
- .6 Gas Unit Heaters UH-4 and UH-5:
 - .1 Activate to maintain 20°C (68°F) setpoint (user adjustable), as measured by BAS thermostats.
 - .2 BAS to prevent UH-4 and UH-5 operation when HP-13 cooling is enabled.
- .2 Apparatus Bay ventilation equipment shall operate according to the following Scenarios. Airflows listed assumption that each Vehicle Exhaust Fan System will operate at 1600 cfm. Contractor to confirm actual airflow with air balance and adjust rates of General Exhaust and Make-Up Air to provide balanced airflow.
 - .1 Scenario 1:
 - .1 Inputs:
 - .1 Vehicle Exhaust Fan System 1 Activated
 - .2 Outputs:
 - .1 Exhaust:
 - .1 Vehicle Exhaust System 1 enabled at 1600 cfm
 - .2 Make-Up Air:
 - .1 Enabled at 1500 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
 - .3 HP-13:
 - .1 Disabled
 - .2 Scenario 2:
 - .1 Inputs:
 - .1 Vehicle Exhaust Fan System 2 Activated
 - .2 Outputs:
 - .1 Exhaust:
 - .1 Vehicle Exhaust System 2 enabled at 1600 cfm
 - .2 Make-Up Air:
 - .1 Enabled at 1500 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
 - .3 HP-13:
 - .1 Disabled
 - .3 Scenario 3:
 - .1 Inputs:
 - .1 Vehicle Exhaust Fan System 1 Activated
 - .2 Vehicle Exhaust Fan System 2 Activated
 - .2 Outputs:

- .1 Exhaust:
 - .1 Vehicle Exhaust Fan System 1 enabled at 1600 cfm
 - .2 Vehicle Exhaust Fan System 2 enabled at 1600 cfm
- .2 Make-Up Air:
 - .1 Enabled at 3100 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
- .3 HP-13:
 - .1 Disabled
- .4 Scenario 4:
 - .1 Inputs:
 - .1 Vehicle Exhaust System 1 Activated
 - .2 CO/NO2 Detection or Manual Twist Timer Activated
 - .2 Outputs:
 - .1 Exhaust:
 - .1 Vehicle Exhaust Fan System 1 enabled at 1600 cfm
 - .2 General Exhaust Fan F-1 enabled at 1500 cfm
 - .2 Make-Up Air:
 - .1 Enabled at 4000 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
 - .2
 - .3 HP-13:
 - .1 Disabled
- .5 Scenario 5:
 - .1 Inputs:
 - .1 Vehicle Exhaust Fan System 2 Activated
 - .2 CO/NO2 Detection or Manual Twist Timer Activated
 - .2 Outputs:
 - .1 Exhaust:
 - .1 Vehicle Exhaust Fan System 2 enabled at 1600 cfm
 - .2 General Exhaust Fan F-1 enabled at 1500 cfm
 - .2 Make-Up Air:
 - .1 Enabled at 4000 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
 - .3 HP-13:
 - .1 Disabled
- .6 Scenario 6:
 - .1 Inputs:
 - .1 Vehicle Exhaust Fan System 1 Activated
 - .2 Vehicle Exhaust Fan System 2 Activated

- .3 CO/NO2 Detection or Low Voltage Twist Timer Activated
- .2 Outputs:
 - .1 Exhaust:
 - .1 Vehicle Exhaust Fan System 1 enabled at 1600 cfm
 - .2 Vehicle Exhaust Fan System 2 enabled at 1600 cfm
 - .3 General Exhaust Fan F-1 enabled at 900 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
 - .2 Make-Up Air:
 - .1 Enabled at 4000 cfm
 - .3 HP-13:
 - .1 Disabled
- .7 Scenario 7:
 - .1 Inputs:
 - .1 CO/NO2 Detection or Low Voltage Twist Timer Activated
 - .2 Outputs:
 - .1 Exhaust:
 - .1 General Exhaust Fan F-1 enabled at 4100 cfm
 - .2 Make-Up Air:
 - .1 4000 cfm (100 cfm less than exhaust to negatively pressurize Apparatus Bays).
 - .3 HP-13:
 - .1 Disabled
 - .8 Interlock intake air damper with MAU-1 operation.

3.12 Water-to-Water Heat Pu WSHP-1

- .1 Normal Operating Conditions occur when:
 - .1 Boiler B-1 is disabled, and
 - .2 There is no call for cooling at HCC-1, and
 - .3 There is no call for heating at HCC-1
- .2 Under Normal Operating Conditions:
 - .1 Packaged heat pump controls to activate heat pump to maintain 43°C (110°F) 'pre-heat' water temperature in Storage Tank ST-1.
 - .2 Control valve to ST-1 to open, control valve to HCC-1 to close.
 - .3 Domestic hot water tanks DWH-1 and DWH-2 shall be set to maintain 60°C (140°F) water temperature.
 - .4 Domestic hot water recirculation pump P-5 to run continuously based on line voltage timer (user adjustable.)
- .3 When Boiler B-1 is enabled:

- .1 Disable domestic hot water pre-heat (switch domestic hot water heating to electric only). This is to prioritize boiler capacity for space heating.
- .2 Heat pump to disable unless there is call for heating or cooling at HCC-1.
- .4 When there is a call for cooling at HCC-1:
 - .1 Control valve to ST-1 to close, control valve to HCC-1 to open.
 - .2 Heat pump to operate according to ERV-1 strategy.
- .5 When there is a call for cooling at HCC-1:
 - .1 Control valve to ST-1 to close, control valve to HCC-1 to open.
 - .2 Heat pump to operate according to ERV-1 strategy.
- .6 The following points shall be monitored by the BAS.
 - .1 Heat Pump Alarm Status (dry contact on Heat Pump Controller)
 - .2 Source Water Supply Temperature
 - .3 Source Water Return Temperature
 - .4 Load Water Supply Temperature
 - .5 Load Water Return Temperature

3.13 Mec anical Roo Heatin /Coolin

- .1 Cooling Operation:
 - .1 Exhaust Fan EF-3 to activate when room temperature exceeds 24°C (75°F), as measured by BAS thermostat.
 - .2 Motorized dampers on exhaust duct and air intake to open when exhaust fan is activated. Dampers to close after 30 second delay after exhaust fan is deactivated.
- .2 Heating Operation:
 - .1 Unit Heater UH-3 to activate to maintain 18°C (65°F), as measured by BAS thermostat.
 - .2 BAS to prevent UH-3 from operating when EF-3 enabled for cooling.
- .3 Alarm when room temperature falls 5°C (9°F) outside of setpoint.

3.14 SCBA Roo Heatin /Coolin

- .1 Cooling Operation:
 - .1 Exhaust Fan EF-4 to activate when room temperature exceeds 24°C (75°F), as measured by BAS thermostat.
 - .2 Motorized dampers on exhaust duct and air intake to open when exhaust fan is activated. Dampers to close after 30 second delay after exhaust fan is deactivated.
- .2 Heating Operation:
 - .1 Unit Heater UH-2 to activate to maintain 18°C (65°F), as measured by BAS thermostat.

- .2 BAS to prevent UH-3 from operating when EF-3 enabled for cooling.
- .3 Alarm when room temperature falls 5°C (9°F) outside of setpoint.

- 3.15 Base board Heaters (EBB-)**
 - .1 Activate to maintain 22°C (72°F) setpoint (user adjustable), as measured by line voltage thermostats.

- 3.16 Electric Unit Heaters (UH-)**
 - .1 Activate to maintain 18°C (61°F) setpoint (user adjustable), as measured by line voltage thermostats.

- 3.17 Electric Forced Fan Heaters (FFH-)**
 - .1 Activate to maintain 15°C (59°F) setpoint (user adjustable), as measured by line voltage thermostats.

- 3.18 Wee in Tile Supply Pumps (P-3A and P-3B)**
 - .1 Controlled by packaged duplex pump controller.
 - .2 BAS to monitor control panel alarm status (dry contact).

- 3.19 Apparatus Basement Ventilation (F-6)**
 - .1 Activate to maintain 15°C (59°F) setpoint (user adjustable), as measured by line voltage thermostat.
 - .1 Supply Fan Failure: fan enabled, but the status is off.

END OF SECTION

Part 1 General

1.1 Related Sections

- .1 Division 0 □ Bidding & Contract Requirements
- .2 General Requirements
- .3 All Electrical Drawings and Division 25, 26, 27, 28 Series Specification Sections.

1.2 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CAN3-C235-83 (R2015) - Preferred Voltage Levels for AC Systems, 0 to 50 000 V.
- .3 CSA (Canadian Standards Association).
- .4 ULC (Underwriters □ Laboratories of Canada).
- .5 ASTM E-814, - Fire Tests of Penetration Fire Stops.
- .6 ANSI/ UL1479 - Fire Tests of Through Penetration Firestops

1.3 Regulator □ Requirements

- .1 Conform to CSA-C22.1-18.
- .2 Comply with all CSA Electrical Bulletins in force at time of tender submission.
- .3 Comply with all provincial by-laws, ordinances, codes, rulings, and other requirements.
- .4 Comply with requirements of the electrical supply authority and the local inspection authority.
- .5 Products: Listed and classified by CSA, or ULC and as suitable for the purpose specified and indicated. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments.

1.4 Definitions

- .1 The following are definitions of terms and expressions used in the specification:
 - .1 Defective: A condition determined exclusively by the Contract Administrator.
 - .2 Demolish: The complete removal of the existing item identified complete with associated infrastructure back to last remaining device or source as required to accommodate the overall scope of work. Demolished items shall be legally disposed of off site.
 - .3 Electrical Code: Canadian Electrical Code or Local Code in effect at project location.
 - .4 Exposed: Any work not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors, in closets or cupboards or under counters is considered exposed.

- .5 Indicated: as shown on contract drawings or noted in Contract Documents.
- .6 Inspection Authority: agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.
- .7 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
- .8 New: Produced from new materials.
- .9 Provide: Wherever the term "provide" is used in relationship to equipment, conduit and other materials specified for the work, it means "supply, install, connect and leave in working order all materials and necessary wiring, supports, access panels, etc., as necessary for equipment indicated. □Wherever the terms "provide" is used in connection with services such as testing, load balancing, start-up, preparation of drawings for any part of the work, it means procure, prepare, supervise, take responsibility for, and pay for these services.
- .10 Relocate: The complete relocation of the existing item identified to the new location as indicated, modifying the existing infrastructure as required to accommodate the relocation and overall scope of work.
- .11 Remove and Reinstall: The temporary removal of the existing item identified complete with associated infrastructure to accommodate the overall scope of work, the temporary storage of the item, preparing the item for reuse, and reinstallation of the item as indicated.
- .12 Remove and Replace: The complete removal and replacement of the item identified in its current location, with a new item, modifying the existing infrastructure as required to accommodate the overall scope of work.
- .13 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .14 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.
- .15 Supply Authority: electrical power utility company responsible for delivery of electrical power to project.
- .16 Typical: A representative characteristic that is standard for all installations whether individually noted or not throughout the documents. □Typical□ applies to each individual or combined installation except where specifically noted or otherwise indicated that the application is non-typical.

1.5 Per its Fees

- .1 Submit all quantities of drawings and specifications necessary for examination and approval to Electrical Permit Department and Electrical Supply Authority prior to commencement of work.
- .2 Obtain and pay for all permits necessary for the electrical installation.

1.6 Inspection

- .1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of work. Copies of Certificate shall be included in Maintenance Manuals.

- .2 Certificate of Inspection and Approval shall be submitted before final payment may be considered to be due.
- .3 During the course of the project construction, the Contract Administrator will carry out periodic site reviews and prepare a deficiency list for remedial action by the Electrical Subcontractor. When requested, the Electrical Contractor shall respond in writing to the Contract Administrator, stating corrective action and completion date for each item listed as deficient. This response shall be in the hands of the Contract Administrator within three working days of receipt of the Site Review Report.

1.7 Product Changes and Substitutions

- .1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders, and Division 01 Product Exchange Procedures Division 01 Substitutions Sections. In case of a discrepancy between this section and Division 00 and Divisions 01, the more stringent requirements shall apply.
- .2 The Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- .3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .4 Any substituted item submitted for consideration must not exceed the available space limitations, and all additional costs for mechanical, electrical, structural and architectural revisions required to incorporate the substituted material shall be the responsibility of the Electrical Division. Review maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations.
- .5 A request constitutes a representation that the Bidder:
 - .1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - .2 Will provide the same warranty for the Substitution as for the specified Product.
 - .3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to The City.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
 - .5 Will reimburse The City and Contract Administrator for review or redesign services associated with re-approval by authorities.
- .6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.8 Submittals or Review

- .1 Refer to Division 01.
- .2 Progress Payment Application Template

- .1 Prior to the first application for payment, submit for review a draft progress application template.
- .2 Progress Application shall contain separate line items for the following systems:
 - .1 Site Services
 - .2 Distribution Equipment including Panels, Distribution Panels, Transformers, etc.
 - .3 Emergency Generator and Standby Power Systems
 - .4 Lighting
 - .5 Lighting Controls
 - .6 Branch Wiring, Conduit, Raceway, Boxes
 - .7 Exit & Emergency Lighting
 - .8 Electric Heat
 - .9 Electric Vehicle Charging
 - .10 Photovoltaics
 - .11 Voice/Data
 - .12 Paging
 - .13 Audio/Visual Systems
 - .14 Intercom
 - .15 Fire Alarm
 - .16 CCTV
 - .17 Intrusion
 - .18 Access Control
 - .19 Close Out (As-Builts, O&Ms)
- .3 Progress for each system shall break out labor and materials separately.
- .3 Shop Drawings Administrative Requirements
 - .1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepm.com.
 - .2 Shop drawing documents shall be grouped by specification section. Clearly list the specification section on the front page or cover sheet of the submittal. Shop drawings related to multiple sections may not be grouped together into a single document. Documents that are groups incorrectly will be returned without being examined and shall be considered rejected.
 - .1 Each drawing shall include the name of project as found on the drawings or specifications, the equipment supplier and the specification section that the equipment is specified under.
 - .3 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .4 Work affected by submittal shall not proceed until review is complete.

- .5 Present Shop Drawings, product data, samples and mock-ups in SI Metric and/or Imperial inch-pound units, to match the units used in the schedules.
- .4 Shop Drawings and Product Data
 - .1 Submit shop drawings and product data for review by the Contract Administrator. All drawings shall be in English and metric dimensions or in imperial where indicated. Manufacture of equipment shall not commence until shop drawings have been reviewed.
 - .2 Material submitted for review shall be marked up bear the Contractor's and where applicable the Utility's reviewed stamp.
 - .3 Shop drawings shall be reviewed by the electrical contractor, general contractor, and where applicable the Utility prior to submittal to Contract Administrator, confirming that they meet all the design requirements. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents.
 - .4 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
 - .5 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .6 Where applicable, include wiring, single line and schematic diagrams.
 - .7 Include wiring drawings or diagrams showing inter-connection with work of other sections.
- .5 Provide scaled drawings showing layout of all electrical equipment and coordination of same with mechanical equipment in all electrical, electrical/mechanical and voice data rooms.
- .6 Submit samples in accordance with General Conditions. Samples shall be forwarded to the Contract Administrator's office and returned. Approved samples will be retained until after tender closing, then all samples will be returned except for the sample submitted by the Manufacturer who has been listed by the successful Contractor in the tender documents. This sample will be used for comparison with the actual production run of successful manufacturer.
- .7 Submit shop drawings of service entrance equipment to utilities.

1.9 Closeout Submittals

- .1 Refer to Division 01.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Four weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, one draft copy of operating and maintenance manuals in Canadian English.
- .4 Copy will be returned with Contract Administrator's comments.
- .5 Revise content of documents as required prior to final submittal.

- .6 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three final copies of operating and maintenance manuals in Canadian English.
- .7 Summary audit documents associated with requirements for LEED classification documentation.
- .8 Maintenance Data:
 - .1 Provide operation and maintenance data for incorporation into Maintenance Manuals.
 - .2 Include details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .3 Include technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .4 Include all warranty information.
 - .5 Submit Maintenance Manuals to the Contract Administrator for review. Manuals that are incomplete shall be returned to the Electrical Sub-Contractor for completion. Completed manuals shall be submitted, to the satisfaction of the Contract Administrator, before final payment may be considered to be due.
 - .6 Format
 - .1 Refer also to Section 01 78 10 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 10.
 - .2 Organize data in the form of an instructional manual.
 - .3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.
 - .4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
 - .5 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
 - .6 Arrange content by systems under Section numbers and sequence of Table of Contents.
 - .7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .8 Text: Manufacturer's printed data, or typewritten data.
 - .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 - .7 Contents
 - .1 Refer also to Section 01 78 10 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 10.
 - .2 Table of Contents: Provide:
 - .1 Title of project.

- .2 Date of submission.
- .3 Names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.
- .4 Schedule of products and systems, indexed to content of volume.
- .3 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .5 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control, wiring, and schematic diagrams and performance curves.
- .6 Include Systems Certifications where applicable.
- .7 Include manufacturer specific warranties where applicable.
- .8 Include a list of maintenance materials provided in each related section.
- .9 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate.
- .10 Training: Record of The City's representative training as specified.
- .9 Maintenance Materials:
 - .1 Provide maintenance materials as specified. Include a list of the maintenance materials in each related section of the operation and maintenance data.
 - .2 Turn materials over to The City in an orderly fashion upon completion of installation.
- .10 Record Documentation:
 - .1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:
 - .1 Drawings: Scan the full-sized field-verified as-built drawing set and save to PDF format. Scans shall be in colour and with good resolution to ensure drawings and markups are legible.
 - .2 Specifications: Adobe Acrobat (PDF).
 - .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.
 - .3 Submit completed record documents to Contract Administrator on a CD, DVD, or by electronic transfer.
 - .4 Project record documents shall comprise a complete and accurate record of the actual electrical installation. Record drawings that are inaccurate or incomplete shall be returned to the contractor for correction and completion.

- .5 Record drawings shall contain a stamp bearing the words "Record Drawing" or "As-Built Drawing" the electrical contractor's company name, date, and the contractor's signature.
- .6 The Contract Administrator will recommend a suitable deficiency holdback until accurate and complete record drawings have been submitted in acceptable form.
- .7 Indicate on record drawings, location of all buried services. This information is to be certified correct by the Contract Administrator before backfilling commences.
- .8 Record actual size and location of all cables including depth of cables where buried.
- .9 Contractor to take all schedules/details from specification and put onto additional drawing sheets for Record Drawings.

1.10 Examination

- .1 Prior to submitting a tender, examine the site and local conditions which will affect the work. Refer to the Architectural, Mechanical and Structural drawings, schedules and specifications for construction details to be certain that the electrical work can be satisfactorily carried out as specified. Claims for extra payments resulting from conditions which could reasonably be foreseen during an examination of the documents and/or site, will not be recognized.
- .2 Ensure that all equipment designated as "Existing to Remain" or "Existing to be Relocated" is suitable for its intended re-use, including panelboards and circuits. Report any discrepancies to the Contract Administrator before tender close.
- .3 Refer to General Conditions for instructions regarding a prearranged site visit during the tender period.
- .4 Notify Contract Administrator of any discrepancies, omissions, etc., prior to the awarding of the contract, otherwise the Electrical Contractor shall perform the work as directed at no additional cost to The City.

1.11 Short Circuit/Coordination/Arc Flash Study

- .1 Provide a Short Circuit Study based on the IEEE calculation methods found in IEEE 551. The study shall include a summarized table which lists all equipment included in the short circuit study and their respective short circuit interrupt ratings. The study shall list equipment which marginally passes or fails the short circuit test calculations. The study shall also provide recommendations for mitigating equipment which marginally pass or fail their associated short circuit ratings.
- .2 Provide a Protection and Coordination Study based on IEEE 242 and IEEE 1015. The study shall include all circuit breakers, relays, fuses, transformers, and other protective equipment which are fed from all energy sources in the associated distribution. The study shall include time-current curves as necessary to determine all circuit breaker settings. The study shall include an analysis of all time-current curves, an analysis of the coordinated circuit breaker settings, and recommendations for mitigating any potential protection and coordination issues. The study shall include all phase and ground fault curves with recommended settings for full selective coordination on all life safety devices including but not limited to generators, fire pumps, elevators and lifts. The study shall include a table of all circuit breaker settings for every circuit breaker considered in the

- study. The study shall be coordinated with the Arc Flash study to mitigate serious potential arc flash incident energies when applicable.
- .3 Provide an Arc Flash study based on IEEE 1584 and CSA Z462. The arc flash study shall include all areas in the distribution where an arc-flash hazard is present which includes, but is not limited to, equipment analyzed in the short circuit study. The arc flash study shall be coordinated with the protection and coordination study. The Arc Flash Study shall include, for all considered equipment, worst case arc flash results including the local incident energies, working distances, and arc flash boundaries. The Arc Flash Study shall include recommended settings for any breakers with Arc Flash Maintenance function to limit arc flash levels to targeted levels.
 - .4 Provide Arc Flash labels based on the results of the Arc Flash Study. Labels shall conform to the requirements set out in CSA Z462.
 - .5 Submit a preliminary copy of the studies complete with short circuit information and preliminary breaker coordination to the Contract Administrator with distribution shop drawings. Feeder lengths for the preliminary study shall be based on worst case estimates based on the intended installation by the electrical contractor.
 - .6 Submit a final copy of the Short Circuit/Coordination/Arc Flash Study to the Contract Administrator upon completed installation of all feeders and distribution. Final copy of Short Circuit/Coordination/Arc Flash Study shall be signed and sealed by a Professional Engineer. Feeder lengths shall be based as-installed on site measurements. Arc Flash Study shall be based on real fault data, provided by the utility. All data sources and their respective origins shall be listed and included in the report or appendices.
 - .7 Include the final copy of the Short Circuit/Coordination/Arc Flash Study in each Maintenance Manual.
 - .8 Ensure circuit protective devices such as over current trips, relays, fuses, are installed and adjusted to values and settings as recommended in the Studies.
 - .9 Ensure arc flash labels are affixed to the appropriate equipment and placed on the equipment as per the guidelines set out in CSA Z462.
 - .10 Arc flash labels shall be placed on the exterior of the electrical equipment; free of moving doors, hinges, and moving parts; and be visible on approach to the electrical equipment. Panelboards in public spaces may have their arc flash labels installed inside of a hinged door provided the equipment is constructed such that with the door open there are no exposed current-carrying parts.
 - .11 The Short Circuit study shall include all new infrastructure from the secondary side of the utility distribution transformer

1.12 Efficiency Manitoba

- .1 Electrical contractor shall make application on behalf of The City for the Efficiency Manitoba Incentive for all available rebates under the Commercial Lighting Program.
- .2 Application shall be made and acceptance provided by Efficiency Manitoba prior to commencement of demolition.
- .3 Electrical Contractor shall gather all information as required to complete the application.

- .4 Electrical Contractor shall provide updates to The City regarding status of the application and expected rebates.

Part 2 Products

2.1 Materials and Equipment

- .1 Provide labour, materials, transportation, equipment and facilities, etc., required for the complete electrical installation as indicated or implied on the drawings and specifications.
- .2 Electrical equipment shall be new and of type and quality specified.
- .3 Request for approval of material, as equal, shall conform to the specification.
- .4 Equivalent materials and equipment
 - .1 Bidders shall submit a tender based on the specified materials and equipment only.
 - .2 Bidders may submit a tender based on equivalent materials and equipment only if such items have been approved as equals by the Contract Administrator.
 - .3 Bidders may submit, with their tender, an alternate price based on alternate materials and equipment only if such items have been approved as alternates by the Contract Administrator.
 - .4 Submissions for equals or alternates shall be received by the Contract Administrator, ten working days prior to tender closing. Submissions shall include sufficient manufacturer's data to clearly show equivalency, as well as an itemized list of equal or alternate items, the items for which they were submitted and a space for the Contract Administrator to indicate approved equal approved alternate or not approved . Submittal list will be returned or may be picked up at the Contract Administrator's office. Where submissions are not returned by the Contract Administrator before tender closing or are not received by the Contract Administrator ten working days before close of tender, they are considered not approved.
 - .5 All submissions shall include the following phrase We have reviewed all contract documents, contract drawings and specifications relating to the equipment presented herein and shall bear the name and signature of the manufacturer or their agent.

2.2 Voltage Ratings

- .1 Operating voltages: to CAN3-C235-83(R2015).
- .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 shall operate in extreme operating conditions established in above standard without damage to equipment.

2.3 Finishes

- .1 Finish outdoor electrical equipment such as parking lot panels, to match light standards.

- .2 Paint indoor switchgear light grey to EEMAC-2Y-1.
- .3 Paint indoor distribution enclosure trims light grey to EEMAC-2Y-1. Distribution tub shall be galvanized.
- .4 Paint outdoor electrical equipment enclosures with two (2) coats of U.V. resistant Urethane Enamel to minimum 1.5 mil dry coat thickness. Colour shall be "equipment green" to EEMAC 2Y-1.
- .5 Clean and touch up surfaces of shop-painted equipment, scratched or marred during shipment or installation, to match original paint.
- .6 Clean, prime and paint exposed wiring, conduit, junction and pull boxes, hangers, racking, and fasteners to prevent rusting and to match surrounding finishes where applicable.

2.4 Labels and Warning Signs

- .1 Manufacturer's nameplates and CSA labels shall be visible and legible after equipment is installed.
- .2 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities, including indication of multiple power sources.
- .3 Provide quantity as required of buried cable signs reading "Buried Cable" and "Buried High Voltage Cable". Signs shall be installed at building structure/equipment, at locations as directed on site and as per Canadian Electrical Code.

2.5 Protection

- .1 Guards
 - .1 Provide guards for all electrical equipment and devices in gymnasium and other areas subject to damage.
- .2 Sprinkler Proof Equipment
 - .1 All surface mounted electrical equipment located in sprinklered areas shall be sprinkler proof and shall be provided with suitable hoods and shields.
 - .2 Entrance of conduits into the top of surface mount electrical panels/cabinets/distributions and motor control centers shall utilize O-rings and watertight connectors.
 - .3 All recessed mounted branch circuit panels and distribution panels shall be provided with a Type 2 enclosure.
- .3 Construction
 - .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark live part "LIVE () VOLTS" with appropriate voltage.
 - .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision.

2.6 Spare Parts and Maintenance Materials

- .1 Assemble spare parts as specified.

- .2 Include the following:
 - .1 Part number.
 - .2 Identification of equipment or system for which parts are applicable.
 - .3 Installation instructions as applicable.
- .3 Provide a written list complete with The City's signature assuring that spare parts have been received by The City.

2.7 Access Doors

- .1 Access doors shall be minimum #12 gauge prime coat painted bonderized steel. Each shall be complete with a heavy flush frame and anchor, concealed hinges, positive locking screwdriver lock, and mounting and finishing provisions to suit the finish material for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc. shall be ULC. listed and labeled and of a rating to maintain the fire separation integrity.
- .2 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.
- .3 Supply access doors in inaccessible construction shall give access to all concealed junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair.
- .4 Before commencing installation of electrical work, submit to the Architect for approval, a list of required access doors showing the exact sizes and locations of such access doors. Locate access doors in walls and partitions to the Architect's approval, and arrange electrical work to suit. Access doors shall be, wherever possible, of a standard size for all applications. Confirm exact dimensions with the Architect, prior to ordering.
- .5 Access doors will be installed by the Division responsible for the particular type of construction in which access doors are required. Supply the access doors to the Division installing same at the proper time to avoid construction delays.

Part 3 Execution

3.1 Coordination With Other Trades

- .1 Refer to Mechanical, Structural, Architectural and Interior Design drawings and specifications for additional electrical work in connection with other Divisions. Where such work is included in other sections of the specifications, provide equipment, conduit, wiring, etc. (in accordance with the approved manufacturer's shop drawings), as required, for operation of the specified equipment.
- .2 Schedule execution of electrical work with associated work specified in other Divisions.
- .3 Coordinate electrical work with work of other trades to avoid conflicts with pipes, air ducts or other equipment. Provide additional supports, wiring, etc., to relocate electrical equipment, as required, where structural members, air ducts, piping or other equipment interferes with the electrical installation.

- .4 Prior to installation provide scaled drawings of all mechanical/electrical rooms and communication rooms showing layout of all equipment (mechanical and electrical) for Contract Administrator review.

3.2 Quality Assurance

- .1 Do complete installations in accordance with CSA C22.1-18.
- .2 While not identified and specified by number in this Division, comply with CSA Electrical bulletins in force at time of tender submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.
- .3 Electrical installations shall comply with all requirements of the electrical supply authority and the inspection authority.
- .4 Electrical installation shall be in accordance with the applicable versions of the Canadian Electrical Code, Provincial and other codes, rules and regulations. Supply material and labour required to meet the requirements of these codes, rules and regulations even though the work is not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.

3.3 Workmanship

- .1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install conduit and cable runs parallel and perpendicular to building lines in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are to be exposed, install neatly and group in a tidy appearance.
- .2 Install equipment/junction boxes and apparatus requiring maintenance, adjustment or eventual replacement, with adequate clearances and accessibility for same.
- .3 Provide for all requirements shown on shop drawings or manufacturer's installation instructions.
- .4 Work deemed by the Contract Administrator to be unsatisfactory shall be replaced at no additional cost.

3.4 Delivery, Storage and Handling

- .1 Deliver all materials to site in an orderly fashion.
- .2 Store all materials in a clean and dry place, secure from vandalism or theft. All materials shall be left in shipping containers until required for use.
- .3 Provide additional protection such as tarps, padding, wood skids, etc., as required to ensure protection of equipment and as directed by the Architect.

3.5 Excavation and Backfilling

- .1 Excavate and backfill as required for underground electrical services as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Backfilling shall restore the excavated area to the original condition and shall include sodding where required.

- .2 Work shall be in accordance with the current CSA Bulletin.
- .3 Include all costs for excavation and backfilling, for any underground electrical installation, unless otherwise indicated.
- .4 Work shall be arranged in such a manner that will not interfere with regular pedestrian or vehicular traffic patterns.
- .5 Provide trenching, cable installations and backfill promptly. Open trenches shall be barricaded in an appropriate manner.
- .6 Cables required to cross under roadways, paved areas, sidewalks, etc. shall be installed in PVC conduits pushed under such areas.
- .7 Six (6") of sand shall be provided surrounding installed cables and 2" x 4" treated plank installed 6" above the cables. Install cable marker tape in all trenches, minimum 12" above cables. The remainder of the trench shall be backfilled with granular base course. All backfill material shall be thoroughly tamped and compacted to at least 90% of maximum density at optimum moisture. The ground shall be left free from ruts and rough spots. In any asphalt areas, backfill shall be granular material only.
- .8 All sodded areas disturbed or damaged during trenching and backfilling shall be repaired with manured soil mix and resodded. Make all repairs to damaged asphalt and/or concrete surfaces to match existing.
- .9 Care shall be taken when excavating near existing services. Existing trees and shrubbery in work area shall be protected from damage.
- .10 Install buried cable signs as per CEC and Manitoba Electrical addendums.

3.6 Conduit Sleeves and Holes

- .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete shall be sized for free passage of conduit.
- .2 Holes through exterior walls and roof shall be flashed and made weatherproof.
- .3 Make necessary arrangements for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pullboxes and outlet boxes.
- .4 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .5 Provide a minimum of two (2) separate conduit sleeves embedded in each concrete lighting fixture base. At least one (1) unused conduit shall be for possible future extension of wiring.
- .6 All conduits and cables shall be entered into the building above grade unless otherwise noted.
- .7 All coring in buildings with electrical in the slab shall be scanned at contractor's expense to prevent damage.

3.7 Cutting and Patching

- .1 Pay the costs of all cutting and patching required for the installation of electrical work. Payment for cutting and patching shall be made through the General Contractor.

- .2 Cutting and patching required for the installation of electrical work shall be done by the particular trade whose work is involved. No cutting or patching shall be carried out by the tradesman employed on the electrical work.
- .3 Obtain the approval of the Architect before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall be in accordance with the requirements of the corresponding Divisions of the specification.

3.8 De ice Installation

- .1 Device Location
 - .1 Locate devices as indicated.
 - .2 Do not install devices back-to-back in wall.
 - .3 Drawings are schematic only and do not indicate all architectural or structural elements.
 - .4 Change location of devices at no extra cost or credit, providing distance does not exceed 10'-0" (3 m) and information is provided before installation.
 - .5 Locate light switches on latch side of doors.
 - .6 Vertically align devices of different systems when shown in close proximity to each other and occurring at different mounting heights.
 - .7 Coordinate mounting heights and location of all equipment with Architectural, Mechanical and Structural Drawings prior to installation of rough-in boxes.
- .2 Mounting Heights
 - .1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
 - .2 If mounting height of equipment is not indicated, verify with Architect before proceeding with installation.
 - .3 Install electrical equipment at the following heights unless indicated or directed otherwise:

Device / Equipment	Mounting Height	
Devices above counters	150mm	6"
Receptacles:		
- General	400mm	16"
- General (Accessible Height)	450mm	18"
- Mechanical/Shop Areas	1000mm	40"
- Clock	2150mm	84"
- Above top of continuous baseboard heater	200mm	8"
- Exterior	1000mm	40"
Switches, Dimmers, push buttons, Luxo bracket	1200mm	47"
- General		
- Accessible Suites	900mm	36"
Clocks	2150mm	84"

Exit Signs	25mm	1□
Emergency Lighting Battery Banks/Remote Headers	2350mm or 150mm	92□ or 6□
Automatic Door Operator Pushbuttons	900mm	36□
Occupancy Sensors □ Switch based with manual override controls.	1200mm	47□
Occupancy Sensors □ General	Per manufacturers recommendations	
Fire Alarm Visual, Audible, & Combination Devices	2350mm or 150mm	92□ or 6□
Fire Alarm Manual Pullstations	1100mm	43□
Fire Fighter Handsets	1500mm	59□
Thermostats		
- General	1200mm	47□
- Accessible Suites	900mm	36□
Intercom Stations	1200mm	47□
Proximity/Card Readers	900mm	36□
Communication Outlets (Accessible Height)	450mm	18□
Hand Dryers	1200mm	47□
Branch Circuit Panelboards, Control Panels, Annunciators. Install panels taller than 1800mm (72□) with bottom no more than 100mm (4□) above floor.	2000mm	78□
Enclosed circuit breakers	1600mm	60□
Lighting	Refer to Architectural Drawings.	

Measured to top of device/equipment

Measured from Ceiling to top edge of device where mounting height would be lower than required specification.

Measured to operating handle of device.

Coordinate counter backsplash heights with architectural drawings prior to rough-in. Maintain minimum 1□ clearance above backsplash height.

Measured above door trim to underside of device.

- .1 Coordinate all mounting heights with Architectural elevations.
- .2 Where installed in block or brick, mounting heights shall be as above or at bottom of nearest course.
- .4 Circuiting is representational within a panel only. Circuit all electrical equipment and devices to their individually respective, intended panels.
- .5 Panelboards and other equipment which are to be surface mounted shall be installed on minimum 19mm (3/4□) good one side, fir plywood mounting backboards. Treat backboards with wood preservative prior to

installation and paint with primer and two (2) coats gray enamel before any equipment is mounted. Provide plywood mounted boards unless specified otherwise in other sections.

- .6 Panelboards mounted on exterior concrete/block walls shall have minimum 3/4" air gap behind enclosure (to minimize condensation).
- .7 All transformers, motor control centers and floor-mounted distribution panels shall be mounted on 100mm (4") concrete housekeeping pads. The Electrical Contractors shall be responsible for provision of these pads.

3.9 Fire roo in

- .1 Where cables or conduits pass through block or concrete walls and floors and any fire-rated assembly, seal openings with firestopping systems that have been tested for specific fire-resistance-rated construction conditions conforming to the construction assembly type, penetrating item type, annular space requirements, and fire-rating involved in each instance.
- .2 Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- .3 Openings within walls and floors designed to accommodate cabling systems subjected to frequent cable changes shall be provided with re-enterable products.
- .4 Fire proofing of electrical cables, conduits, trays, etc, passing through fire barriers shall conform to local codes and inspection authorities.
- .5 Fire stop materials shall be asbestos free and have been tested in accordance with ASTM E-814, and ULC 1479.
- .6 Fire stop and smoke seals shall be done in accordance with Section 07 84 13.
- .7 Approved manufacturers:
 - .1 Nelson Firestop Products
 - .2 Specified Technologies
 - .3 Hilti Firestop

3.10 Load Balance

- .1 Measure phase current to panelboards with normal loads operating at time of measurement. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, a report listing phase and neutral currents on panelboards, 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.
- .4 Include load balance test results in maintenance manuals.

3.11 Testin

- .1 Conduct and pay for tests including, but not limited to, the following systems:
 - .1 High voltage distribution equipment in accordance with relevant sections of specification.
 - .2 Power generation and distribution system.
 - .3 Circuits originating from branch distribution panels.
 - .4 Lighting and its control.
 - .5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .6 Heating cables and mats.
 - .7 Systems:
 - .1 Fire Alarm
 - .2 Public Address
 - .3 Communication cabling systems.
 - .4 Intrusion Detection
 - .5 Access Control
 - .6 CCTV
 - .8 Grounding systems.
- .2 Insulation Resistance Testing
 - .1 Hi-pot all H.V. cable and equipment over 600 volts, to manufacturer's specifications.
 - .2 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .3 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
 - .4 Check resistance to ground before energizing.
- .3 Furnish Manufacturer's Certificate or letter confirming that entire installation, as it pertains to each system, has been installed to manufacturer's instructions. Submit letter in accordance with this section.
- .4 Carry out tests in presence of Contract Administrator where directed.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results in Maintenance Manuals.

3.12 Care, Operation and Start-up

- .1 Instruct The City's operating personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions shall be done at a time convenient to The City.
- .2 Arrange and pay for services of Manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

- .3 Provide these services for such a period, and for as many visits as necessary to put equipment into operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

3.13 Cleanin

- .1 Final cleaning shall be done in accordance with the specification.
- .2 Final cleaning shall include, but not be limited to, all lighting reflectors, lenses, and other lighting surfaces that have been exposed to dust and dirt throughout the course of construction.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Electrical demolition.

1.2 Related Sections

- .1 Section 02 41 19 - Selective Demolition.

Part 2 Products

2.1 Materials and Equipment

- .1 Materials and equipment for patching and extending work: As specified in individual Sections.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify field measurements and circuiting arrangements are as shown on Drawings.
- .3 Verify that abandoned wiring and equipment serve only abandoned facilities.
- .4 Electrical drawings are based on existing record documents and/or casual field observations. Coordinate full extent of demolition work with all disciplines. Coordinate on site with all trades prior to commencement of demolition.
- .5 Report discrepancies to the Contract Administrator, and City before disturbing the existing installation.
- .6 Beginning of demolition means installer accepts existing conditions.

3.2 Preparation

- .1 Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- .2 Reroute/extend/re-feed existing electrical as required to maintain existing systems not indicated to be removed.
- .3 Coordinate utility service outages with Utility Company.
- .4 Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- .5 Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switch overs and connections. Obtain permission from the City at least forty eight (48) hours before partially or completely disabling system. Disable system at a time suitable to the City only. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.

- .6 Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable existing system only to make switch overs and modifications. Notify City and local fire service and at least forty eight (48) hours before partially or completely disabling system. Disable system at a time suitable to the City only. Minimize outage duration and make all arrangements for fire watch during outage. Make temporary connections and relocations to maintain service in areas adjacent to and in the work area as required. Where existing devices are covered to minimize dust infiltration during construction, ensure all dust caps are removed during non-construction periods.
- .7 Where existing luminaires, equipment or devices are to be temporarily relocated, and are to remain in service, provide an apparatus suitable to support the equipment.

3.3 Demolition and Extension of Existing Electrical Work

- .1 Demolish and extend existing electrical work to this Section and as indicated.
- .2 The construction documents indicate major items of equipment, fixtures and devices, that exist and may not indicate every item or supporting wiring and conduit to be removed and/or relocated.
- .3 Carefully examine the site and construction documents to verify the extent of work defined in the construction documents. Be responsible for determining which existing equipment and/or devices are to be removed and/or relocated.
- .4 Remove, relocate, and extend existing installations to accommodate new construction including all existing equipment and/or devices indicated within the construction documents.
- .5 Where existing equipment and/or devices are to be temporarily relocated, coordinate the required structure to support the equipment.
- .6 Remove abandoned wiring to source of supply.
- .7 Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- .8 Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- .9 Disconnect and remove abandoned panelboards and distribution equipment.
- .10 Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- .11 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- .12 Repair adjacent construction and finishes damaged during demolition and extension work.
- .13 Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- .14 Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 Cleanin and Re air

- .1 Clean and repair existing materials and equipment which remain or are to be reused.
- .2 Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, broken electrical parts and lenses.

3.5 Finis es

- .1 Clean, prime and paint exposed wiring, conduit, junction and pull boxes, hangers, racking, and fasteners to prevent rusting and to match existing finishes where applicable.

3.6 Installation

- .1 Install, wire, and connect relocated materials and equipment under the provisions of Section 26 05 00.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Building wire and cable.
- .2 Non-metallic sheathed cable.
- .3 Direct burial cable.
- .4 Armoured cable.
- .5 Metal clad cable.
- .6 Variable frequency (speed) drive cable.
- .7 Fire rated cable.
- .8 Wiring connectors and connections.

1.2 Related Sections

- .1 Section 26 05 53 - Electrical Identification.
- .2 Section 31 23 18 - Trenching: Trenching and backfilling for direct burial cable installation.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 C22.2 No. 0.3-09 (R2014) - Test Methods for Electrical Wires and Cables.
- .3 CSA C22.2 No. 48-15 - Non-metallic Sheathed Cable.
- .4 CSA C22.2 No. 51-14 - Armoured Cables.
- .5 CSA C22.2 No. 52-15 - Underground Secondary and Service Entrance Cables.
- .6 CAN/CSA-C22.2 No. 65-18 - Wire Connectors.
- .7 CSA C22.2 No. 75-17 - Thermoplastic-Insulated Wires and Cables.
- .8 CSA C22.2 No. 123-16 - Metal Sheathed Cables.
- .9 CAN C22.2 No.131-17 - Type TECK 90 Cable.
- .10 CSA C22.2 No. 208-14 - Fire Alarm and Signal Cable.
- .11 NECA (National Electrical Contractors Association) - National Electrical Installation Standards (NEIS).
- .12 NETA (InterNational Electrical Testing Association) - ANSI/NETA ATS-2017 - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- .13 CSA (Canadian Standards Association).
- .14 ULC (Underwriters Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

- 1.5 Su it tals or Re ie**
 - .1 Refer to 26 05 00 Common Work Results for Electrical.
 - .2 Product Data: Provide for Fire Rated Cable.

- 1.6 Su it tals or In or ation**
 - .1 Refer to 26 05 00 Common Work Results for Electrical.
 - .2 Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
 - .3 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

- 1.7 Stora e and Handlin**
 - .1 Cables shall be stored and handled in accordance with manufacturer's recommendations.

- 1.8 Closeout Su it tals**
 - .1 Refer to 26 05 00 Common Work Results for Electrical.
 - .2 Record Documentation:
 - .1 Record actual locations of components and circuits.
 - .2 Record routing of all equipment and panelboard feeders.
 - .3 Testing
 - .1 Fire Rated Cabling
 - .4 Manufacturer's Certification and Extended Warranty
 - .1 Fire Rated Cabling

- 1.9 Qualit Assurance**
 - .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

- 1.10 Re ulator Re uire ents**
 - .1 Conform to CSA-C22.1.
 - .2 Provide products listed and classified by CSA or ULC and as suitable for the purpose specified and indicated.

- 1.11 Pro ect Conditions**
 - .1 Conductor sizes are based on copper unless indicated as aluminum or "AL".

- .2 If aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop.

Part 2 Products

2.1 Buildin Wire and Ca le

- .1 Description: Single conductor insulated wire RW90.
- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation: Cross-Linked Polyethylene material rated 90 degrees C.

2.2 Ar oured Ca le

- .1 Description: Type ACWU90 and AC90.
- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation Temperature Rating: 90 degrees C.
- .5 Insulation Material: Cross-Linked Polyethylene.
- .6 Rating: CSA FT4

2.3 Metal Clad Ca le

- .1 Description: Type TECK90.
- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation Temperature Rating: 90 degrees C.
- .5 Conductor Insulation Material: Cross-Linked Polyethylene (XPLE), type RW90.
- .6 Armour Material: Aluminum.
- .7 Armour Design: Interlocked metal tape.
- .8 Outer jacket: PVC.
- .9 Rating: Hazardous Location, CSA FT4

2.4 Varia le Fre uenc (S eed) Dri e Ca le

- .1 Provide variable frequency drive cables meeting the requirements of CSA C22.2 No. 123 and CSA C22.2 No. 174 from all VFDs to each designated motor load, comprised as follows:
 - .1 Sectored ground design consisting of 3 bare bonding conductors.
 - .2 1000 volt rated cross linked polyethylene insulated phase conductors.
 - .3 FT4 rated PVC outer jacket.
 - .4 Sized to suit project requirements.

2.5 Fire Rated Ca le

- .1 Manufacturers:

- .1 Pyrotenax; Product: Type MI (mineral insulated) for use in System 1850.
- .2 Substitutions: Not permitted.
- .2 Description: Mineral Insulated
- .3 Conductor: Copper
- .4 Insulation Voltage Rating: 600V.
- .5 Insulation: Magnesium Oxide
- .6 Outer Jacket: Copper
- .7 Additional Warranty: 30 Years from date of sale.

2.6 Connectors

- .1 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs, as required.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that field measurements are as indicated.
- .3 Verify that interior of building has been protected from weather.
- .4 Verify that mechanical work likely to damage wire and cable has been completed.
- .5 Verify that raceway installation is complete and supported.

3.2 Preparation

- .1 Completely and thoroughly swab raceway before installing wire.

3.3 Wiring Methods

- .1 Concealed Dry Interior Locations: Use only armoured cable and building wire in raceway.
- .2 Exposed Dry Interior Locations: Use only building wire in raceway.
- .3 Above Accessible Ceilings: Use only armoured cable, metal clad cable, and building wire in raceway.
- .4 Wet or Damp Interior Locations: Use only metal clad cable, armoured cable with jacket, and building wire in raceway.
- .5 Exterior Locations: Use only building wire Type RWU90 insulation in raceway, metal clad cable, and armoured cable with jacket.
- .6 Underground Installations: Use only direct burial cable, armoured cable with jacket, and metal clad cable.
- .7 Use wiring methods indicated.

3.4 Installation

- .1 Route wire and cable as required to meet project conditions.

- .2 Install cable to the CSA-C22.1.
- .3 Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- .4 Use stranded conductors for control circuits.
- .5 Use conductor not smaller than 12 AWG for power and lighting circuits and sized for maximum 3% voltage drop as per the following Table:

Maximum Conductor Length for 120V Branch Circuits		
Breaker Size (A)	Conductor	
	Size (AWG)	Max Length (m)
15A	#12	20
	#10	35
	#8	55
	#6	90
20A	#12	15
	#10	25
	#8	40
	#6	65
	#4	110
30A	#10	15
	#8	25
	#6	45
	#4	70

- .1 Where conductors are required to meet voltage drop requirements that are too large for proper termination at breakers or end devices, a transition to a suitable sized conductor may be made within 3m (10') of the termination with a minimum smaller conductor size of #10AWG.
- .6 Use conductor not smaller than 16 AWG for control circuits.
- .7 Pull all conductors into raceway at same time.
- .8 Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- .9 Protect exposed cable from damage.
- .10 All cable routed below grade shall enter/exit the building below grade unless noted otherwise.
- .11 Where cabling is installed on building exterior, or direct buried, make provision for differential settling of exterior grade, buildings, and other structures and supports. Provide slack within cabling systems as required.
- .12 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
- .13 Single conductor cables shall be installed one cable diameter apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors and shall be watertight for top entry. Cable armour shall be grounded via an

aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG insulated (unless otherwise noted) copper ground wire shall be installed with each set of feeder cables. Cable bending radius shall be at least twelve times the overall cable diameter and bend shall not damage or distort the outer sheath.

- .14 Armoured cable shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable shall be of sufficient length to allow the lighting fixture to be relocated to any location within an 1800mm (6') radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box. (Minimum requirements).
- .15 Armoured cable may be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions. Cables shall be clipped before entering junction or outlet boxes.
- .16 Fire Rated Cabling
 - .1 Fire Rated Cable shall be installed in complete unbroken lengths parallel with building lines. Cabling shall be installed and terminated as per manufacturer's instructions in accordance with its ULC System designation. Care shall be taken at all times to prevent the entry of moisture into the ends of the cable.
 - .2 Fire Rated Cable shall be supported as per its ULC System designation requirements. Coordinate all routing and mounting requirements with manufacturer's written instructions.
 - .3 Preinstallation Testing:
 - .1 Prior to pulling wiring cable into place, an insulation resistance test shall be performed by installing contractor to ensure integrity of wiring cable as described in the installation manual.
 - .2 Proceed with installation only after any unsatisfactory conditions have been corrected.
- .17 VFD Cabling
 - .1 Provide VFD cable between the VFD and associated motor for all for all VFD driven motors. Coordinate VFD locations with mechanical. VFD cable lengths shall be kept as small as practically possible to reduce electromagnetic interference. Maintain as much separation as possible between noise-susceptible cables and VFD cables: a minimum of 1 ft. for shielded instrumentation cables and 3 ft. for unshielded instrumentation cables. If the VFD cables and noise-susceptible cables must lie close to each other, parallel runs shall not exceed 3 m (10 ft.). If VFD cable must cross other cable type, cables shall cross perpendicularly, at a single point.
- .18 Use suitable cable fittings and connectors.
- .19 Use bonding bushings at both ends of armoured cables.
- .20 Neatly train and lace wiring inside boxes, equipment, and panelboards.
- .21 Clean conductor surfaces before installing lugs and connectors.
- .22 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

- .23 Aluminum Conductors
 - .1 Terminate aluminum conductors with tin-plated aluminum- bodied compression connectors only. Fill with anti- oxidant compound before installing conductor.
 - .2 Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- .24 Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- .25 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- .26 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- .27 Trench and backfill for direct burial cable installation as specified in Section 32 23 18 and Section 32 23 23. Install warning tape along entire length of direct burial cable, within 75 mm(3 inches) of grade.
- .28 Identify wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

3.5 Testin

- .1 Fire Rated Cabling
 - .1 Complete Insulation Resistance
 - .1 Megger all cables at the following stages.
 - .1 When received at Project site before installation.
 - .2 After sealing termination prior to being attached to the termination point.
 - .2 Maintain and submit records of testing
 - .3 Insulation resistance must exceed 200 megohms at 500 V dc.
 - .4 All results must meet manufacturer's specification.
 - .2 Inspections:
 - .1 After installing conductors and cables and before electrical circuitry has been energized, test all conductors for compliance with requirements.
 - .2 Perform each of the following visual and electrical tests:
 - .1 Inspect exposed sections of conductor and cable for physical damage and correct connection in accordance with the single-line diagram.
 - .2 Test bolted connections for high resistance using one of the following:
 - .1 Low-resistance ohmmeter.
 - .2 Calibrated torque wrench.
 - .3 Inspect for correct identification.
 - .4 Inspect cable jacket and condition.

- .5 Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500V (dc) for 300V and 600V cable for a one-minute duration.
- .6 Continuity test on each conductor and cable.
- .7 Uniform resistance of parallel conductors.
- .3 Installation will be considered failed if it does not pass tests and inspections.
- .4 Prepare test and inspection reports to record the following:
 - .1 Procedures used.
 - .2 Results that comply with requirements.
- .5 Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements. Provide manufacturer's review and test report confirming that cabling system has been installed per their recommendations and meets performance requirements.
- .6 Provide manufacturer's certification of extended warranty.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Grounding electrodes and conductors.
- .2 Equipment grounding conductors.
- .3 Bonding.

1.2 Related Sections

- .1 Section 26 00 00 □ Basic Electrical Materials and Methods.
- .2 Section 26 41 00 - Lightning Protection.
- .3 Section 33 79 19 - Site Utilities Grounding.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-Z32-09 Electrical Safety & Essential Electrical Systems in Health Care Facilities.
- .3 IEEE 81-2012 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

1.4 System Description

- .1 Metal and underground water pipe.
- .2 Metal frame of the building.
- .3 Ground ring specified in Section 33 79 19.
- .4 Metal and underground gas piping system.
- .5 Rod electrode.

1.5 Performance Requirements

- .1 Maximum Grounding System Resistance: 5 ohms.

1.6 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide for grounding electrodes and connections.

1.7 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate overall resistance to ground.

1.8 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Record Documentation: Record actual locations of components and grounding electrodes.
- .3 Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.9 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.

1.10 Regulatory Requirements

- .1 Products: Listed and classified by ULC and/or CSA as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Rod Electrodes

- .1 Material: Copper-clad steel.
- .2 Diameter: 15.8mm (5/8 inch) minimum.
- .3 Length and Quantity: As required to meet performance requirements.

2.2 Mechanical Connectors

- .1 Material: Bronze.

2.3 Wire

- .1 Material: Stranded copper.
- .2 Grounding Electrode Conductor: Size to meet CSA-C22.1 requirements.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 Installation

- .1 Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- .2 Provide bonding to meet Regulatory Requirements.
- .3 Exposed conductors shall be protected from mechanical injury.
- .4 Mechanical connections shall be used for bonding connections to equipment. Soldered joints shall not be permitted.
- .5 Buried connections of grounding and bonding conductors shall be made using exothermic welding process.

- .6 Provide bonding wire connected to both ends of flexible conduit. Neatly attach to exterior of flexible conduit.
- .7 Provide separate ground conductors for all exterior pole mounted luminaires.
- .8 Interface with site grounding system.
- .9 Interface with lightning protection system.
- .10 Bonding connections shall be made using a star configuration. Loop connections shall be avoided.
- .11 Single conductor cables with metallic armour shall be bonded at the supply end only. Provide non-metallic entry plates for load end terminations. Provide a separate bonding conductor.
- .12 Provide separate bonding conductor in all non-metallic raceways.
- .13 Bond together metal siding not attached to grounded structure; bond to ground.
- .14 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- .15 Provide additional separate bonding conductor within branch circuit raceways where indicated on the drawings. Terminate each end on suitable lug, bus, or bushing.

3.3 Syste Groundin

- .1 Install system and circuit grounding connection to neutral points of 600V and 208V systems.
- .2 Grounding conductors shall be routed in or adjacent to primary conduits or cables.
- .3 Provide grounding connection to utility pad mounted transformer in accordance with the requirements of the supply authority.

3.4 E ui ent Bondin

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to:
 - .1 Service equipment
 - .2 Distribution Panels
 - .3 Transformers
 - .4 Generators
 - .5 Motor Frames
 - .6 Motor Control Centres
 - .7 Starters
 - .8 Control Panels
 - .9 Building Steel Work
 - .10 Elevators
 - .11 Outdoor lighting

3.5 Co unication S□ste s

- .1 Install communications grounding system for bonding of all telephone, data, fire alarm, paging as follows:
 - .1 Provide minimum #6 AWG ground (or larger as indicated on drawings) from all voice/data, server, and IT communications rooms to main building ground.
 - .2 Provide grounding for utility telephone and data demarcation locations in accordance with utility requirements.
 - .3 Sound, fire alarm, and other communication systems as indicated.

3.6 Field Qualit□ Control

- .1 Perform ground continuity and resistance tests using fall-of-potential measurement system method per IEEE 81-2012 standards. A report shall be submitted to the Contract Administrator from the testing agency.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator, if provided, during tests.
- .4 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Conduit and equipment supports.
- .2 Anchors and fasteners.

1.2 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CECA - Canadian Electrical Contractors Association.
- .3 CSA (Canadian Standards Association).
- .4 ULC (Underwriters Laboratories of Canada).

1.3 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide manufacturer's catalogue data for fastening systems.

1.4 Regulator Requirements

- .1 Provide products listed and classified by CSA and as suitable for purpose specified and shown.

Part 2 Products

2.1 Product Requirements

- .1 Materials and Finishes: Provide adequate corrosion resistance.
- .2 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- .3 Anchors and Fasteners:
 - .1 Concrete Structural Elements: Use expansion anchors.
 - .2 Steel Structural Elements: Use beam clamps and spring steel clips.
 - .3 Concrete Surfaces: Use expansion anchors.
 - .4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - .5 Solid Masonry Walls: Use expansion anchors.
 - .6 Sheet Metal: Use sheet metal screws.
 - .7 Wood Elements: Use wood screws.

2.2 Steel Channel

- .1 U-shape, galvanized steel or stainless steel as indicated, sized to suit installation, surface-mounted, suspended or set in poured concrete walls and ceilings as required.

- .2 Provide appropriate anchors, fasteners, fittings and supports for a complete supporting system.

2.3 Roo Installations

- .1 For roof mounted conduit and wiring, provide supports equivalent to MIFAB C-Port Series. Minimum 6 1/2" height, supports to be constructed of recycled rubber, UV resistant and designed to support rooftop equipment. Supports to be selected, sized, and configured to match equipment installation requirements and roof construction with pipe clamps. All metal work including strut or pipe clamps to be stainless steel.

2.4 Installation

- .1 Provide anchors, fasteners, and supports to CSA-C22.1.
- .2 Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- .3 Do not use powder-actuated anchors.
- .4 Do not drill or cut structural members.
- .5 Do not use plastic cable ties.
- .6 Use stainless steel channel for exterior or wet applications.
- .7 Use galvanized steel channel for interior dry location applications.
- .8 Fabricate supports primarily from steel channel systems. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- .9 Where the structural system is open web steel joists, supporting device shall be by means of structural steel angles or channel system spanning the top chords of adjacent joists. The number of joists to be spanned in this way shall be determined by the incident load of the system or equipment being supported.
- .10 In no case shall the hanging of the electrical supporting devices be directly from roof or ceiling decking, be allowed, unless special permission is obtained from the Contract Administrator.
- .11 Install surface-mounted cabinets and panelboards with minimum of four anchors.
- .12 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 inch) off wall.
- .13 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Metal conduit.
- .2 PVC coated metal conduit.
- .3 Flexible metal conduit.
- .4 Liquid tight flexible metal conduit.
- .5 Electrical metallic tubing.
- .6 Non-metallic conduit.
- .7 Electrical non-metallic tubing.

1.2 Related Sections

- .1 Section 07 84 00 - Firestopping.
- .2 Section 26 05 34 - Boxes.
- .3 Section 26 05 37 - Duct Bank.
- .4 Section 26 05 26 - Grounding And Bonding.
- .5 Section 26 05 29 - Electrical Supporting Devices.
- .6 Section 26 05 53 - Electrical Identification.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 18.1-13 (R2018) - Metallic Outlet Boxes.
- .3 CSA C22.2 No. 45.1-07 (R2017) - Electrical Rigid Metal Conduit - Steel.
- .4 CSA C22.2 No. 56-17 - Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .5 CSA-C22.2 No. 83.1-07 (R2017) - Electrical Metallic Tubing - Steel.
- .6 CSA C22.2 No. 211.1-06 (R2016) - Rigid Types EB1 and DB2/ES2 PVC Conduit.
- .7 CSA C22.2 No. 211.2-06 (R2016) - Rigid PVC (Unplasticized) Conduit.
- .8 CSA C22.2 No. 2420-09 (R2014) - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- .9 CSA C22.2 No. 227.2.1-14 - Liquid-Tight Flexible Nonmetallic Conduit.
- .10 CSA C22.2 No. 327-18 - HDPE Conduit, Conductors-in-conduit, and Fittings
- .11 CSA (Canadian Standards Association).
- .12 ULC (Underwriters Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate location with roofing installation

1.5 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation:
 - .1 Accurately record actual routing of conduits equal to or larger than 35mm (1-1/4").
 - .2 Accurately record actual routing of backbone conduit runs.
 - .3 Accurately record actual routing of all conduit in slab.

1.6 Regulator Requirements

- .1 Design conduit size to CSA-C22.1.
- .2 Provide products listed and classified by CSA or ULC as suitable for purpose specified and shown.

1.7 Delivery, Storage, and Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Accept conduit on site. Inspect for damage.
- .3 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- .4 Protect PVC conduit from sunlight.

Part 2 Products

2.1 Conduit Requirements

- .1 Minimum Size: 21 mm (3/4 inch) unless otherwise specified.
- .2 Underground Installations:
 - .1 More than 1525 mm (5 ft) from Foundation Wall: Use thick wall non-metallic conduit.
 - .2 Within 1525 mm (5 ft) from Foundation Wall: Use rigid steel conduit.
 - .3 In or Under Slab on Grade: Use thick wall non-metallic conduit.
 - .4 Minimum Size: 27 mm (1 inch).
 - .5 Provide a separate ground wire in all below-grade conduits.
 - .6 Provide an exterior trace wire for all conduits containing non-current carrying cabling.
 - .7 Use waterproof fittings.
- .3 Outdoor Locations, Above Grade: Use rigid steel conduit.
- .4 In Slab:
 - .1 Use electrical non-metallic tubing.

- .2 Maximum Size Conduit in Slab: 27mm (1 inch)
- .5 Wet and Damp Locations: Use non-metallic conduit.
- .6 Dry Locations:
 - .1 Concealed: Use electrical metallic tubing.
 - .2 Exposed: Use electrical metallic tubing.
- .7 Hazardous Areas: Use rigid steel conduit or TECK cable complete with conduit seal fittings and compound.
- .8 Raised Floor Systems: Liquid-tight flexible metal conduit or TECK cable.

2.2 Metal Conduit

- .1 Rigid Steel Conduit: C22.2 No. 45.1.
- .2 Fittings and Conduit Bodies: All steel fittings.

2.3 Flexible Metal Conduit

- .1 Description: Interlocked steel construction.
- .2 Fittings: CSA C22.2 No. 56.
- .3 Provide a separate ground wire in all flexible metal conduit.

2.4 Liquid Tight Flexible Metal Conduit

- .1 Description: Interlocked steel construction with PVC jacket.
- .2 Fittings: CSA C22.2 No. 56.
- .3 Provide a separate ground wire in all liquid tight flexible metal conduit.

2.5 Electrical Metallic Tubing (EMT)

- .1 Description: CSA C22.2 NO. 83.1; galvanized tubing.
- .2 Fittings and Conduit Bodies: CSA C22.2 No. 83.1; steel, set screw type in dry locations, watertight connectors in sprinklered areas
- .3 Refer to Section 26 05 53 for colour requirements.

2.6 Non-Metallic Conduit

- .1 Description:
 - .1 CSA C22.2 No. 211.2; PVC.
 - .2 CSA C22.2 No. 327-18; HDPE
- .2 Fittings and Conduit Bodies:
 - .1 CSA C22.2 No. 211.2.
 - .2 CSA C22.2 No. 327-18
- .3 Provide a separate ground wire in all non-metallic conduit

2.7 Fittings

- .1 Fittings shall be manufactured for use with conduit specified.
- .2 Insulated throat liners on connectors.

- .3 Steel raintight connector fittings complete with O-rings, for use on weatherproof or sprinkler proof enclosures. Steel raintight couplings shall be used for surface conduit installation exposed to moisture or sprinkler heads. Steel raintight connectors shall be used for all top entries to panels, contactors and motor control centres.
- .4 Expansion fittings
 - .1 Outdoor locations - Weatherproof expansion fittings with internal bonding assembly, suitable for 100 mm (4") or 200 mm (8") linear expansion.
 - .2 Wet and Damp Locations - Watertight expansion fittings with integral bonding jumper suitable for linear expansion, and 21 mm (3/4") deflection in all directions, as required.
 - .3 Panel Entry - Weatherproof expansion fittings for linear expansion as required.
 - .4 PVC Conduit - O-ring type expansion fittings.
 - .5 Flexible watertight conduit between junction boxes with integral bonding jumper suitable for linear and lateral movement greater than 19 mm (3/4").

Part 3 Execution

3.1 Execution

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that field measurements are as shown on Drawings.
- .3 Verify routing and termination locations of conduit prior to rough-in.
- .4 Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- .5 Drawings do not contain all conduits. Provide all conduit as required for a complete system.
- .6 All conduit sizes indicated on drawings are minimum sizes unless otherwise noted. Where larger conduit sizes are required to meet Canadian Electrical Code requirements, contractor shall provide larger size at no additional cost. Increase conduit size at no extra costs where required to accommodate length of run and voltage drop requirements in accordance with Canadian Electrical Code requirements.

3.2 Installation

- .1 Install conduit to CSA C22.1.
- .2 Install non-metallic conduit to manufacturer's written instructions.
- .3 Arrange supports to prevent misalignment during wiring installation.
- .4 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- .5 Group related conduits; support using conduit rack.
- .6 Construct rack using steel channel. Provide space on each for 25% additional conduits.

- .7 Fasten conduit supports to building structure and surfaces to Section 26 05 29.
- .8 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- .9 Do not attach conduit to ceiling support wires.
- .10 Arrange conduit to maintain headroom and present neat appearance.
- .11 Provide flexible metal conduit for all connections to motors, recessed lighting, suspended lighting, transformers, and equipment subject to movement or vibration.
- .12 Provide conduit systems for all home run and main branch wiring in ceiling spaces. AC-90 shall be used only for connections from conduit systems to wiring devices in steel stud partitions and lighting fixtures for a maximum of 1830 mm (6 feet) horizontally from the conduit system junction box.
- .13 Conduit Routing:
 - .1 All conduit shall be concealed except in mechanical and electrical rooms or as otherwise noted.
 - .2 Where surface conduit is installed:
 - .1 Locate more than 2000 mm (78 inches) from infrared or gas-fired heaters.
 - .2 Group conduits on suspended or surface rack support.
 - .3 Route conduit parallel and perpendicular to walls.
 - .4 Route conduit installed above accessible ceilings parallel and perpendicular to walls.
 - .5 Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
 - .6 Route conduit in and under slab from point-to-point.
 - .7 Do not route conduits through structural members unless otherwise indicated.
 - .8 Do not route conduit through terrazzo or concrete toppings unless otherwise indicated.
 - .9 Do not route conduit horizontally in masonry walls unless otherwise indicated.
 - .10 Do not cross conduits in slab.
- .14 Conduits in Poured Concrete:
 - .1 Submit marked up drawings of proposed conduit routing complete with conduit sizes to Structural and Electrical Contract Administrators for approval prior to installation.
 - .2 Coordinate installation of conduit to suit reinforcing steel.
 - .3 Locate in centre third of slab.
 - .4 Provide minimum separation of 150 mm (6") between parallel conduit runs.
 - .5 Do not install conduit in drop panels, beams, or columns unless approved by the Structural Contract Administrator.

- .6 Where conduits are grouped, or do not follow perpendicular to parallel to building lines, provide photos in electronic format (minimum resolution 1920x1080) of conduit installation prior to concrete pour.
- .7 Record drawings shall indicate location of all conduit embedded in concrete, or run below slab complete with dimensions to building lines.
- .8 For slab-on-grade, conduit larger than 27 mm (1") shall be routed below slab and encased in minimum 75 mm (3") of concrete.
- .15 All conduit below grade shall be sloped to provide drainage away from the building.
- .16 Where conduit is installed on building exterior, or direct buried, make provision for differential settling of exterior grade, buildings and other structures and supports. Provide expansion fittings as required.
- .17 Maintain adequate clearance between conduit and piping.
- .18 Maintain 300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding 40 degrees C (104 degrees F).
- .19 Cut conduit square using saw or pipe cutter; de-burr cut ends.
- .20 Bring conduit to shoulder of fittings; fasten securely.
- .21 Where threaded connections are used, threads shall be of sufficient length to ensure a tight connection.
- .22 Where conduit becomes blocked, remove and replaced blocked sections.
- .23 Join non-metallic conduit using cement as recommended by manufacturer.
 - .1 Wipe non-metallic conduit dry and clean before joining.
 - .2 Apply full even coat of cement to entire area inserted in fitting.
 - .3 Allow joint to cure for 20 minutes, minimum.
- .24 Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- .25 Install no more than equivalent of two 90-degree bends between boxes.
 - .1 Use conduit bodies to make sharp changes in direction, as around beams.
 - .2 Use hydraulic one-shot bender to fabricate and factory elbows for bends in metal conduit larger than 53 mm (2 inch) size.
 - .3 All metallic conduit shall be bent cold. Replace sections where conduit is kinked or flattened by more than 10% of its original diameter.
- .26 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- .27 Ensure conduit systems are dry prior to installation of wiring.
- .28 Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and control expansion joints, and where conduit transitions from below to above grade.
- .29 Provide polypropylene pull string in each empty conduit except sleeves and nipples.

- .30 Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- .31 Ground and bond conduit to Section 26 05 26.
- .32 Identify conduit to Section 26 05 53.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Wall and ceiling outlet boxes.
- .2 Parking lot outlet boxes.
- .3 Floor boxes.
- .4 Pull and junction boxes.

1.2 Related Sections

- .1 Section 07 84 00 - Firestopping.
- .2 Section 08 31 13 - Access Doors And Frames.
- .3 Section 26 27 26 - Wiring Devices.
- .4 Section 26 27 16 - Cabinets And Enclosures.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 18.1-13 (R2018) - Metallic Outlet Boxes.
- .3 CSA C22.2 No. 40-17 - Junction and Pull Boxes.
- .4 CSA C22.2 No. 85-14 - Rigid PVC Boxes and Fittings.
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate installation of outlet box for equipment connected under Section 26 05 80.

1.5 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.6 Regulator Requirements

- .1 Products: Listed and classified by CSA or ULC, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Outlet Boxes

- .1 Sheet Metal Outlet Boxes: CSA-C22.2 No. 18, galvanized steel.
 - .1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm (1/2 inch) male fixture studs where required.
 - .2 Concrete Ceiling Boxes: Concrete type.
- .2 Non-metallic Outlet Boxes: CSA-C22.2 No. 18.
- .3 Cast Boxes: CSA-C22.2 No. 18, Type FS or FD as required, cast ferric alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- .4 In-wall Boxes: 18 gauge white powder coated steel complete with trim ring, will accept standard single gang outlet boxes, wiring devices and cover plates, complete with screw-on steel cover with cable exit.
- .5 Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.2 Par in Lot Outlet Box

- .1 Wall or Fence Mounted: CSA-C22.2 No. 18, type 3R rated, while in use 45 degree receptacle mounting flange, 6□x 6□x 4□galvanized steel body, ground lug type A, spot welded construction, for use with IPLC receptacle.
- .2 Manufacturers:
 - .1 ACE Manufacturing Metals Ltd.: APB-WIA Series

2.3 Floor Boxes

- .1 Floor Boxes: CSA-C22.2 No. 18, fully adjustable, four compartments with feed through tunnel compartment, standard 87 mm (3-7/16 inches) deep, suitable for concrete or wood floor applications.
- .2 Manufacturers:
 - .1 Legrand Wiremold: RFB4 series.
 - .2 Thomas & Betts Steel City: 665 series.
- .3 Substitutions: Refer to 26 05 00 Common Work Results for Electrical.
- .4 Material: Steel.
- .5 Shape: Rectangular.
- .6 Service Fittings: As specified in Section 26 27 26.
- .7 Shape: Rectangular.
- .8 Service Fittings: As specified in Section 26 27 26.

2.4 Pull and Junction Boxes

- .1 Sheet Metal Boxes: CSA-C22.2 No. 18, galvanized steel.
- .2 Hinged Enclosures: As specified in Section 26 27 16.
- .3 Surface Mounted Cast Metal Box: CSA-C22.2 No. 18, Type 4 or Type 6 as required or as indicated; flat-flanged, surface mounted junction box:

- .1 Material: Galvanized cast iron.
- .2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.
- .4 In-Ground Cast Metal Box: CSA-C22.2 No. 18, Type 6, flanged, recessed cover box for flush mounting:
 - .1 Material: Galvanized cast iron.
 - .2 Cover: Non-skid cover with neoprene gasket and stainless steel cover screws.
 - .3 Cover Legend: "ELECTRIC".
- .5 Fibreglass Hand Holes: Die moulded glass fibre hand holes:
 - .1 Cable Entrance: Pre-cut 150 x 150 mm (6 x 6 inch) or as indicated, cable entrance at centre bottom of each side.
 - .2 Cover: Glass fibre weatherproof cover with non-skid finish.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify locations of floor boxes and outlets throughout prior to rough-in.

3.2 Installation

- .1 Install boxes to CSA-C22.1.
- .2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- .3 Set wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device and as indicated. Coordinate locations with architectural drawings.
- .4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3 m (10 ft) if required to accommodate intended purpose.
- .5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- .6 Maintain headroom and present neat mechanical appearance.
- .7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- .8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm (6 inches) from ceiling access panel or from removable recessed luminaire.
- .9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- .10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

- .11 Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- .12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- .13 Use flush mounting outlet box in finished areas.
- .14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- .15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm (6 inches) separation. Provide minimum 600 mm (24 inches) separation in acoustic rated walls.
- .16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- .17 Use stamped steel bridges to fasten flush mounting outlet box between studs.
- .18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- .19 In-wall boxes:
 - .1 Use in-wall boxes for wall mounted television and smart board power and communications applications.
- .20 Do not install in-wall box back-to-back in walls; provide minimum 150 mm (6 inches) separation. Provide minimum 600 mm (24 inches) separation in acoustic rated walls.
- .21 Secure in-wall box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Use stamped steel bridges to fasten in-wall outlet box between studs.
- .22 Install in-wall mounting box without damaging wall insulation or reducing its effectiveness.
- .23 Use adjustable steel channel fasteners for hung ceiling outlet box.
- .24 Do not fasten boxes to ceiling support wires.
- .25 Support boxes independently of adjacent or connecting conduit systems.
- .26 Use gang box where more than one device is mounted together.
- .27 The use of sectional boxes is not permitted.
- .28 Use gang box with plaster ring for single device outlets.
- .29 Use cast outlet box in exterior locations where exposed to the weather and wet locations.
- .30 Set floor boxes level.
- .31 Large Pull Boxes: Where pull boxes have a long dimension of 305 mm (12 inches) or more, use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.
- .32 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .33 Vacuum clean interior of outlet boxes before installation of wiring devices.

3.3 Ad ustin

- .1 Adjust floor box flush with finish flooring material.
- .2 Adjust flush-mounting outlets to make front flush with finished wall material.
- .3 Install knockout closures in unused box openings.

3.4 Cleanin

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean interior of boxes to remove dust, debris, and other material.
- .3 Clean exposed surfaces and restore finish.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Nameplates and labels.
- .2 Wire markers.
- .3 Conduit markers.
- .4 Underground warning tape.

1.2 References

- .1 CSA (Canadian Standards Association).
- .2 ULC (Underwriters Laboratories of Canada).

1.3 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide catalogue data for nameplates, labels, and markers.
- .3 Installation Data: Provide list of all equipment requiring nameplates complete with associated nameplate configuration for review.

1.4 Regulator Requirements

- .1 Provide products listed and classified by CSA or ULC and as suitable for purpose specified and shown.

1.5 Language

- .1 All identification shall be in English.

Part 2 Products

2.1 Nameplates and Labels

- .1 Nameplates:
 - .1 Exterior Stainless steel, etched and color filled with stamped product specific labelling.
 - .2 Interior - Engraved three-layer laminated plastic, white letters on blue background for normal power and systems, white letters on red background for life safety power and systems, and white letters on orange background for standby power and systems.
 - .3 Locations:
 - .1 Electrical distribution, motor control centres, disconnect switches, panelboards and control equipment enclosures.
 - .1 Nameplate shall include:
 - .1 Distribution Name
 - .2 Distribution Voltage, Phase, Wires, Amperage
 - .3 Room Location

- .4 Fed From:
 - .1 Panel Name
 - .2 Supplying Breaker Size/Poles
 - .3 Room Location
- .2 Electrical distribution and motor control centres.
 - .1 Nameplates at individual breakers shall include:
 - .1 Load Name
 - .2 Room Location of Load
 - .3 Breaker Size/Poles
- .3 Electrical distribution and panelboards where breakers are applied in series ratings shall also include:
 - .1 BREAKERS ARE INSTALLED IN A SERIES RATED COMBINATION AND SHALL ONLY BE REPLACED WITH COMPONENTS OF THE SAME TYPE AND RATING.
- .4 Circuit breakers and fused switches which directly feed a single conductor cable shall include the maximum continuous load allowed:
 - .1 MAXIMUM CONTINUOUS LOAD: X AMPS
- .5 Adjustable circuit breakers shall include the maximum continuous load allowed:
 - .1 MAXIMUM CONTINUOUS LOAD: X AMPS
- .6 Mechanical equipment disconnect switches:
 - .1 Nameplate shall include:
 - .1 Mechanical Equipment Mark
 - .2 Panel Name & Circuit number
- .7 Communication/Systems Racks & Cabinets
 - .1 Nameplate shall include:
 - .1 System Name
 - .2 Room Number
 - .3 Rack/Cabinet Number (if applicable)
 - .4 Fed From:
 - .1 Room Number.
 - .2 Rack/Cabinet Number (if applicable)
 - .3 Patch Panel and/or Rack Position (if applicable)
- .8 Fire Alarm System Equipment
 - .1 Nameplate shall include:
 - .1 Room Number
 - .2 Equipment Name
 - .3 Fed From:
 - .1 Room Number.
 - .2 Panel Name and Circuit Number
- .9 Fire Alarm Equipment Branch Circuit Breakers

- .1 Nameplate shall be red using white lettering and meet AHJ requirements. Nameplate shall indicate FIRE ALARM PANEL, NACPS etc. or approved wording.
- .10 Pole mounted luminaires.
 - .1 Nameplate shall include:
 - .1 Manufacturer & Model # of Pole
 - .2 Manufacturer & Model # of Luminaire
 - .3 Voltage
 - .4 Ballast Model #
 - .5 Lamp Wattage & Model #
 - .6 Fed From Panel & Circuit Number
 - .11 Emergency Lighting Units.
 - .1 Nameplate shall include:
 - .1 Unit #
 - .2 Manufacturer & Model # of unit equipment
 - .3 AC circuit supplying unit
 - .4 AC lighting circuits monitored (voltage relay)
 - .5 Date installed
 - .12 Parking receptacles.
 - .1 Nameplate shall include:
 - .1 Circuit number
- .4 Letter Size:
 - .1 Use 6mm (1/4 inch) letters for identifying equipment mark designations and system types.
 - .2 Use 3mm (1/8 inch) letters for identifying supporting information.
 - .3 Use 6mm (1/4 inch) letters for identifying grouped equipment and loads.
 - .5 Nameplates on exterior equipment shall be UV & weather resistant.
 - .6 Wording on nameplates shall be approved prior to manufacture. Submit schedule of nameplates and wording.
- .2 Labels: Plastic self-adhesive non-smear labels with 5mm (3/16 inch) black letters on white background.
 - .1 Locations:
 - .1 Wiring devices, including lighting control devices and receptacles.
 - .1 Label shall include:
 - .1 Indicate associated panel and circuit number.
 - .2 E.g. A-32 (A is for Panel-A, and 32 is the circuit number)
 - .3 Lighting controls to include brief description of lighting being controlled.
 - .4 E.g. Pendants
 - .2 Voice/Data Outlets
 - .1 Label shall include:
 - .1 Indicate associated rack or cabinet name

- .2 Indicate associated patch panel and drop number
- .3 E.g. □IDC-A-13□(IDC is for rack name, patch panel A, drop number 13)
- .3 Voice/Data Patch Panels
 - .1 Label shall include:
 - .1 Indicate associated rack or cabinet name
 - .2 Indicate patch panel name.
 - .3 E.g. □IDC-A□(IDC is for rack name, patch panel A)

2.2 Wire Mark ers

- .1 Wire Markers: Permanent tape type wire markers not susceptible to thermal or mechanical influence.
- .2 Locations:
 - .1 Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.
 - .1 Legend:
 - .1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - .2 Control Circuits: Control wire number indicated on Shop Drawings.
 - .2 Voice/Data drops including both ends of cable.
 - .1 Label shall include:
 - .1 Indicate associated rack or cabinet name
 - .2 Indicate associated patch panel and drop number
 - .3 E.g. □IDC-A-13□(IDC is for rack name, patch panel A, drop number 13)

2.3 Conduit Mar ers

- .1 Manufacturers:
 - .1 Brady; Product: BMP71 Indoor/Outdoor Vinyl Labels.
 - .2 Substitutions: Refer to Section 26 05 00.
- .2 Description: Vinyl label.
- .3 Location: Provide markers for each conduit longer than 4.7m (10 ft).
- .4 Spacing: 6m (20 ft) on centre.
- .5 Colour:
 - .1 Normal Power System: Blue
 - .2 Life-Safety Power System: Red
 - .3 Standby Power System: Orange
 - .4 Fire Alarm System: Red.
 - .5 Communication System: Yellow
 - .6 Security Systems: Black
 - .7 Nursecall Systems: Pink

- .8 Controls System: White
- .6 Legend:
 - .1 600 Volt System: 600V.
 - .2 120/208 Volt System: 120/208V.
 - .3 Fire Alarm System: FIRE ALARM.
 - .4 Communication System:
 - .1 VOICE
 - .2 DATA
 - .3 VOICE/DATA
 - .5 Public Address System: PA
 - .6 CCTV System: CCTV
 - .7 Access Control System: ACCESS CONTROL
 - .8 Intrusion System: INTRUSION
 - .9 Nursecall System: NURSECALL
 - .10 Controls System: CONTROLS

2.4 Under ground Warning Tape

- .1 Manufacturers: Brady
 - .1 Product: Detectable Identoline.

Part 3 Execution

3.1 Preparation

- .1 Degrease and clean surfaces to receive nameplates and labels.

3.2 Application

- .1 Install nameplate and label parallel to equipment lines.
- .2 Secure nameplate to equipment front using rivets or screws.
- .3 Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- .4 Conduit shall be integrally colour coded through a colouring process applied by the conduit manufacturer.
- .5 Identify underground conduits using underground warning tape. Install one tape per trench at 75mm (3 inches) below finished grade.
- .6 Provide identification on all junction box covers indicating associated system, panel and circuit numbering using permanent marker.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Electrical connections to equipment specified under other sections.

1.2 Related Sections

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 08 33 23 - Overhead Coiling Doors.
- .3 Section 22 47 00 - Plumbing Equipment.
- .4 Section 23 81 13 - Unitary Air Conditioners.
- .5 Section 26 05 33 - Conduit.
- .6 Section 26 05 19 - Building Wire And Cable.
- .7 Section 26 05 34 - Boxes.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 127-18 - Equipment and Lead Wires.
- .3 ANSI/NEMA WD 6-2016 Wiring Devices □ Dimensional Specifications.
- .4 NEMA WD 1-1999 (R2015) - General Colour Requirements for Wiring Devices.
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters □ Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.
 - .3 Determine connection locations and requirements.
- .3 Sequencing:
 - .1 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
 - .2 Sequence electrical connections to coordinate with start-up schedule for equipment.

1.5 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.

1.6 Su itttals or In or ation

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.7 Re ulator Re uire ents

- .1 Products: Listed and classified by CSA or ULC, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Mec anical E ui ent Connections

- .1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.
- .2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment, except for temperature/humidity control systems.
- .3 Unless otherwise noted, motors and control devices shall be supplied by Division 21, 22, and 23. Motor horsepower ratings shall be as shown in the Division 21, 22, and 23 specifications.
- .4 Provide the Mechanical Contractor with a copy of the Motor Schedule and ensure conformance with voltage shown.
- .5 All equipment, mounted on the exterior of the building, shall be weatherproof.

2.2 Cords and Ca s

- .1 Attachment Plug Construction: Conform to NEMA WD 1.
- .2 Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- .3 Cord Construction: NFPA 70, Type SJO, multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- .4 Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over-current protection.

2.3 Auto atic Door O erators

- .1 Power: Wire and connect motorized door operators as indicated.
- .2 Controls: Wire and connect all associated controls including but not limited to entry pushbuttons, vertical kick bars, motion sensors, electric strikes, electric locks, key switches etc. Confirm controls requirements with automatic door shop drawings and automatic door contractor.

- .3 Interface with Other Systems:
 - .1 Interface with access control system and intrusion alarm system as indicated. Coordinate sequencing of door operators with other systems to City's requirements.
 - .2 Where fire doors equipped with power-operators are installed in rated wall assembly partitions, wire and connect the power-operator fire alarm releasing device to the fire alarm system using an addressable relay control module. Power-operator shall release on ALARM event only.
- .4 Execution: Coordinate complete installation with automatic door shop drawings and automatic door contractor.

2.4 Overhead Door Operators

- .1 Power: Provide a disconnect switch at overhead door motor electrical connection.
- .2 Controls: Wire and connect overhead door up/down controls complete with all safety controls including but not limited to remote control panel, open/close drive loops and infrared safety beams. Confirm controls requirements with overhead door shop drawings and overhead door contractor.
- .3 Interface with Other Systems: Interface with access control system and intrusion alarm system as indicated. Coordinate sequencing of door operators with other systems to City's requirements.
- .4 Execution: Coordinate complete installation with overhead door shop drawings and overhead door contractor.

2.5 Fuel-Fired Appliance Emergency Shut-Off

- .1 Provide red emergency push button with yellow back-box to disconnect power to all fuel-fired equipment throughout the space.
- .2 Emergency shut-off shall incorporate a 24V control scheme using contactors for designated appliances.
- .3 Identify shut-off with "FUEL-FIRED APPLIANCE EMERGENCY SHUT-OFF"
- .4 Provide a manual control device vandal guard complete with clear vandal resistant, UV Stabilized polycarbonate shield and frame complete with integral 95db piezo horn and battery. Vandal guard shall be equal to STI Stopper II series.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 Electrical Connections

- .1 Make electrical connections to equipment manufacturer's written instructions.
- .2 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

- .3 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- .4 Provide receptacle outlet where connection with attachment plug is indicated or as required. Provide cord and cap where field-supplied attachment plug is indicated or as required.
- .5 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- .6 Install disconnect switches, controllers, control stations, and control devices as indicated or as required by the manufacturer of the associated equipment.
- .7 Modify equipment control wiring with terminal block jumpers as indicated or as required.
- .8 Provide interconnecting conduit and wiring between devices and equipment where indicated or as required.
- .9 Provide ground fault circuit interrupter type circuit breakers for circuits supplying hot tubs, whirlpool tubs, tub lifts etc. Wire and connect associated controls as required by the equipment shop drawings.
- .10 Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.
- .11 Illuminated Signage: Provide a disconnect switch for illuminated signage.
- .12 Pre-Wired Powered Furniture:
 - .1 Power Wiring:
 - .1 Provide a termination box suitable for furniture whip power connection. Coordinate locations and quantities of termination boxes for furniture whip connections with furniture supplier.
 - .2 Coordinate lengths of all furniture whips with furniture supplier such that furniture whips are supplied at appropriate lengths, pre-cut and CSA certified from factory.
 - .3 Where furniture whips require field cutting, include all costs necessary for CSA field certification of furniture whip field modifications.
- .13 Mechanical Equipment:
 - .1 Power Wiring
 - .1 Install power feeders, starters, disconnects, and associated equipment and make connections to all mechanical equipment.
 - .2 Wire and connect all loose line and load side reactors to associated drives as required. Coordinate locations and quantities with mechanical contractor.
 - .3 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.
 - .4 Install main power feeders to starter/control panels furnished by Division 21, 22, and 23. Install branch wiring from starter/control panels to controlled equipment such as motors, electric coils, etc.
 - .5 Flexible connections to motors shall not exceed 6 feet (1.83 m), unless approved by Contract Administrator.
 - .2 Controls

- .1 Install all electrical controls as indicated on the drawing schedules.
- .2 Wire and connect line voltage remote thermostats and P/E switches for furnaces, condensing units, force flows, gas-fired unit heaters, electric heaters and rooftop units.
- .3 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, domestic hot water recirculating pumps, booster pumps, jockey pumps and compressors.
- .4 Wire and connect electrical interlocks for starters supplied by Division 21, 22, and 23.
- .5 Wire and connect hi-limit cutouts for remotely mounted electric heating coils provided by Division 21, 22, and 23.
- .3 Disconnects
 - .1 Disconnects shall be mounted independently from the equipment that it is serving.
- .14 Fuel-Fired Appliance Emergency Shut-Off:
 - .1 For room entrances located within the building, the switch shall be located immediately outside the room containing the appliances, adjacent the door.
 - .2 For room entrances located outside of the building, the switch shall be located immediately inside the room containing the appliances by adjacent the door.
 - .3 For rooms with more than one (1) door, a disconnect shall be provided at each door.
 - .4 Power shall disconnect to all fuel-fired appliances within the room, using the single emergency shut-off control point.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Two-winding transformers.

1.2 Related Sections

- .1 Section 26 05 26 - Grounding And Bonding.
- .2 Section 26 05 33 - Conduit: Flexible conduit connections.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C9-17 - Dry-Type Transformers.
- .3 CSA C22.2 NO. 47-13 (R2018) - Air-Cooled Transformers (Dry Type).
- .4 NEMA ST20-1992 (R1997) - Dry Type Transformers for General Applications. (Rescinded Standard - included for information only)
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters Laboratories of Canada).

1.4 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, power, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

1.5 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate loss data, efficiency at 25%, 50%, 75% and 100% rated load, and sound power level per octave band from 63Hz to 8kHz.

1.6 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation: Record actual locations of transformers in project record documents.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.8 Re ulator□ Re uire ents

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

1.9 Deli er□, Stora e, and Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- .3 Handle to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

Part 2 Products

2.1 T o-Windin Trans or ers

- .1 Manufacturers:
 - .1 Delta
 - .2 Hammond
 - .3 Bmag
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: NEMA ST20, factory-assembled, air cooled dry type transformers ratings as indicated.
- .3 Primary Voltage: 600 volts, 3 phase.
- .4 Secondary Voltage: 208Y/120 volts, 3 phase.
- .5 Insulation system and average winding temperature rise for rated kVA as follows:
 - .1 1-15 kVA: Class 185 with 115 degrees C (200 degrees F) rise.
 - .2 16-500 kVA: Class 220 with 150 degrees C (277 degrees F) rise.
- .6 Case temperature: Do not exceed 35 degrees C (60 degrees F) rise above ambient at warmest point at full load.
- .7 Winding Taps:
 - .1 Transformers Less than 15 kVA: Two 5% below rated voltage, full capacity taps on primary winding.
 - .2 Transformers 15 kVA and Larger: NEMA ST20.
- .8 Sound Levels: Maximum sound levels:
 - .1 1-25 kVA: 45 dB.
 - .2 26-150 kVA: 50 dB.
 - .3 151-300 kVA: 55 dB.
 - .4 301-500 kVA: 60 dB.
- .9 Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.

- .10 Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- .11 Mounting:
 - .1 1-15 kVA: Suitable for wall mounting.
 - .2 16-75 kVA: Suitable for floor and wall mounting.
 - .3 Larger than 75 kVA: Suitable for floor mounting.
- .12 Coil Conductors: Continuous windings with terminations brazed or welded.
- .13 Enclosure: NEMA ST20, Type 3R ventilated. Provide lifting eyes or brackets.
- .14 Isolate core and coil from enclosure using vibration-absorbing mounts.
- .15 Nameplate: Include transformer connection data.

2.2 Source Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Production test each unit according to NEMA ST20.

Part 3 Execution

3.1 Installation

- .1 Install transformers to manufacturer's instructions.
- .2 Set transformer plumb and level.
- .3 Use flexible conduit, under the provisions of Section 26 05 33, 600mm (24") minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- .4 Mount wall-mounted transformers using integral flanges or accessory brackets provided by the manufacturer.
- .5 Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- .6 Mount floor-mounted transformers on 100mm (4") housekeeping pad.
- .7 Provide grounding and bonding to Section 26 05 26.
- .8 Provide minimum 150mm (6") of clearance from walls and 100 mm (4") of clearance from adjacent equipment for ventilation.
- .9 Maintain shipping supports after transformer is installed and remove just before putting transformer into service.
- .10 Loosen isolation pad retaining bolts until no compression is visible.

3.2 Ad ustin

- .1 Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Switchboards.
- .2 Metering transformers.
- .3 Accessories.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete: Concrete for supporting foundations and pads.
- .2 Section 26 05 26 - Grounding and Bonding.
- .3 Section 26 24 01 - Utility Service Entrance.
- .4 Section 26 25 00 - Feeder and Plug-In Busway.
- .5 Section 26 18 16 - Fuses.

1.3 References

- .1 ANSI C39.1-1981(R1992) - Requirements for Electrical Analog Indicating Instruments.
- .2 NEMA C12.1-2008 - Code for Electricity Metering.
- .3 IEEE C57.13-2008 - IEEE Standard Requirements for Instrument Transformers.
- .4 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .5 CSA-C22.2 No. 5-09 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
- .6 NEMA KS 1-2001 (R2006) - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- .7 NEMA PB 2-2006 - Deadfront Distribution Switchboards.
- .8 NEMA PB 2.1-2007 - General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less.
- .9 NEMA 260-1996 (R2004) - Safety Labels for Pad Mounted Switchgear and Transformers Sited in Public Areas.
- .10 NETA ATS 2007 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- .11 CSA (Canadian Standards Association).
- .12 ULC (Underwriters Laboratories of Canada).

1.4 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- .3 Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; and switchboard instrument details.

1.5 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate results of factory production tests.
- .3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- .3 Record Documentation: Record actual locations of switchboard in project record documents.

1.7 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials: Provide two (2) of each key.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 Regulator Requirements

- .1 Products: Listed and classified by ULC, CSA and as suitable for the purpose specified and indicated.

1.10 Delivery, Storage, and Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- .3 Handle to NEMA PB 2.1 and manufacturer's written instructions. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

Part 2 Products

2.1 Manufacturers

- .1 Eaton
- .2 Schneider
- .3 Siemens
- .4 GE
- .5 Substitutions: Refer to Section 26 05 00.

2.2 Switchboards

- .1 Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- .2 Ratings:
 - .1 Voltage: As indicated
 - .2 Main Bus: Ampere rating as indicated
 - .3 Integrated Equipment Rating: As indicated
- .3 Main Section Devices: Individually mounted and compartmented.
- .4 Distribution Section Devices: Individually mounted and compartmented.
- .5 Auxiliary Section Devices: Individually mounted and compartmented.
- .6 Bus Material: Copper.
- .7 Bus Connections: Bolted and, accessible from front for maintenance.
- .8 Fully insulate load side bus bars. Do not reduce spacing of insulated bus.
- .9 Ground Bus: Extend length of switchboard.
- .10 Moulded Case Circuit Breakers: CAN/CSA-C22.2 No. 5, integral thermal and instantaneous magnetic trip in each pole.
- .11 Include electronic trip unit where indicated:
 - .1 Adjustable continuous current setting.
 - .2 Adjustable short time pickup setting encompassing an I²t ramp function.
 - .3 Adjustable long time delay tLD and pickup setting I_r.
 - .4 Adjustable flat response short time delay and instantaneous trip setting.
 - .5 Adjustable ground fault pickup and flat response ground fault delay.
- .12 Circuit Breaker Functions:
 - .1 Provide electronic trip with adjustable long time, short time and instantaneous settings, as well as adjustable arc flash reduction settings for all main service breakers.
 - .2 Provide electronic trip at the following locations:
 - .1 Breakers feeding:
 - .1 Fire pumps
 - .2 Elevators
 - .3 Generator emergency distributions
 - .2 Generator emergency distribution main breaker

- .3 Additional breakers as indicated
- .3 Provide ground fault protection at the following locations:
 - .1 All 347/600V breakers 1000A and larger
 - .2 All 120/208V breakers 2000A and larger
 - .3 Additional breakers as indicated
- .13 Circuit breakers, ULC and CSA listed.
- .14 Moulded Case Circuit Breakers with Current Limiters: CAN/CSA-C22.2 No. 5, moulded case circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
- .15 Solid-State Moulded Case Circuit Breakers: CAN/CSA-C22.2 No. 5, with electronic sensing, timing and tripping circuits for adjustable current settings.
- .16 Ground fault trip ground fault sensing integral with circuit breaker.
 - .1 Instantaneous trip.
 - .2 Adjustable short time trip.
 - .3 Stationary mounting.
- .17 Line and Load Terminations: Accessible from the front and the rear of the switchboard, suitable for the conductor materials and sizes indicated.
- .18 Ground Fault Sensor: Ground return type.
- .19 Metering Transformer Compartment: For Utility Company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements.
- .20 Pull Section: Size as indicated or width, depth and height to match switchboard. Arrange as indicated.
- .21 Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- .22 Pull Box: Removable top and sides, same construction as switchboard.
- .23 Enclosure: Type 1 provided with a sprinkler drip hood.
 - .1 Align sections at front and rear.
 - .2 Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
- .24 Mimic Bus: Show bussing, connections and devices in single line form on the front panels of the switchboard using colour, factory painting and, fastened flat against the panel face with screws or rivets.

2.3 Digital Multi-Function Meters

- .1 The power meter to be applied in 600V three-phase, four-wire systems in WYE mode.
- .2 The power meter shall be capable of being applied without modification at nominal frequencies of 60Hz.
- .3 The power meter unit and display shall be mounted in the pre-made cut-out without tools.

- .4 The power meter display shall be backlit dot-matrix LCD for easy viewing, display shall also be anti-glare and scratch resistant with a minimum of 128x128 pixels.
- .5 All setup parameters required by the power meter shall be stored in nonvolatile memory and retained in the event of a control power interruption. Cumulative quantities for real, reactive and apparent energies shall be stored in non-volatile memory. The power meter shall provide the user the ability to reset the cumulative energy quantities from the display of the unit or via communications.
- .6 The power meter shall have a real time clock with battery back-up with at least 1 year ride through time without external power.
- .7 The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 31st harmonic (fundamental of 60 Hz). The power meter shall provide continuous sampling at a minimum of up to 64 samples/cycle, simultaneously on all voltage and current channels in the meter.
- .8 0-10 amps with 5 amps nominal input from CT secondary.
- .9 Residual current shall be calculated by vectorial summation of the phase currents.
- .10 A fourth CT input shall be available to measure neutral or ground current.
- .11 Operating temperature range: meter: -25 to 70 °C, display -20 to 70 °C.
- .12 The power meter device shall comply with ANSI C12.20 Class 0.5 and IEC 61557-12 Class 0.5 for revenue meters. Accuracy for Active energy of the power meter shall be class 0.5S as per IEC 62053-22. Accuracy for reactive energy of the power meter shall be class 2 as per IEC 62053-23 (reactive energy). No annual calibration shall be required to maintain this accuracy.
- .13 The power meter shall provide for onboard data logging. Each power meter shall be able to log data, alarms and events, and waveforms (if applicable). Logged information to be stored in each Power Meter include the following: Data logs, Min/Max log files of selected parameter values, Alarm logs for each user defined alarm or event and Waveform log. The meters shall offer the following on-board nonvolatile memory. The power meter shall have onboard memory sufficient to log 14 values every 15 minutes for 90 days.
- .14 Real-time readings
 - .1 Current (Per-phase, 3-Phase Avg, % Unbalanced)
 - .2 Neutral and Ground (4CTs)
 - .3 Voltage (L-L Per-phase, L-L 3-Phase Avg, L-N Per-Phase, 3-Phase Avg, % Unbalanced)
 - .4 Real Power (Per-phase, 3-Phase Total)
 - .5 Reactive Power (Per-phase, 3-Phase Total)
 - .6 Apparent Power (Per-phase, 3-Phase Total)
 - .7 Power Factor (True/Displacement)(Per-phase, 3-Phase Total)
 - .8 Frequency
 - .9 THD, thd, TDD (Current and Voltage), Neutral & ground current THD
 - .10 Individual harmonics up to the order of 15th
 - .11 Temperature (Internal Ambient)
 - .12 K-Factor (Per-Phase)

- .13 Crest Factor (Per-Phase)
- .15 Energy Readings
 - .1 Accumulated Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute)
- .16 Demand Readings
 - .1 Demand Current Calculations (Per-Phase, 3-Phase Avg, Neutral)- Present and Peak
- .17 Demand Calculations (3-Phase Total):
 - .1 Real Power
 - .2 Reactive Power
 - .3 Apparent Power
- .18 All power demand calculations shall use any one of the following calculation methods, selectable by the user:
 - .1 Thermal demand using a sliding window technique.
 - .2 Block interval, with optional sub-intervals. Block methods available are Sliding, Fixed and Rolling.
 - .3 Demand can be calculated using a Synchronization signal:
 - .4 Demand can be synchronized to an input pulse from an external source.
 - .5 Demand can be synchronized to a communication signal.
 - .6 Demand can be synchronized to the clock in the power meter
- .19 Power Analysis Values
 - .1 THD, thd □ Voltage, Current (3-Phase, Per-phase, Neutral & Ground current)
 - .2 Power Factor (Per-phase, 3-Phase)
 - .3 Displacement Power Factor (Per-phase, 3-Phase)
 - .4 Fundamental Voltage, Magnitude and Angle (Per-phase)
 - .5 Fundamental Currents, Magnitude and Angle (Per-phase)
 - .6 Fundamental Real Power (Per-phase, 3-Phase)
 - .7 Fundamental Reactive Power (Per-phase)
 - .8 Harmonic Power (Per-phase, 3-Phase)
 - .9 Phase Rotation
 - .10 Unbalance (Current and Voltage)
 - .11 Harmonic Magnitudes & Angles (Per-phase)
 - .12 Total Demand distortion factor (TDD)

2.4 Meterin Trans or ers

- .1 Coordinate CT & PT requirements with Supply Utility.

2.5 Accessories

- .1 Circuit Breaker Lifting Device: Carriage and track on top of each switchboard with lifting device to serve draw-out circuit breakers in switchboard.

2.6 Source Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Shop inspect and test switchboard according to NEMA PB 2.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that field measurements are as indicated on Shop Drawings and as instructed by the manufacturer.

3.2 Preparation

- .1 Provide concrete housekeeping pad to Section 03 30 00.

3.3 Installation

- .1 Install switchboard in locations shown on Drawings, according to CSA-C22.1.
- .2 Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- .3 Install fuses in each switch.

3.4 Adjustment

- .1 Adjust all operating mechanisms for free mechanical movement.
- .2 Tighten bolted bus connections to manufacturer's written instructions.
- .3 Adjust circuit breaker trip and time delay settings to values as indicated.

3.5 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Touch up scratched or marred surfaces to match original finish.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Distribution panelboards.
- .2 Branch circuit panelboards.
- .3 Load centres.

1.2 Related Sections

- .1 Section 26 05 26 - Grounding and Bonding.
- .2 Section 26 05 53 - Electrical Identification.
- .3 Section 26 18 16 - Fuses.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 29-15 - Panelboards and Enclosed Panelboards.
- .3 CSA C22.2 No. 94.1-15 Enclosures for Electrical Equipment, Non-Environmental Considerations
- .4 CSA C22.2 No. 94.2-15 Enclosures for Electrical Equipment, Environmental Considerations
- .5 NEMA ICS 2-2000 (R2005) - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
- .6 NEMA KS 1-2001 (R2006) - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- .7 NETA ATS 2007 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- .8 CSA (Canadian Standards Association).
- .9 ULC (Underwriters Laboratories of Canada).

1.4 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.5 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- .3 Record Documentation: Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

1.7 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials: Provide two (2) of each panelboard key.

1.8 Quality Assurance

- .1 Products of This Section: Manufactured to ISO 14000 and ISO 9000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 Regulator Requirements

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Distribution Panelboards

- .1 Manufacturers:
 - .1 Eaton
 - .2 Schneider Electric
 - .3 Siemens
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: CSA-C22.2 No.29, circuit breaker type.
- .3 Panelboard Bus: Copper and ratings as indicated. Provide copper ground bus in each panelboard.
- .4 Minimum integrated short circuit rating: 18,000 amperes rms symmetrical for 250 volt panelboards; 22,000 amperes rms symmetrical for 600 volt panelboards or as indicated.
- .5 Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.
- .6 Moulded Case Circuit Breakers: CSA-C22.2 No. 5, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers ULC listed as Type HACR for air conditioning equipment branch circuits.

- .7 Circuit Breaker Functions:
 - .1 Provide electronic trip LSI adjustable functions at the following locations:
 - .1 Breakers feeding:
 - .1 Fire pumps
 - .2 Elevators
 - .3 Generator emergency distributions
 - .2 Generator emergency distribution main breaker
 - .3 Additional breakers as indicated
 - .2 Provide ground fault protection at the following locations:
 - .1 All 347/600V breakers 1000A and larger
 - .2 All 120/208V breakers 2000A and larger
 - .3 Additional breakers as indicated
- .8 Circuit Breaker Accessories:
 - .1 Trip units and auxiliary switches as indicated.
- .9 Enclosure: CSA C22.2 No. 94.1:
 - .1 Surface mounted: Type 2.
 - .2 Recessed mounted: Type 2.
 - .3 Exterior use: Type 4 or as indicated.
- .10 Cabinet Front: Surface type, fastened with hinge and latch and concealed trim clamps, hinged door with flush lock, metal directory frame and finished in manufacturer's standard gray enamel.

2.2 **Branch Circuit Panelboards**

- .1 Manufacturers:
 - .1 Eaton
 - .2 Schneider
 - .3 Siemens
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: CSA-C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.
- .3 Panelboard Bus: Copper and ratings as indicated. Provide copper ground bus in each panelboard.
- .4 Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 250 volt panelboards; 18,000 amperes rms symmetrical for 600 volt panelboards or as indicated.
- .5 Moulded Case Circuit Breakers: CSA-C22.2 No. 5, plug-on and type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers unless indicated.
- .6 Current Limiting Moulded Case Circuit Breakers: CSA-C22.2 No. 5, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole.

Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

- .7 Circuit Breaker Functions:
 - .1 Provide electronic trip LSI adjustable functions at the following locations:
 - .1 Breakers feeding:
 - .1 Fire pumps
 - .2 Elevators
 - .3 Generator emergency distributions
 - .2 Generator emergency distribution main breaker
 - .3 Additional breakers as indicated
 - .2 Provide ground fault protection at the following locations:
 - .1 All 347/600V breakers 1000A and larger
 - .2 All 120/208V breakers 2000A and larger
 - .3 Additional breakers as indicated
- .8 Enclosure: CSA C22.2 No. 94.1:
 - .1 Surface mounted: Type 2.
 - .2 Recessed mounted: Type 2.
 - .3 Exterior use: Type 4 or as indicated.
- .9 Cabinet Box: 153mm (6 inches) deep, 508mm (20 inches) wide.
- .10 Cabinet Front: Surface and Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

2.3 Surge Protection Devices (SPDs)

- .1 SPDs shall be close-coupled to panelboard equipment for the protection of AC electrical circuits and equipment from the effects of lightning induced currents, substation switching transients, and internally generated transients resulting from inductive and/or capacitive load switching and other electronic equipment.
- .2 The surge suppression system shall be comprised of Types 1, 2, & 3 SPDs that are listed and labeled for their intended installation. System design shall be in accordance with the latest edition of the IEEE C62 standards.
- .3 Characteristics:
 - .1 Surge Rating (I_{max}) shall be no less than:
 - .1 Service Entrance: 200kA
 - .2 Distribution Panel: 100kA
 - .3 End Use Equipment: 50kA
 - .2 Nominal Discharge Current Rating (I_n) shall be no less than:
 - .1 Type 1 & 2 devices - 20 kA
 - .2 Type 3 devices - 3 kA
 - .3 Short Circuit-Current Rating (SCCR) shall be no less than 200 kA.
 - .4 Maximum Continuous Operating Voltage (MCOV):
 - .1 No less than 15% of normal system operating voltage.

- .2 No more than 25% of normal system operating voltage.
- .5 Minimum Voltage Protection Rating (VPR)
 - .1 120/208V - 700 Volts L-N, 1200 Volts L-L
 - .2 347/600V - 1200 Volts L-N, 2000 Volts L-L
- .6 Noise Filtering
- .4 Provide SPDs as indicated on the electrical single line diagram.

2.4 Monitorin Syste

- .1 Provide network and software to collect all voltage, current, power, and energy data for all monitored loads.
- .2 Provide IP network connectivity with CAT6 cable for monitoring system.
- .3 Coordinate with building automation sub-contractor to make energy usage data available to the building automation system for the following aggregate loads:
 - .1 Current Building HVAC load (kVA)
 - .2 Peak Building HVAC load (kVA)
 - .3 Building HVAC Energy (kWh)
 - .4 Current Building Interior Lighting load (kVA)
 - .5 Peak Building Interior Lighting load (kVA)
 - .6 Building Interior Lighting Energy (kWh)
 - .7 Current Building Exterior Lighting load (kVA)
 - .8 Peak Building Exterior Lighting load (kVA)
 - .9 Building Exterior Lighting Energy (kWh)
- .4 Building automation system shall pole required data from registers of electrical monitoring system.

Part 3 Execution

3.1 Installation

- .1 Install panelboards to CSA-C22.1 and to manufacturer's written instructions.
- .2 Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- .3 Height: Refer to section 26 05 00.
- .4 Provide filler plates for unused spaces in panelboards.
- .5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- .6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- .7 Provide spare conduits out of each recessed panelboard to an accessible location below floor and above ceiling where applicable. Minimum spare conduits: three (3) empty 35mm (1-1/4") up and two (2) 35mm (1-1/4") down. Identify each as spare.
- .8 Ground and bond panelboard enclosure according to Section 26 05 26.

3.2 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Perform inspections and tests listed in NETA ATS Section 7.4 for switches, Section 7.5 for circuit breakers.

3.3 Ad ustin

- .1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20% of each other.
- .2 Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

Part 1 General

1.1 Su ar

- .1 Section includes EV charging equipment that provides Level 2 EV charging.

1.2 De initions

- .1 EV: Electric vehicle.
- .2 EV Cable: The off-board cable containing the conductor(s) to connect the EV power controller to the EV that provides both power and communications during energy transfer.
- .3 EV Capable: Parking spaces that include nearby termination of raceway (conduit) to a power source with sufficient electrical panel capacity designed for simultaneous charging of electric vehicles in all planned EV parking spaces. Electrical wiring need not be pulled through raceway (conduit) until charging station is installed.
- .4 EV Charger or EV Charging Equipment: See "EVSE".
- .5 EV Connector: A conductive device that, when electrically coupled to an EV inlet, establishes an electrical connection to the EV for the purpose of power transfer and information exchange. This device is part of the EV coupler.
- .6 EV Coupler: A mating EV inlet and connector set.
- .7 EV Inlet: The device in the vehicle into which the EV connector is inserted, and a conductive connection is made for the transfer of power and communication. This device is part of the EV coupler.
- .8 EV Make Ready: Parking spaces that include nearby termination of raceway (conduit) and electrical wiring pulled to a power source with sufficient electrical panel capacity for simultaneous charging of electric vehicles in all EV parking spaces.
- .9 EVSE: Electric Vehicle Supply Equipment. It includes the EV charging equipment and conductors, including the ungrounded, grounded, and equipment grounding conductors and EV cables, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for transferring energy between the premise wiring and the EV.

1.3 Re erences

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA (Canadian Standards Association).
- .3 ULC (Underwriters Laboratories of Canada).

1.4 Su ittals or Re ie

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: For each type of product.

- .1 Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for EV charging equipment.
- .2 Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- .3 Shop Drawings: For EV charging equipment.
 - .1 Include plans, elevations, sections, and mounting attachment details.
 - .2 Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - .3 Detail fabrication and assembly of mounting assemblies for EV charging equipment.
 - .4 Include diagrams for power, signal, and control wiring.
 - .5 Include verification of wireless / cellular communications service at each location of EV charging equipment.

1.5 Su ittals or In or ation

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Submit manufacturer's installation instructions.

1.6 Maintenance Material Su ittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.

1.7 Qualit Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.
- .2 Comply with SAE J1772.

1.8 Re ulator Re uire ents

- .1 Provide products listed and classified by CSA and as suitable for the purpose specified and indicated.

1.9 Field Conditions

- .1 Wireless Survey: Complete wireless survey to determine if wireless provider signals meet or exceed manufacturer's recommended minimum values.
- .2 Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - .1 Ambient Temperature: Not exceeding minus 30 to plus 50 deg C.
 - .2 Altitude: Not exceeding 2000 m.
- .3 Rate Equipment for non-operation under the following conditions:
 - .1 Ambient Temperature: Not exceeding minus 40 to plus 60 deg C.
 - .2 Altitude: Not exceeding 2000 m.
- .4 Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by City or others unless permitted under the following

conditions and then only after arranging to provide temporary electric service according to requirements indicated:

- .1 Notify City no fewer than 2 days in advance of proposed interruption of electric service.
- .2 Do not proceed with interruption of electric service without City's written permission.

1.10 Warrant

- .1 **Manufacturer's Warranty:** Manufacturer and Installer agree to repair or replace components of EV charging units that fail(s) in materials or workmanship within specified warranty period.
 - .1 **Standard Warranty Period:** One year from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

- .1 AddEnergie
- .2 ChargePoint
- .3 ClipperCreek
- .4 Schneider
- .5 Hubbell
- .6 Substitutions: Refer to Section 26 05 00.
- .7 Source Limitations: Obtain EV charging equipment from single manufacturer.

2.2 EV Charging Equipment Description

- .1 EV Charging Equipment Mounting: pedestal mount.
- .2 Enclosures: Rated for environmental conditions at installed location.
 - .1 Indoor Locations: NEMA 250, Type 3R.
 - .2 Outdoor Locations: NEMA 250, NEMA 4X.
 - .3 Aluminum and UV-resistant plastic.
 - .4 Paint and Anodized.
 - .5 Charging components protected by security screws.
 - .6 Charging connectors in locking holsters.
 - .7 Meter, modem, and CPU, tamper resistant.
- .3 EV Cable and Connectors:
 - .1 SAE J1772 connector.
 - .2 One connector per charger. with locking holster
 - .3 5 m cable.
- .4 Status Indicators:
 - .1 LEDs to indicate power, vehicle charging, charging complete, system status, faults, and service, as well as authorization.

- .5 Display Screen:
 - .1 VGA-resolution, daylight-viewable LCD screen with UV protection. Daylight readable and fingerprint resistant.
 - .2 Displays power, charging, charging complete, remote control, system status, faults, payment and pricing details, and service.
- .6 Networking:
 - .1 WAN Communications: Cellular GSM/GPRS and CDMA.
 - .2 LAN Communications: 2.4 GHz Wi-Fi 802.11b/g/n.
 - .3 Capable of remote configuration, diagnostics and reporting.
 - .4 Capable of remote software updates (future proof).
- .7 Payment System:
 - .1 RFID (ISO 15693, ISO 14443), NFC, Contactless credit card reader.
 - .2 PCI (Payment Card Industry) compliant.
 - .3 Capable of remote control and authorization including mobile phone application or toll free phone number.
- .8 Charging Network: Compatible with the ChargePoint EV charging network.
 - .1 Multiple units shall independently connect to charging network.
 - .2 Individual units shall be capable of indicating station status and availability providing or connecting user to customer support and remote control.

2.3 Performance Requirements

- .1 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
- .2 Surge Withstand: 6 kV at 3000 A.
- .3 Integral GFCI.
- .4 Auto-GFCI fault retry.
- .5 Input Power:
 - .1 40 A, 208/240-V ac, 60 Hz, single phase per charger.
 - .2 Dual circuits do not need to be interlocked.
- .1 EV Charging Levels:
 - .1 Single vehicle: AC Level 2 at up to 7.5 kW per vehicle.
 - .2 Multiple vehicles simultaneously charging at a site may be charged up to 7.5 kW per vehicle.

2.4 General Finish Requirements

- .1 Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- .2 Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if

they are within the range of approved Samples and are assembled or installed to minimize contrast.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- .3 Examine roughing-in for EV charging equipment electrical conduit to verify actual locations of conduit connections before equipment installation.
- .4 Examine walls, floors, and pavement for suitable conditions where EV charging equipment will be installed.
- .5 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- .1 Concrete Base & Post Mounting:
 - .1 Install EV charging equipment on 24-inch (600-mm) nominal-diameter and 24-inch (600-mm) concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."
 - .1 Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - .2 Install rigid steel post & anchor bolts to elevations required for proper attachment to supported equipment.
 - .3 Secure EV charging equipment to post according to manufacturer's written instructions.
 - .2 Wiring Method: Install cables in raceways and cable trays. Conceal raceway and cables except in unfinished spaces.
 - .1 Comply with requirements for underground raceways and enclosures specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems."
- .3 Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- .4 Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- .5 Circuit Breakers: Comply with Section 26 28 16 "Enclosed Switches and Circuit Breakers."
- .6 Secure covers to enclosure.

3.3 Connections

- .1 Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- .2 Comply with grounding requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- .3 Comply with requirements for installation of conduit in Section 26 05 33 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.
- .4 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

3.4 Identification

- .1 Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 Field Quality Control

- .1 Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- .2 Perform tests and inspections with the assistance of a factory-authorized service representative.
- .3 Tests and Inspections:
 - .1 For each unit of EV charging equipment, perform the following tests and inspections:
 - .1 Unit self-test.
 - .2 Operation test with load bank or EV.
 - .3 Network communications test.
- .4 EV charging equipment will be considered defective if it does not pass tests and inspections.
- .5 Prepare test and inspection reports.

3.6 Startup Service

- .1 Engage a factory-authorized service representative to perform startup service.
 - .1 Complete installation and startup checks according to manufacturer's written instructions.

3.7 On-Going Management Services

- .1 Engage a station manufacturer that offers a service to manage the administration and policies of the electric vehicle charging stations on an ongoing basis.

3.8 Software Service Agreement

- .1 Technical Support: Beginning at Substantial Completion, service agreement shall include software support for the duration of an active Network Service Plan.

- .2 Upgrade Service: At Substantial Completion, remotely update software to latest version. Install and program software upgrades that become available while an active Network Service Plan is maintained. Upgrading software shall include operating system and new or revised licenses for using software.

3.9 Demonstration

- .1 Utilize EV Station Management Services, or Train City's maintenance personnel to adjust, operate, and maintain EV charging equipment.

3.10 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Hinged cover enclosures.
- .2 Cabinets.
- .3 Terminal blocks.
- .4 Accessories.

1.2 Related Sections

- .1 Section 26 05 29 - Electrical Supporting Devices.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.2 No. 94-M91 (R2006) - Special Purpose Enclosures.
- .3 CSA-C22.2 No. 158-10 - Terminal Blocks.
- .4 CSA (Canadian Standards Association).
- .5 ULC (Underwriters Laboratories of Canada).

1.4 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide manufacturer's standard data for enclosures and cabinets.

1.5 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials: Provide [two (2)] of each key.

1.7 Regulator Requirements

- .1 Conform to requirements of CSA-C22.1.
- .2 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Hinged Cabinet Enclosures

- .1 Construction: CAN/CSA-C22.2 No. 94.
 - .1 Surface Mounted Indoor: Type 1 16 gauge steel enclosure complete with sprinkler drip hood.
 - .2 Recessed Mounted Indoor: Type 1 16 gauge steel enclosure.
 - .3 Exterior Use: Type 4 14 gauge steel enclosure or as indicated.
- .2 Covers: Surface or Flush cabinet front with continuous hinge,
 - .1 Indoor: Held closed by flush latch operable by key.
 - .2 Outdoor: Held closed by hasp and staple for padlock.
- .3 Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
- .4 Enclosure Finish: Manufacturer's standard grey enamel.

2.2 Cabinets

- .1 Boxes: Galvanized steel with removable end walls.
- .2 Box Size: 600mm (24 inches) wide x 150mm (6 inches) deep.
- .3 Backboard: Provide 19mm (3/4 inch) thick plywood backboard for mounting terminal blocks. Paint matte white.
- .4 Fronts: Steel, flush with concealed trim clamps and door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
- .5 Provide metal barriers to form separate compartments wiring of different systems and voltages.
- .6 Provide accessory feet for free-standing equipment.

2.3 Terminal Blocks

- .1 Terminal Blocks: CSA-C22.2 No. 158.
- .2 Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- .3 Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- .4 Provide ground bus terminal block, with each connector bonded to enclosure.

2.4 Accessories

- .1 Description: Plastic channel with hinged or snap-on cover.

Part 3 Execution

3.1 Installation

- .1 Install components to CSA-C22.1 and to manufacturer's written instructions.

- .2 Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner to Section 26 05 29.
- .3 Install cabinet fronts plumb.

3.2 Cleanin

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean electrical parts to remove conductive and harmful materials.
- .3 Remove dirt and debris from enclosure.
- .4 Clean finishes and touch up damage.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Wall switches.
- .2 Wall dimmers.
- .3 Receptacles.
- .4 Device plates and decorative box covers.
- .5 Floor box service fittings.
- .6 Poke-through service fittings.
- .7 Access floor box.

1.2 Related Sections

- .1 Section 26 05 39 - Underfloor Ducts.
- .2 Section 26 05 34 - Boxes.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 42-10 (R2015) - General Use Receptacles, Attachment Plugs, and Similar Wiring Devices
- .3 CSA C22.2 No. 42.1-13 (R2017) - Cover Plates for Flush-Mounted Wiring Devices.
- .4 CSA C22.2 No. 55-15 - Special use switches.
- .5 CAN/CSA C22.2 No. 111-18 - General-Use Snap Switches.
- .6 CSA C22.2 No. 184-15 - Solid-State Lighting Controls.
- .7 CSA (Canadian Standards Association).
- .8 ULC (Underwriters Laboratories of Canada).

1.4 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

1.5 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Submit manufacturer's installation instructions.

1.6 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials:

- .1 Provide two of each style, size, and finish wall plate.

1.7 **Quality Assurance**

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.8 **Regulator Requirements**

- .1 Provide products listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 **Products**

2.1 **Wall Switches**

- .1 Manufacturers:
 - .1 Leviton
 - .2 Hubbell
 - .3 Cooper
 - .4 Legrand
 - .5 Substitutions: Refer to Section 26 05 00.
- .2 General-use snap switch:
 - .1 Grade: Commercial Specification Grade CSA-C22.2 No. 111
 - .2 Style: Standard toggle
 - .3 Device Body: White nylon toggle.
 - .4 Ratings: Match branch circuit and load characteristics. Amperage rating shall be marked on body of switch.
- .3 Body and Handle: White nylon toggle.
- .4 Indicator Light: Separate pilot strap red colour with load on.
- .5 Locator Pilot Light: Separate pilot strap red colour.

2.2 **Wall Dimmers**

- .1 Manufacturers:
 - .1 Lutron
 - .2 Substitutions: Refer to Section 26 05 00
- .2 Description: Wall dimmer complete with slide to off control and surge protection.
- .3 Body and Handle: White with linear slide control.
- .4 Voltage: 120 volts.
- .5 Power Rating: Match load as required for circuits controlled.
- .6 Products:
 - .1 Incandescent or Halogen: NT series
 - .2 Magnetic Low Voltage: NTLV series

- .3 Electronic Low Voltage: NTELV series
- .4 Fluorescent or LED 3-wire: NTF series
- .5 Fluorescent 2-wire: NTFTU series
- .6 Fluorescent or LED 0-10VDC: NTSTV-DV

2.3 Astronomic Wall Switch Timer

- .1 Application: As indicated on the plans and schedules.
- .2 Manufacturers:
 - .1 NSI Industries model SS721Z.
 - .2 Substitutions: Refer to Section 26 05 00
- .3 Description: Seven (7) day astronomic in-wall time switch complete with manual on/off override.
- .4 Scheduling: Ten (10) on and off pairs of set points available for individual programs on each day of the week. Minimum setting of one (1) minute per schedule.
- .5 Operation Modes: Random, Manual, and Vacation modes.
- .6 Power Backup: Supercapacitor complete with two (2) days backup.
- .7 Device Body: Smooth white.
- .8 Ratings:
 - .1 Resistive Loads: 16 amps
 - .2 Fluorescent Ballasts: 13 amps
 - .3 LED Drivers: 10 amps
 - .4 Motor Load: 1/2HP
- .9 Operating Temperature: 0 degrees C. to 40 degrees C.

2.4 Receptacles

- .1 Manufacturers:
 - .1 Leviton
 - .2 Hubbell
 - .3 Cooper
 - .4 Legrand
 - .5 Substitutions: Refer to Tender No. 543-2022B; Part B □ Bidding Procedures.
- .2 General-duty duplex convenience receptacle:
 - .1 Grade: Commercial Specification Grade. Nema WD-6 Compliant, CSA-C22.2 No.42.
 - .2 Style: Standard.
 - .3 Device Body: Smooth white nylon face and base.
 - .4 CSA Configuration: Type as specified and indicated.
 - .5 Tamper resistant as indicated or as per Electrical Code.

- .3 GFCI Receptacle: Duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements complete with steady-on [Green-Power-On] and steady-on [Red-Power-Tripped Off] LED indicator lights.
- .4 Exterior Use Receptacle: Extra Heavy Duty Industrial grade duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements complete with steady-on [Green-Power-On] and steady-on [Red-Power-Tripped Off] LED indicator lights complete with UV and corrosion resistant device body complete with CSA 5-20R configuration only.
- .5 USB Charger Receptacle: General-duty tamper resistant decorator style duplex receptacle with dual USB type C chargers with smart chips optimized for USB power delivery meeting specification of USB-PD 3.0 and Quick Charge 4. Type C port shall be rated 6A 20V (auto sensing) at 60W for single port charging and 30W per port for dual port charging. Standard of acceptance Leviton T5636 for 5-15R and T5836 for 5-20R. Color white.
- .6 Controlled Receptacle: General-duty dual-controlled duplex receptacle with integral relay, wireless RF communication, and manual override button. Control system shall be complete with wireless RF signal packs to control all receptacles in individual rooms as indicated on drawings. RF signal packs shall be integrated with room lighting control occupancy sensor to turn off controlled receptacle within 20 minutes of unoccupied state.
- .7 Surge Protection Receptacle: General-duty duplex receptacle with integral surge protection device, power-on indicator light and damage-alert alarm with silencing screw. Surge suppression shall be 240 joules/15000A per mode. Device body shall be decorator style, smooth blue nylon face and base.
- .8 Isolated Ground Receptacle: General-duty duplex receptacle with insulation barrier between green grounding screw and metal box mounting strap. Device body shall be smooth orange nylon face with [IG triangle]
- .9 Receptacle on Emergency Circuit: Heavy Duty Specification grade duplex receptacle with smooth red nylon face. CSA configuration as indicated. Type as indicated.
- .10 Range Receptacle: CSA configuration 14-50R commercial specification grade complete with stainless steel faceplate.
- .11 Dryer Receptacle: CSA configuration 14-30R commercial specification grade complete with stainless steel faceplate.
- .12 Suitable for No. 10 AWG for back and side wiring.
- .13 Break-off links for use as split receptacles.
- .14 Double wipe contacts and riveted grounding contacts.
- .15 Receptacles shall be of one manufacturer throughout the project.

2.5 Wall Plates

- .1 Nylon Cover Plate: Impact resistant unbreakable nylon with reinforcing ribs. Style and color shall match wiring device. Combination or multi-gang covers as required or indicated. Jumbo or standard size as indicated or specified.
- .2 Standard Stainless Steel Cover Plate: 430 type stainless steel cover plate complete with protective plastic film. Combination or multi-gang covers as required or indicated. Jumbo or standard size as indicated or specified.

- .3 Metallic While-in-Use covers: Nema 3R rated, die-cast aluminum construction with powder coated chip resistant paint corrosion protection and plug/cord management, suitable for horizontal mounting on device box only, and padlock provision.
- .4 Thermoplastic While-in-Use covers: Nema 3R rated, thermoplastic construction, suitable for horizontal mounting on device box only, and padlock provision.
- .5 Weatherproof Cover Plate: Gasketed cast metal with gasketed double hinged device covers suitable for horizontal mounting on device box only. Provide single hinged device cover for GFI type receptacle only.

2.6 Intelligent Parallel Line Controller (IPLC) Receptacles

- .1 Manufacturers:
 - .1 Vantera Incorporated: IPLC M210
 - .2 Substitutions: Refer to Section 26 05 00.
- .2 Description: Assembly comprising of duplex receptacle complete weatherproof zinc die-cast housing complete with green and red LED indicator lights complete with CPU access port for custom programming.
- .3 Programming Schedule: Each IPLC shall be factory pre-programmed:
 - .1 To suit Efficiency Manitoba requirements and
 - .2 To limit power use to 650W per 15A circuit and 975W per 20A circuit.
- .4 Wiring Device: Utilize heavy duty, or industrial grade 5-15R or 5-20R duplex receptacles, single circuit or split-wired as indicated complete with weatherproof cover plate.
- .5 Data-Mate Programmer: Hand-held device for transfer of data between IPLC receptacles and windows based computer complete with software package for custom reprogramming IPLC settings. Supply one (1) programmer only and turn over to City.

2.7 Accessories

- .1 Audible Device Vandal Guard: Clear vandal resistant, UV Stabilized polycarbonate shield and frame complete with integral 95db piezo horn and battery. Flush mounted or surface as indicated. Outdoor rated as required. Vandal guard shall be equal to STI Stopper II series.
- .2 Device Vandal Guard: Clear vandal resistant, UV Stabilized polycarbonate shield and frame. Flush mounted or surface as indicated. Outdoor rated as required. Vandal guard shall be equal to STI Stopper II series.

Part 3 Execution

3.1 Installation

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that outlet boxes are installed at proper height.
- .3 Verify that wall openings are neatly cut and will be completely covered by wall plates.

- .4 Verify that floor boxes are adjusted properly.
- .5 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- .6 Verify that openings in access floor are in proper locations.

3.2 Pre aration

- .1 Provide extension rings to bring outlet boxes flush with finished surface.
- .2 Clean debris from outlet boxes.

3.3 Installation

- .1 Install to CSA-C22.1 and to manufacturer's written instructions.
- .2 Install devices plumb and level.
- .3 Install switches with OFF position down.
- .4 Provide neutral conductor in box for all line voltage lighting control devices.
- .5 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- .6 Do not share neutral conductor on load side of dimmers.
- .7 Install receptacles with grounding pole on bottom.
- .8 Use exterior use receptacles for exterior applications unless noted otherwise.
- .9 Connect wiring device grounding terminal to branch circuit equipment grounding conductor and outlet box.
- .10 Install locator pilot light for lighting controls located in crawlspace.
- .11 Install indicator pilot light for all lighting controlled from a remote switch location. Switch and light shall be clearly labelled identifying the controlled lighting.
- .12 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .13 Connect wiring devices by wrapping conductor around screw terminal.
- .14 Use jumbo size plates for outlets installed in masonry walls.
- .15 Stainless steel protective coverings shall be maintained until project completion and turn-over to City.
- .16 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- .17 Install metallic While-In-Use covers on exterior receptacles.
- .18 Use weatherproof covers for parking receptacles, and dust-tight applications only, or as indicated.
- .19 Install protective rings on active flush cover service fittings.

3.4 Intelli ent Par in Lot Controller (IPLC) Rece tacles

- .1 Install IPLC receptacle on Parking Lot Outlet Box. Refer to architectural details. Coordinate installation with GC.

- .2 Provide lamacoid labelling on all IPLC receptacles indicating Block Heaters Only. The use of in-car warmers is prohibited.

3.5 Inter ace Wit Ot er Products

- .1 Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights specified and as indicated on drawings.
- .2 Coordinate installation of access floor boxes with access floor system.
- .3 Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 05 39.

3.6 Field Qualit Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Inspect each wiring device for defects.
- .3 Operate each wall switch with circuit energized and verify proper operation.
- .4 Verify that each receptacle device is energized.
- .5 Test each receptacle device for proper polarity.
- .6 Test each GFCI receptacle device for proper operation.

3.7 Ad ustin

- .1 Adjust devices and wall plates to be flush and level.

3.8 Cleanin

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Packaged engine generator set.
- .2 Remote radiator.
- .3 Heat exchanger.
- .4 Exhaust silencer and fittings.
- .5 Fuel fittings and day tank.
- .6 Remote control panel.
- .7 Battery and charger.
- .8 Weatherproof enclosure.

1.2 Related Sections

- .1 Section 23 05 48 - Vibration Isolation.
- .2 Section 23 07 19 - Piping Insulation.
- .3 Section 23 11 13 - Fuel Oil Piping.
- .4 Section 23 21 00 - Hydronic Piping: Cooling water system and exhaust piping.
- .5 Section 23 21 23 - HVAC Pumps.
- .6 Section 23 31 00 - Duct Work.
- .7 Section 26 36 00 - Enclosed Transfer Switch.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 100-04 (R2009) - Motors and Generators.
- .3 CSA-Z32-09 - Electrical safety and essential electrical systems in health care facilities
- .4 CSA-C22.2 No. 5-09 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
- .5 CAN/CSA-C22.2 No. 94-M91 (R2006) - Special Purpose Enclosures.
- .6 CSA-C282-09 - Emergency Electrical Power Supply for Buildings.
- .7 NFPA 30 - Flammable and Combustible Liquids Code, 2008 Edition.
- .8 NFPA 110 - Standard for Emergency and Standby Power Systems, 2010 Edition.
- .9 CSA (Canadian Standards Association).
- .10 ULC (Underwriters Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Pre-installation Meetings: Convene one week before starting work of this section.

1.5 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .1 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and data sheets for generating units and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Include following technical data:
 - .1 Engine: make, model, rating and performance curves.
 - .2 Starter motor, make model.
 - .3 Generator: make, model and rating complete with generator saturation curves, heat damage curves, reactive capability and special data.
 - .4 Voltage regulator: make, model, type.
 - .5 Governor: type, model.
 - .6 Battery: make, type, voltage, capacity.
 - .7 Charger: make, model, input and output rating.
 - .8 Submit general outline drawing of complete assembly showing engine, radiator and generator mounting, exhaust, recirculating and intake air louvre arrangement, exhaust gas silencer and pipe arrangement, locations of fuel and lubricating oil filters, fuel supply and return line connections, lubricating oil drain valve, radiator and coolant drain valves, air cleaner, engine instrument panel, starting motor, power and control junction boxes, engine and generator mounting feet. Indicate on drawings:
 - .1 Horizontal and vertical dimensions.
 - .2 Minimum door opening required for moving unit.
 - .3 Head room required for removal of piston and connecting rod.
 - .4 Weight of engine, generator, baseplate, radiator and exhaust silencer.
 - .9 Identify exact locations and details where necessary of interconnecting services to permit final engineering by Departmental Representative.
 - .10 Baseplate construction details and materials.
 - .11 Outline and layout of panels.
 - .12 Schematic and wiring diagrams of engine, generator, control panel complete with interconnecting wiring diagrams.
 - .13 Single line diagram showing all breakers, switches, metering and protective relays.
 - .14 Field wiring diagrams.
 - .15 Complete bill of materials, including manufacturer's name, catalogue numbers and capacity.
 - .3 Lubricating oil system: where oil pump not provided, submit certification to Departmental Representative ensuring oil pump is not required and will not detract from service life of engine.

- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

1.6 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate results of performance testing.
- .3 Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- .4 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- .5 Manufacturer's Field Reports: Indicate procedures and findings.

1.7 Closeout Submittals

- .1 Provide maintenance data for diesel generating units for incorporation into manual specified in Section 01 78 10 □ Closeout Submittals.
- .2 Provide in English for incorporation into instruction manuals as follows:
 - .1 Complete set of reviewed shop drawings.
 - .2 Factory test data of engine, generator, exciter, control logic, metering and other pertinent test data.
 - .3 Maintenance and operation bulletins for:
 - .1 Engine and Accessories.
 - .2 Generator.
 - .3 Voltage Regulator and Accessories.
 - .4 Exciter.
 - .5 Permanent magnet generator if installed.
 - .6 Battery charger.
 - .7 Speed Governor.
 - .8 Starting Motor.
 - .9 Batteries.
 - .10 Ventilating Equipment.
 - .11 Timers, Relays, Meters.
 - .12 Power Circuit Breakers.
 - .13 Controller, Contactors.
 - .14 Other Accessories.
 - .4 Submit original brochures; photocopies are not acceptable.
 - .1 Include technically relevant data.
 - .5 Complete sequence of system operation.
 - .6 Complete bill of materials including nameplate data of equipment and accessories.
- .3 Forward, two weeks prior to factory tests, one copy of instruction manual for each unit of different ratings to Contract Administrator.

- .4 Forward, within two weeks after factory tests, one copy of instruction manuals, with updated drawings, for each unit of different ratings, to Contract Administrator.

1.8 Tools

- .1 Provide complete set of tools required for proper care, adjustment and maintenance of equipment supplied.
- .2 Where metric size nuts and bolts are used, provide one set of sockets complete with ratchet handle and set of combination wrenches, to fit sizes used.

1.9 Extra Stoc Materials

- .1 Provide maintenance materials in accordance with Section 01 78 10 Closeout Submittals.
 - .1 Extra Material/Spare Parts: provide the following:
 - .1 One spare control circuit breaker per rating.
 - .2 Ten spare indicating light bulbs per rating.
 - .3 One spare control relay and socket per rating and contact arrangement.
 - .4 One spare contactor operating coil.
 - .5 Six fuel filter elements for each type of fuel filter/water separator.
 - .6 Six lubricating oil filter elements.
 - .7 Three air cleaner elements.

1.10 Qualit Assurance

- .1 Provide Products listed and classified by ULC/CSA or testing firm acceptable to authority having jurisdiction and as suitable for purpose specified and indicated.
- .2 Perform Work to Ontario Electrical Safety Code, latest edition.
- .3 Conform to CSA B139 Series 15, CSA C282-09.
- .4 Maintain one copy of document on site.
- .5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .6 Supplier Qualifications: Authorized and distributor of specified manufacturer with minimum three years documented experience.

1.11 Deli er Stora e, And Protection

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .2 Prepare, crate and protect equipment against shipping and storage damage.

- .3 Provide minimum 12.5 mm plywood outer covering single vapour barrier inside.
- .4 Mount unit and panel on shipping skids with plank floor.
- .5 Each package to have shipping weight, address, dimensions and brief description of contents stencilled on at least two sides.
 - .1 Staple on outside packing list contained in waterproof envelope.
 - .2 Place copy of packing list inside.
 - .3 Mail additional copies to consignee.
- .3 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials in accordance with Section 01 61 00 □ Product Requirements.

Part 2 Products

2.1 Syste Description

- .1 Provide automatic, unattended, emergency power supply system consisting of:
 - .1 Liquid cooled low voltage diesel electric generating unit with control panel.
 - .2 Accessories and equipment specified in this specification.
- .2 Provide design, fabrication, testing, transportation, demonstration and equipment warranty.

2.2 Desi n Criteria

- .1 Description: CAN/CSA-C282, engine generator system to provide source of power for Level 1 and 2 and applications
- .2 Design equipment to meet following requirements:
 - .1 Total load: 200kW.
 - .2 Voltage: 600 V.
 - .3 Frequency: 60 Hz.
 - .4 3 Phase/4 Wire.
 - .5 Power factor: 0.8.
 - .6 Load harmonic content: 15% THD.
 - .7 Maximum rotational speed: 1800 rpm.
 - .8 Interrupting capacity: 1 MVA.
 - .9 Performance: automatic.
 - .10 Ambient temperature: 40 degree C.
 - .11 Relative humidity: 60%.
- .3 Design unit capable of starting, attaining settled voltage and frequency limits and accepting 80% rated load with voltage and frequency settling to specified steady state bands, within 15 seconds for any temperature between 0 degree C to 40 degrees C.

- .4 Use engine manufacturer's standard, published continuous (prime) horsepower rating in assessing engine capacity and derate this rating for specified conditions and engine driven accessories in accordance with ISO 3046-1.
- .5 Description of generating set operation:
 - .1 Automatic starting on abnormal or loss of normal voltage via control signal from transfer switches.
 - .2 When emergency supply has reached settled voltage and frequency preset limits (adjustable) transfer switch will transfer load to emergency supply.
 - .3 Continue to supply load until hydro supply returns or set is shut down manually or under failure conditions.
 - .4 On hydro restoration, monitored by the transfer switch, for time period in excess of three minutes (adjustable), transfer switch will transfer load to hydro supply.
 - .5 Adjustable time delay relay to allow engine to run unloaded to cool down and subsequently to shut down, ready for next cycle.
 - .6 Equip engine with key switch with following positions: auto-off-crank-start, key removable in auto position only.
 - .7 Automatic shut down on:
 - .1 Overcranking.
 - .2 Overspeed.
 - .3 High engine temperature.
 - .4 Low lubricating oil pressure.
 - .5 Over and under frequency.
 - .6 Emergency breaker failure.
 - .7 Electrical fault lock-out on short circuit and generator over and under voltage.

2.3 Asse I

- .1 Provide items as follows plus other items necessary to make unit complete:
 - .1 Diesel engine.
 - .2 Diesel engine accessories.
 - .3 Baseplate and drip pan.
 - .4 Vibration isolators.
 - .5 Governor.
 - .6 Engine exhaust system.
 - .7 Engine cooling system.
 - .8 Engine ventilating system.
 - .9 Starting motors.
 - .10 Batteries and rack.
 - .11 Battery charger.
 - .12 Generator and exciter.
 - .13 Voltage regulator and accessories.
 - .14 Control panel.

- .15 Circuit Breaker.
- .16 Spares and accessories.

2.4 Mountin

- .1 Connect engine flywheel housing rigidly to generator stator housing with SAE adapter.
 - .1 Mount unit on common, heavy duty fabricated steel baseplate.
 - .2 Obtain approval for design and materials of baseplate from engine manufacturer.
- .2 Baseplate: rigid material to maintain alignment of engine-generator shafts and frames under shipping, installation and service conditions.
- .3 Install machine engine-generator feet and baseplate sole plates parallel and true.
 - .1 Shims: steel type, installed under generator feet.
- .4 Provide spring type isolators as follows:
 - .1 Isolators: cast iron housings, complete with levelling bolts, adjustable oil proof snubbers and minimum 6 mm sound pads.
 - .2 Isolation efficiency 95% minimum.
- .5 Determine quantity and location of isolators.
 - .1 Locate each isolator to carry equal proportion of weight and that pressure exerted on floor by each isolator does not exceed 345 kPa.
- .6 Ship isolators loose for installation at project site.

2.5 Diesel En ine

- .1 Full diesel, heavy duty, cold start, liquid cooled, vertical in-line or vee, and current manufacture of a type and size that has been service as a prime mover for electric power generation for not less than two years.
 - .1 Turbocharged engine is acceptable providing brake mean effective pressure (BMEP) at rated output is 275 psi.
 - .2 Mechanically driven superchargers not acceptable.
- .2 Engine: minimum of four (4) cylinders.
- .3 Engine with auxiliary starting aids (i.e., glow plug assist start) not acceptable.
- .4 Equip engine air intakes with dry type heavy duty air cleaners located close to inlet manifold.
 - .1 Cleaner element: directly replaceable with elements of Canadian manufacture.
- .5 Provide engine wiring in liquid-tight conduit and fittings with insulated bushings.
 - .1 Use stranded, minimum No.14 AWG, TEW 105 degree C and coloured coded wires .
 - .2 Terminate wiring with coded, insulated terminals flanged fork type. Terminal blocks heavy duty, screw type.
 - .3 Wire markers of slip on oil proof type.
 - .4 Maximum of two wires per terminal block.

- .6 Provide high quality lubricating oil pressure gauge, lubricating oil temperature gauge, tachometer, coolant temperature gauge thermocouple, exhaust pyrometer and other standard gauges and instruments.
 - .1 Calibrate and scale gauges and instrument in both metric and imperial units and symbols.
 - .2 Mount oil temperature sensors on engine full flow pressure line.
 - .3 Hoses or tubing for gauges: high pressure reinforced type.
- .7 Mount unit accessories, including gauges, instruments, and protective sensors, to isolate or dampen vibrations.
- .8 Dynamically balance complete engine-flywheel generator arrangement after assembly.
 - .1 Torsional or other vibration tolerance within 10% above or below rated speed of unit, when operating unloaded or connected to any load within its rating.
 - .2 Cyclic irregularity: 1/250 maximum.
- .9 Provide engine flywheel with graduated marking around its periphery to facilitate fuel injection and valve timing.
- .10 Provide removable wet type cylinder liners.
 - .1 Furnish cylinder head with removable valve seat insert and guides.
- .11 Provide personnel safety guards for exposed moving parts and exhaust manifolds.
 - .1 Provide platform for servicing upper part of engine where applicable.
- .12 Engine control panel complete with:
 - .1 Lubricating oil pressure gauge.
 - .2 Lubricating oil temperature gauge.
 - .3 Coolant temperature gauge.
 - .4 Low coolant level gauge.
 - .5 Engine switch auto-off-crank-start selector switch and crank pushbutton.
 - .6 D.C. main power supply circuit breaker.
 - .7 Terminal blocks for connection to D.C. power supply, engine monitoring and shutdown device.
 - .8 Provide low oil pressure, high coolant temperature, low coolant level and overspeed protection to shut down engine on manual operation.

2.6 Coolin and Ventilation Syste

- .1 Provide complete cooling and ventilating system for unit.
- .2 Thermostatically control system and maintain coolant, ethylene glycol, within engine manufacturer's tolerances, with unit operating at rated load under specified conditions. Cooling system engine mounted radiator type.
 - .1 Design and supply complete ventilating system where engine mounted radiator is required.
 - .1 Radiator cooling fan to be pusher type, minimum two belt drive with belt adjuster.

- .2 Fan, pulley and belt with removable protective cage.
- .2 Provide multi-fan system suitable for indoor installation complete with electrical controls and breaker type combination starters.
 - .1 Starters mounted in control panel.
 - .2 Motor of splash proof enclosure.
 - .3 Provide braided corrugated flexible lines for pipe terminations at radiator and engine, isolating valves, fittings and pipe for installation of radiators approximately 9m from front of engine.
- .3 Provide drain valves for draining coolant from engine block and radiator.
 - .1 Drain coolant conveniently into large container through flexible extensions.
 - .2 Dripping valves or leaking connections will not be permitted.
- .4 Ventilation system: complete with canvas connections, mounting hardware, modulating damper motors, dampers, inlet and outlet hoods, bird/insect/screen, air filters, manual potentiometer, damper linkages, low voltage transformer, thermostat, fan motor.
 - .1 Provide positive seal, zero heat loss louvers.
- .5 Ventilating system operation as follows:
 - .1 Air inlet and outlet damper closed when engine not running.
 - .2 On engine start, air inlet damper to open.
 - .3 Inlet damper minimum opening to be set by manual potentiometer.
 - .4 Thermostat to modulate inlet and outlet dampers to maintain set room temperature.
 - .5 Fan to start when inlet louvres 90% open (adjustable).

2.7 Lubrication System

- .1 Provide full pressure lubricating system complete with filters and oil cooler.
- .2 Oil pump: engine driven gear type complete with strainer.
- .3 Equip filters with automatic by-pass valve and full flow filter elements conveniently located for servicing and directly replaceable with elements of Canadian manufacture.
 - .1 Cooler to have sufficient capacity to maintain oil temperature within engine manufacturer's tolerances with unit operating at rated load under conditions specified.
- .4 Equip engine oil sump with oil drain pipe, gate valve and pipe cap.
 - .1 Permit complete drainage in a convenient manner.
- .5 Metallic oil hoses: steel reinforced rubber type with crimped or swaged end fittings.

2.8 Fuel System

- .1 Provide complete fuel system including fuel lift pump and filters in accordance with CSA-B139 Series 15 and TSSA FS-219-16 Code Adoption Document.

- .1 Filter elements to be directly replaceable with elements of Canadian manufacture.
- .2 Day Tank: 380 L (100 gal) unit with dual integral pumps and level control. Include flexible fuel line connections, fuel gauge, check valve, high fuel level alarm contact, and indicating light. Operate pump with motor rated 120 volts AC. Conform to NFPA 30.

2.9 Exhaust System

- .1 Provide complete exhaust system including heavy duty industrial type silencer with condensate drain, plug and flanged couplings; stainless steel, corrugated expansion joints, length to suit, to absorb both vertical and horizontal expansion; flanges, bolts, gaskets, adjustable hangers and pipe and pipe-thimble to permit projection of pipe 1.0 m beyond wall.
 - .1 Exhaust tail pipe end at 45 degree angle and terminate in Insulate interior exhaust piping and silencer. All exhaust terminations to be vertical per TSSA.
 - .2 Arrange exhaust system to suit openings.
 - .1 Where schedule of dimensions does not indicate location of opening, arrange exhaust run best suited to engine.
 - .3 Provide exhaust pyrometers located on common exhaust manifold or two pyrometers on separate manifolds.
 - .1 Pyrometer range to include temperature at 110% load.

2.10 Jacket Coolant Heater

- .1 Provide engine jacket coolant heaters complete with 20 degree C to 60 degree C adjustable immersion type thermostat.
 - .1 Size heaters to maintain coolant at 40 degree C in an ambient temperature of 0 degree C.
- .2 Obtain circulation of heated coolant on thermosiphon principle.
 - .1 However, if this does not provide sufficient circulation to avoid hot spots in system, provide electrical motor driven circulating pump to operate automatically when heater is energized.
 - .2 Motor: 120 V single phase splash-proof type complete with breaker type combination starter.
 - .3 Starter mounted in control panel.

2.11 Speed Governor

- .1 Provide full electronic governor with speed changer and dry type actuator.
 - .1 Governing system: in accordance with ISO 3046-4.
- .2 Governor with following features:
 - .1 Ten turn locking type manual speed adjustment.
 - .2 Speed regulation, steady state, no-load to full load and vice versa: +/- 0.25%.
 - .3 Transient peak, no-load to full-load and vice versa +/-10%.

- .4 Recovery time to steady state condition on application of 80% load from no load not to exceed 3 seconds.
- .5 Frequency: externally adjustable from zero to 5% while engine is running.
- .6 Class A accuracy.

2.12 Startin Syste

- .1 Provide complete starting system including cranking starting motors, batteries, battery stand, heavy-duty battery cables and battery charger.
- .2 Provide positive engaging type cranking motors.
 - .1 Cranking motor and flywheel ring gear arrangements which may permit tooth to tooth abutment not acceptable.
- .3 Provide lead acid battery with sufficient capacity in ambient room temperature of 0 degree C to crank unit at engine manufacturer's recommended cranking starting speed for period of 3 minutes.
 - .1 Voltage measured at starting motor terminals at end of 3 minutes cranking, with cranking current flowing, not less than 1.75 V per cell.
 - .2 Size battery to suit engine and battery manufacturer's published data.
 - .3 Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 225 ampere-hours minimum capacity. Match battery voltage to starting system. Include necessary cables and clamps.
 - .4 Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.
 - .5 Battery termination: bolt-on or stud type.
 - .6 Protect terminals and exposed electrical connections from accidental short circuit by falling conductive objects on battery.
- .4 Provide battery rack integral to generator set frame, and within outer frame rails.
- .5 Provide battery charger with 120 volt AC input and output equal to 1.20 of ampere-hour capacity of battery based on 8 hour rate.
 - .1 Output voltage ripple: 3% or less.
 - .2 Provide AC input circuit breaker and 24 hours terminating equalizer timer with approximately 4 m of connecting cord and permanent connectors for connecting to battery terminals.
 - .3 Provide 5 spare fuses inside charger panel.
 - .4 Charger: CSA approved.
 - .5 A battery charger integrated with the generator control panel is also acceptable.
- .6 Provide necessary heavy duty, maintenance-free battery cables and connectors.
 - .1 Select cable wire size on the basis of allowing not more than 5% voltage drop at time of peak load.
 - .2 Cable length sufficient to allow battery location on either side of engine.
- .7 Fit turbocharged engines with one spring actuated, two stage accumulator per turbocharger to automatically provide pre-start and post run lubrication to turbochargers.

2.13 Generator

- .1 Provide generator, drip proof, single bearing and close coupled to engine with SAE housing: to NEMA MG 1.
 - .1 Generator: full amortisseur winding, direct connected brushless exciter with easily removable bolt-on diodes with surge protection.
- .2 Maximum deviation of open circuit terminal voltage waveform not to exceed 5%.
- .3 Provide permanent magnet generator (PMG) for generator short circuit sustaining capability not less than 2.4 times rated current.
- .4 Generator winding insulation: Class H; winding temperature rise not to exceed 105 degree C as measured by resistance in ambient temperature of 40 degree C.
- .5 Identify generator windings with metal tags.
 - .1 Bring windings to insulated terminals in metal junction box mounted on side or top of generator.
 - .2 Size junction box to permit mounting of engine and generator low voltage controls and wiring terminals blocks.
 - .3 Provide barrier in junction box to separate low and high voltage wiring.
- .6 Provide voltage regulation system complete with auto/manual control module.
 - .1 Voltage regulator: capable of withstanding continuous vibration, 15 G shock and temperature up to 50 degree C while maintaining accuracy to plus/minus 1%.
- .7 Steady-state voltage regulation not to exceed 0.25%.
 - .1 Transient voltage regulation, when full load is applied or removed, not to exceed 10% when measured by oscilloscope or high speed strip chart recorder with recovery time to steady-state less than 3 seconds.
- .8 Design equipment to minimize radio frequency interference (RFI) under operating conditions.
 - .1 Balanced telephone influence factor (TIF) to: NEMA MG 1.
- .9 Enclosure: CSA-C22.2 No. 100, open drip proof.

2.14 Panel General

- .1 Panel: Unit mounted, dead front, metal-enclosed steel construction.
- .2 Design and construct panel to withstand strains, jars, vibrations and other conditions incident to shipping, storage, installation and service.
- .3 Panel CSA certified. Mount a nameplate bearing CSA monogram in a prominent position on panel.
- .4 Identify instruments and controls with lamacoid or metal engraved nameplates fastened by rivets or screws for permanent identification.
 - .1 Identify door mounted items with nameplates.
 - .2 Attach nameplates to removable items such as relays and wireway covers.
- .5 Provide panel with bolted rear covers.

- .6 Factory wire panel completely. Use stranded, minimum No.14AWG, TEW 105 degree C and coloured for control wiring. Use No.10AWG for CT secondary connections:
 - .1 Blue - DC control.
 - .2 Red - AC control.
 - .3 Black - PT secondary connections.
 - .4 Orange - CT secondary connections.
 - .5 Green - non-current carrying ground.
 - .6 White - current carrying ground.
 - .7 Yellow - interlocks.
 - .8 Brown - generator excitation system.
- .7 Code wiring at each wire end with permanent, non-aging slip on markers.
 - .1 Support and run wiring neatly.
 - .2 Protect wiring from mechanical damage by grommets and shields.
- .8 Code terminal blocks, clamp type, serrated for positive grip and of tough, non-brittle, unbreakable nylon, size 3,453/0 or equivalent.
 - .1 For current transformer secondary circuits, provide terminals blocks of dual connector type.
 - .2 Provide test block for current transformer secondary connections.
- .9 Provide door detent mechanism to maintain hinged door at open position.
- .10 Supply loose 2 sets of wiring markers for each external wiring connection.
 - .1 Place markers in plastic bag and secured inside panel.
- .11 Use wiring duct for interconnection within panel.
- .12 Direct inter-panel connection not permitted, use terminal blocks.

2.15 Control Panel

- .1 Provide control panel for controlling engine generator unit.
- .2 Provide hinged front door and internal sub-panel.
- .3 Provide instrumentation, switching and control as listed in bill of material.
 - .1 Electrical connection of components shown in solid lines on drawing.
- .4 Panel dimensions and layout as indicated.
- .5 Mount terminal blocks on common mounting strips for interconnection wiring between the following:
 - .1 Sub-panel and panel door.
 - .2 Sub-panel and external wiring from diesel generator unit circuits.
 - .3 Sub-panel and external indicating circuits.
 - .4 Sub-panel and secondary circuits of power sub-cubicle.
 - .5 Sub-panel and external wiring from power transfer panel.
- .6 Provide 1 cm x 4 cm horizontal copper ground bus for whole length of enclosure, and two ground lugs; one at each end.

- .1 Lug: capable of accepting grounding conductor of range from No. 8 to No. 2/0 AWG.
- .7 Terminal blocks: CSA approved, clamp type, serrated for positive grip and of tough, non-brittle unbreakable nylon material; maximum two wires per terminal block.
 - .1 Use factory made terminal block jumpers wherever necessary.
- .8 Provide circuit breakers for equipment protection: use fuses where breakers are not applicable.
- .9 Provide top and bottom entry for power and control cables. Provide removable bottom plate.
- .10 Factory installed unit mounted Type 1 120/208/1P/3W/125A main lug only branch circuit panel complete with circuit breakers supplying engine coolant heater, battery charger, battery heater. Engine coolant heater, battery charger shall all be factory pre-wired back to load center.

2.16 Engine Generator Controller

- .1 Provide microprocessor controller complete with control and power modules for sensing, timing, logic and instrumentation to control diesel generator set.
- .2 Controller to include following features:
 - .1 Five position function selection switch - Reset, Off, Auto, Test No. Load, Test Full Load.
 - .2 Inverse time-voltage sensors for monitoring normal and emergency voltage and frequency.
 - .3 Controls necessary to provide system operation.
 - .4 Annunciator lights for following:
 - .1 Overcrank.
 - .2 Low Oil Pressure.
 - .3 High Coolant Temperature.
 - .4 Low Coolant Level.
 - .5 Overspeed.
 - .6 Frequency Limit.
 - .7 Voltage Limit.
 - .8 Contactor Failure.
 - .9 Fire Alarm.
- .3 Function selection to operate as follows:
 - .1 Reset: to reset the engine-generator set after it has been shut down on protective device.
 - .2 Off: the engine-generator set is shut off.
 - .3 Auto: provides automatic operation of engine generator set and transfer system.
 - .4 Test No. Load: exercises engine generator set without load. In event normal power fails during this mode, transfer system will operate to connect load to set.

- .5 Test Full Load: simulates normal power failure and runs engine generator set under load. If emergency power fails under this mode, transfer system to operate to re-store normal power to load.
- .4 Provide sufficiently sized capacitors on power input terminals to controller to maintain supply voltage, especially on D.C. power input during engine start.
- .5 Controller to include following time delays and adjustments.
 - .1 Crank delay preset at 3-20 sec.
 - .2 Restart preset at 15 sec.
 - .3 Bypass preset at 10 sec.
 - .4 Anticipated fail preset at minimum time setting.
 - .5 Engine start preset at 2 sec.
 - .6 EM - normal preset at 20 sec.
 - .7 Cool down preset at 5 min.
- .6 Equip controller with cycle crank provision to crank engine three time with adjustable rest delay of 3-30 seconds preset at 5 seconds.
- .7 Provide controller with following features:
 - .1 Front panel programming and display using keypad and to allow changing of parameters, operating configuration, status, and values.
 - .2 Security access code to prevent unauthorized changes.
 - .3 Self diagnostics, continually operating in the background, to ensure proper operation of microprocessor.
 - .4 Non-volatile memory to store operating logic, configuration and set points upon total loss of power.
 - .5 Sufficient internal power to maintain control outputs and operating sequence upon loss of DC supply from working battery.
 - .6 Isolation of inputs and outputs to ensure correct operation and no damage in event of transient voltages.
 - .7 With modem, initialized by controller. Provide necessary hardware, software and configuration for controller as well as necessary software for central remote monitoring and control station. Provide Communications between controller and central station through switched telephone lines.
 - .8 Operation counter for number of diesel starts (non-resettable).
 - .9 Operating temperature 0-50 degree C.
 - .10 Equip controller with communications system and uninterruptible power supply for central remote monitoring and control.

2.17 Enclosure

- .1 Compact footprint, weatherproof low profile design. Easy access to all major generator and engine control components for servicing. Full house, enclosed exhaust silence ensures safety and protects against rust.
- .2 Cambered roof to prevent water accumulation.
- .3 Rodent barriers on inlet and outlet.
- .4 Wind rated to 100mph.
- .5 Recessed, lockable doors.

- .6 Emergency stop button.
- .7 Level 2 sound attenuation.

2.18 Circuit Breaker

- .1 CAN/CSA-C22.2 No. 5, moulded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, sized to CEC requirements. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in generator connection box.

2.19 Signs

- .1 Provide at front top of each panel and on each generator junction box, lamacoid or metal engraved identification nameplate.
 - .1 Provide nameplates with letter and number identification designation to be given at time of acceptance tests.
- .2 Provide and attach to unit in prominent location, bilingual warning sign as indicated.
- .3 Where metric tools are required to service engine-generator unit, provide bilingual warning sign.

2.20 Finishes

- .1 In accordance with manufacturer's recommendations for surface conditions.
- .2 Clean, finish and paint equipment with smooth and durable finish.
- .3 Provide one half pint can of grey gloss paint for touch up.

2.21 Quality Work

- .1 Manufacture and construct equipment free from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.

2.22 Quality Control

- .1 General: before acceptance, assemble and set up the unit, complete with specified equipment, for tests at the supplier's plant in accordance with manufacturer certifications.
 - .1 Provide suitable test area with adjustable loading facilities.
 - .2 Ensure that engine has run in sufficiently prior to load test, test forms completed, system debugged and recorders connected.
- .2 Product examination: complete mechanical and electrical examination to determine compliance with specification and drawings with respect to materials, workmanship, dimensions and marking.
- .3 Non-operational tests and checks: perform following test and checks before starting the unit:
 - .1 Shaft alignment, end float, angular and parallel.
 - .2 Cold resistance of generator windings.
 - .3 Belt tensioning.

- .4 Equipment grounds.
- .5 Electrical wiring.
- .6 All grease lubricating points.
- .7 Personnel safety guards.
- .8 Air cleaner.
- .9 Coolant.
- .10 Lubricating oil type and level.
- .11 Type of fuel.
- .12 Vibration isolator adjustment.
- .13 Temperature and pressure sensors.
- .14 Engine exhaust system.
- .15 Tools.
- .16 Spares.
- .4 Operation test and check: on completion of non-operational tests and checks, start unit cold. Provide multi-channel recorder and record following:
 - .1 Time for unit to start and reach settled voltage and frequency.
 - .2 Time from initiation of start to full load application, with voltage and frequency settled.
 - .3 Voltage and frequency transient and steady state limits for full load to no load, 3/4 load to no load, load to no load, 1/4 load to no load and vice versa. Measure machine vibration levels under the same load conditions, in accordance with manufacturer certification.
 - .4 Record battery voltage drop during cranking.
- .5 Protection and control demonstration: on completion of operation test and check, demonstrate following:
 - .1 Overheat protection.
 - .2 Low oil pressure protection.
 - .3 Cranking cut out.
 - .4 Overcrank protection (3 tries).
 - .5 Overspeed protection.
 - .6 Under and over frequency.
 - .7 Under and over voltage.
 - .8 Electrical fault protection:
 - .1 Failure to close breaker.
 - .2 Failure to build up voltage.
 - .3 Generator short circuit and overcurrent.
 - .9 All control functions.
- .6 Load tests: load test the unit for 4 hours at full rated load in ambient room temperature of 40 degree C. Take following data at start of load test and every one hour interval thereafter:
 - .1 Frequency.
 - .2 Voltage.
 - .3 Current.

- .4 Kilowatts.
 - .5 Generator winding temperature.
 - .6 Generator frame temperature.
 - .7 Engine coolant temperature.
 - .8 Oil temperature and pressure.
 - .9 Manifold pressure.
 - .10 Ambient room temperature.
 - .11 Generator cooling air outlet temperature.
 - .12 Exciter field current and voltage.
 - .13 Vibration displacement.
 - .14 Ambient air temperature inside panel with doors closed.
- .7 Miscellaneous: provide accurate means for determining fuel and lubricating oil consumption.
- .1 Provide strip chart recorders for monitoring frequency, voltage and load.
 - .2 Provide recorder with ability to select speeds to allow accurate measurement of voltage, frequency and time during tests.
 - .3 Calibrate recorder by the recorder manufacturer (or designated representative) within three months of factory testing.
- .8 Interpretation of ambient room temperature: consider ambient room temperature as that temperature, which is lowest temperature registered out of a group of three thermometers when placed in engine room as follows:
- .1 One thermometer located on each side of engine block, approximately two-thirds of length of block back from front (radiator) end of block, 900 mm out from block and at height equal to height of block.
 - .2 Locate third thermometer over end of exciter on unit centre line, approximately 150 mm above top of exciter.
 - .3 Take thermometer showing lowest temperature to give true ambient air temperature.
 - .4 Adjust temperature to maintain this thermometer at 40 degree C during heat test.
- .9 Voltage and frequency regulation tests: on completion of load tests take hot resistance reading of generator windings.
- .1 Subject the unit to hot voltage and frequency regulation tests for full load to no load, 3/4 load to no load, load to no load, 1/4 load to no load and vice versa.
- .10 Panel performance and functions: check sequence of operation under service conditions.
- .1 Make provision for supplying and connecting required levels of voltage for primary circuits.
 - .2 Test overcurrent relays by impressing current in secondary circuits.
- .11 Additional tests: perform tests, consistent with contract, which Departmental Representative may require to satisfy adequacy and satisfactory operation of the unit.

- .12 Test data, charts and manufacturers' test forms be complete with diagrams and description of test results, deficiencies and corrective action.
 - .1 Ensure test data sheets signed by supplier.

2.23 Accessories

- .1 Remote Generator Emergency Stop Switch: Nema 4X surface mounted non-metallic enclosure complete with red push (stop) pull (reset) button.
- .2 Walk-in Enclosure: Pre-fabricated, skid-mounted unit with engine generator, motorized air intake and exhaust louvres, controls, space heaters, and lighting fixtures. Provide 1.0m (3ft) access aisle around engine-generator, with at least two doors for personnel access. Provide 2.25m (7ft) clear height. Construct unit from insulated sheet metal panels to provide sound and thermal insulation.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions:
 - .1 Verify that substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of liquid cooled diesel electric generating units.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Installation

- .1 Install liquid cooled Diesel electric generating units to CAN3-Z299.3 and in accordance with manufacturer's written instructions.

3.3 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Provide full load test utilizing portable test bank, if required, for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.
- .3 Record in 20 minute intervals during four hour test:
 - .1 Kilowatts.
 - .2 Amperes.
 - .3 Voltage.
 - .4 Coolant temperature.
 - .5 Room temperature.
 - .6 Frequency.
 - .7 Oil pressure.
- .4 Test alarm and shutdown circuits by simulating conditions.

3.4 Manufacturer's Field Services

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Monitor and report installation procedures and unacceptable conditions.

3.5 Interconnections

- .1 Interconnect with fire alarm system to provide notification of generator:
 - .1 Generator common trouble
 - .2 Generator running
 - .3 Generator low fuel
- .2 Interconnect with DDC to provide notification of generator:
 - .1 Generator common supervisory
 - .2 Generator running
 - .3 Generator low fuel

3.6 Adjust

- .1 Adjust generator output voltage and engine speed.

3.7 Cleanin

- .1 Clean in accordance with Section 01 74 00 □ Cleaning and Waste Processing.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 19 □ Construction Waste Management and Disposal.
- .3 Clean engine and generator surfaces. Replace oil and fuel filters.

3.8 Maintenance □ Clearances

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA-C282.

3.9 Warrant□

- .1 Provide five (5) year 1500 hour comprehensive extended warranty for standby generators. Warranty shall cover all parts, labour, and travel costs.

3.10 Closeout Acti ities

- .1 Demonstration:
 - .1 As directed by Contract Administrator and in accordance with Section 01 79 00 □ Demonstration and Training carry out demonstrations of complete interruptible power unit.
 - .2 Provide familiarization training of operating and maintenance staff.
 - .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 aspects of its care and operation.

- .4 Provide fuel required for performing site test and top-up after acceptance test completion.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Luminaires.
- .2 Emergency lighting inverter.
- .3 Exit signs.
- .4 LED luminaires and drivers.
- .5 Lamps.
- .6 Luminaire accessories.

1.2 Related Sections

- .1 Section 23 82 00 - Terminal Heat Transfer Units: Air distribution accessories for air handling luminaires.

1.3 References

- .1 ANSI/NEMA C78.379-2006 - American National Standard for Electric Lamps - Classification of the Beam Patterns of Reflector Lamps.
- .2 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .3 CSA-C22.2 No. 9.0-96 (R2006) - General Requirements for Luminaires.
- .4 CSA-C22.2 No. 250.0-08 - Luminaires.
- .5 CSA-C22.2 No. 141-15 - Emergency lighting equipment.
- .6 NEMA WD 6-2002 (R2008) - Wiring Devices - Dimensional Requirements.
- .7 CSA (Canadian Standards Association).
- .8 ULC (Underwriters Laboratories of Canada).

1.4 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Shop Drawings:
 - .1 Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - .1 Interior
 - .1 0.3m by 0.3m grid
 - .2 Entire project area.
 - .3 Separate Calculation Zones for each room.
 - .2 Exterior
 - .1 1m by 1m grid.
 - .2 Entire project site inclusive of 3m past the property line.
 - .3 Data to include:
 - .1 Fixture info:

- .1 Make & model
- .2 Description
- .3 Lamp info
- .4 Lumens
- .5 Lumen Multiplier
- .6 Light Loss Factor
- .7 Wattage
- .8 Efficiency
- .9 Distribution
- .10 Quantities
- .2 Calculation Zones
 - .1 Average
 - .2 Max
 - .3 Min
 - .4 Max/Min
 - .5 Avg/Min
 - .6 Reflectances used
 - .7 Lighting Power Density (W/sqm)
- .2 Product Data: Provide dimensions, ratings, and performance data.

1.5 Submittals or Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Submit data indicating application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each product.

1.7 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials:
 - .1 Provide two (2) of each plastic lens type.
 - .2 Provide ten (10) replacement lamps for each lamp type.
 - .3 Provide two (2) of each ballast type.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

- .2 Conform to requirements of CSA C22.1, and to the Efficiency Manitoba Commercial Lighting Program.
- .3 Products: Listed and classified by CSA, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Luminaires

- .1 Manufacturers:
 - .1 Refer to Luminaire Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00 Common Work Results for Electrical.
 - .1 All requests for substitutions shall be complete with photometric layouts indicating proposed luminaire performance in a 1' by 1' grid.

2.2 Emergency Lighting Inverter

- .1 Description: Stand-alone pure sine wave output inverter unit equipment designed to operate designated LED fixtures on emergency power and their full nominal lumen rating.
- .2 Battery: 12 volt, valve regulated lead acid type, with minimum 1/2 hour capacity at full load.
- .3 Inverter:
 - .1 120VAC +/- 3%
 - .2 60Hz +/- 1%
 - .3 Transfer Time 1s.
 - .4 Load Power Factor: 0.9 leading to 0.9 lagging.
 - .5 AC lockout
 - .6 Short circuit and brownout protection.
- .4 Housing: Factory white powder coat paint finish steel cabinet.
- .5 Indicators: Lamps to indicate AC ON and RECHARGING.
- .6 TEST Switch: Transfers unit from external power supply to integral battery supply.
- .7 Auto-test self-diagnostic
- .8 Electrical Connection: Hard wired
- .9 Input Voltage: 120V.
- .10 Manufacturers:
 - .1 Refer to Emergency Battery Bank Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00

2.3 Exit Signs

- .1 Housing: Extruded aluminum

- .2 Face: Green Pictogram face with white chevrons.
- .3 Directional Arrows: Universal type for field adjustment
- .4 Mounting: Universal, for field selection and as indicated
- .5 Lamps: LED
- .6 Input Voltage: Universal 120-347VAC, 6-24VDC.
- .7 Manufacturers:
 - .1 Refer to Emergency Lighting Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00

2.4 Led Lu inaires and Dri ers

- .1 All Luminaires
 - .1 Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
 - .2 Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
 - .3 LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
 - .4 LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
 - .5 LED luminaires shall deliver a minimum of 60 lumens per watt.
 - .1 LED's shall be Bin No. 1 quality.
 - .6 Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
 - .7 The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
 - .8 LED color temperatures: CRI 85, 2700K as noted +/- 145K.
 - .9 LED color temperatures: CRI 85, 4000K as noted +/- 275K.
 - .10 LED color temperatures: CRI 85, 5000K as noted +/-283K.
 - .11 Luminaires shall have internal thermal protection.
 - .12 Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
 - .13 Color spatial uniformity shall be within .004 of CIE 1976 diagram.
 - .14 Color maintenance over rated life shall be within .007 of CIE 1976.
 - .15 Indoor luminaires shall have a minimum CRI of 85.
 - .16 Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
 - .17 LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
 - .18 Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

- .2 Power Supplies and Drivers
 - .1 Efficiency Manitoba approved.
 - .2 Power Factor: 0.90 or higher
 - .3 Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
 - .4 Output operating frequency: 60Hz.
 - .5 Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
 - .6 Total Harmonic Distortion Rating: 20% Maximum.
 - .7 Meet electrical and thermal conditions as described in LM-80 Section 5.0.
 - .8 Primary Current: Confirm primary current with Drawings.
 - .9 Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
 - .10 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
 - .11 Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.
- .3 Controller and Control System
 - .1 System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required.
 - .2 The Contractor shall ensure that external control equipment is compatible with LED control requirements
 - .3 Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
 - .4 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers
 - .5 Luminaires used for emergency lighting connected to emergency lighting inverter to be controlled by relay type control that senses loss of normal power and controls the fixture to operate at 100%, locking out all other control until normal power is restored.

2.5 Lamps

- .1 Fluorescent Lamp Manufacturers:
 - .1 Philips
 - .2 Standard
 - .3 Osram Sylvania
 - .4 GE
 - .5 Substitutions: Refer to Section 26 05 00.
- .2 Lamp Types: As specified for luminaire. Less than 1.7mg of mercury. Refer to Section 26 05 00 for substitutions and product options.

2.6 Accessories

- .1 Description: Standard down light reflector shall be semi-specular unless noted otherwise.
- .2 Joiner Fittings: As specified for linear lighting systems, or as required for end to end continuous row mounting as indicated on drawings. Fittings to match style and finish of luminaire specified.
- .3 End Caps: As specified for linear lighting systems, or as required for end of row or stand-alone luminaire installations as indicated on drawings. End caps to match style and finish of luminaire specified.
- .4 Power Cord: As required for suspended lighting systems where wiring is exposed between fixture canopy and fixture lamp assembly. Power cord shall match finish of lighting fixture. Provide 0-10V combination cable as required for dimming purposes. Length of cable shall be suitable for minimum suspension length of 400mm from ceiling finish. Confirm final lengths with installation requirements.
- .5 Wireguard: As specified for luminaire, or as indicated on the drawings.
 - .1 Gauge: Minimum 8 gauge unless noted otherwise.
 - .2 Color: Custom color to be confirmed by architect at time of shop drawing review.

2.7 Source Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Certify fluorescent ballast design and construction by Certified Ballast Manufacturers, Inc.

Part 3 Execution

3.1 Installation

- .1 Support luminaires larger than 600 x 1200mm (24 x 48 inch) size independent of ceiling framing.
- .2 Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- .3 Install surface mounted luminaires, emergency lighting, and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- .4 Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, or suitable clips.
- .5 Install recessed luminaires to permit removal from below.
- .6 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- .7 Install clips to secure recessed grid-supported luminaires in place.
- .8 Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated.

- .9 Install end to end, or continuous rows of luminaires with appropriate joiner fittings to match the luminaire manufacturer and finish.
- .10 Install linear lighting with appropriate end caps where practicable.
- .11 Lighting installed in corridors shall be oriented to maximize light distribution along the corridor rather than across it.
- .12 Install accessories provided with each luminaire.
- .13 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- .14 Daisy chaining of lighting fixtures using AC90 not permitted.
- .15 Bond products and metal accessories to branch circuit equipment grounding conductor.
- .16 Install specified lamps in each luminaire, emergency lighting unit and exit sign.

3.2 Interface with Other Products

- .1 Interface with air handling accessories provided and installed under Section 23 37 00.

3.3 Field Quality Control

- .1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 Adjustment

- .1 Aim and adjust luminaires as directed.
- .2 Position exit sign directional arrows as indicated.
- .3 Allow for warranty visit 6 months after installation to incorporate user feedback on lighting control operations. Make adjustments as required.

3.5 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosures.
- .4 Clean photometric control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

3.6 Closeout Activities

- .1 Demonstration: Demonstrate luminaire operation for minimum of one (1) hours.

3.7 Protection of Finished Work

- .1 Refer to 26 05 00 Common Work Results for Electrical.

3.8 Schedules

- .1 As indicated on drawings.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Luminaires and accessories.
- .2 Poles.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete: Foundations for poles.

1.3 References

- .1 C22.2 NO. 250.0-18 - Luminaires.
- .2 C22.2 No. 9.0-96 (R2016) - General Requirements for Luminaires.
- .3 CAN/CSA-A14-07 (R2017) - Concrete Poles.
- .4 C22.2 No. 206-17 - Lighting Poles.
- .5 CAN/CSA-C239-02 (R2016) - Performance Standard for Dusk-to-Dawn Luminaires.
- .6 CAN/CSA-E60598-2-3-98 (R2017) - Luminaires - Part 2: Particular Requirements - Section 3: Luminaires for Road and Street Lighting.
- .7 IES RP-33-14 - Lighting for Exterior Environments
- .8 IES RP8-14 - Roadway Lighting.
- .9 IES RP20-14 - Lighting for Parking Facilities.
- .10 CSA (Canadian Standards Association).
- .11 ULC (Underwriters Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Provide bolt templates and pole mounting accessories to installer of pole foundations.

1.5 Submittals or Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide dimensions, ratings, and performance data.
- .3 Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.

1.6 Su it tals or In or ation

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate measured illumination levels.
- .3 Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.7 Closeout Su it tals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Maintenance Data: Submit maintenance data for each luminaire.

1.8 Maintenance Material Su it tals

- .1 Refer to 26 05 00 Common Work Results for Electrical.

1.9 Qualit Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.10 Re ulator Re ure ents

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

1.11 Deli er, Stora e, and Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Store and handle lighting poles to CAN/CSA-A14 and CSA-C22.2 No. 206.

Part 2 Products

2.1 Lu inaires and Accessories

- .1 Manufacturers:
 - .1 Refer to Luminaire Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00 Common Work Results for Electrical.
 - .1 All requests for substitutions shall be complete with photometric layouts indicating proposed luminaire performance in a 1 by 1 grid.

2.2 Poles

- .1 Manufacturers:
 - .1 Hapco
 - .2 Substitutions: Refer to Section 26 05 00.

- .2 Material and Finish: Aluminum with anodized finish.
- .3 Section Shape and Dimensions: Tapered round.
- .4 Height: 600 mm (20 ft) or as indicated.
- .5 Base: Nonbreakaway.
- .6 Accessories: Anchor bolts and cast reinforced handhole (75mm x 125mm (3x5)).
- .7 Loading Capacity Ratings:
 - .1 Luminaire Weight: 45kg (100lbs).
 - .2 Luminaire and Bracket Effective Projected Area: 0.7 sq m (8 sq ft)
 - .3 Steady Wind: Minimum 150 kph (90mph).
- .8 Warranty: Lifetime warranty for defects in material, workmanship and to be free from corrosion.

Part 3 Execution

3.1 Installation

- .1 Provide concrete bases for lighting poles at locations indicated, to Section 03 30 00.
- .2 Install poles plumb. Provide shims and double nuts to adjust plumb. Grout around each base.
- .3 Install lamps in each luminaire.
- .4 Bond metal poles, metal accessories and luminaires to branch circuit equipment grounding conductor.

3.2 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.3 Adjust

- .1 Aim and adjust luminaires to provide illumination levels and distribution as directed and indicated on Drawings.

3.4 Cleanin

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosure.
- .4 Clean photometric control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

3.5 Protection o Finis ed Wor

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Re-lamp luminaires where lamps have failed at Substantial Completion.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Heating cable.
- .2 Heating cable mat.
- .3 Temperature controllers for heating cable and mat.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete.

1.3 Performance Requirements

- .1 Pipe Trace Heating: Freeze protection with outside temperature at -40 degreesC (-40 degrees F).
- .2 Snow Melting Installations: 500W/sq m (45W/sq ft) minimum, in protected areas.

1.4 Administrative Requirements

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate installation of heating cable with installation of gutters.
- .3 Pre-installation Meetings: Convene before starting work of this section.
 - .1 Require attendance of parties directly affecting the work of this Section.
 - .2 Review sequencing of installation, protection from damage of finished installation, location of expansion and control joints in concrete and building, and methods used for covering installations with insulation and concrete.

1.5 Submittals or Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data for heating cable, mat and control components.
- .3 Shop Drawings: Indicate mat and heating cable layout, locations of terminations, thermostats, and branch circuit connections.

1.6 Submittals or Information

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.7 Closeout Submittals

- .1 Section 01 78 10: Submission procedures.

- .2 Record Documentation: Accurately record actual locations of temperature sensors, heating cable, mat, thermostats, and branch circuit connections.
- .3 Operation and Maintenance Data:
 - .1 Include description of operating controls.
 - .2 Include repair methods and parts list of components.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

Part 2 Products

2.1 Manufacturers

- .1 Manufacturers:
 - .1 Pentair; Product: GM.
 - .2 Substitutions: Refer to Tender No. 543-2022B; Part B – Bidding Procedures.

2.2 Heating Cable

- .1 Heating Cable: Self-limiting, parallel resistance heating cable.
- .2 Rating: 120 and 208V, (39 W/lin m (12W/lin ft).

2.3 Heating Cable Mat

- .1 Description: Heating cable assembled into pre-spaced unit.
- .2 Heating Cable: Mineral-insulated, copper-sheathed, series resistance heating cable.
- .3 Ratings: 208V
- .4 Non-heating Leads: 3m (10ft) length.
- .5 Unit Size: 900mm (36 inch) width.

2.4 Accessories

- .1 Thermostat: Gutter De-Icing Controller complete with built-in 30mA GFCI protection.
 - .1 Product: ETI GF Pro, manufactured by Pentair.

Part 3 Execution

3.1 Examination

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that ceiling framing, piping and concrete form work is ready to receive work.

- .3 Verify field measurements are as shown on Shop Drawings.
- .4 Verify that required utilities are available, in proper location, and ready for use.
- .5 Beginning of installation means installer accepts conditions.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Bending Radius: Six times cable diameter, minimum.
- .3 Avoid pinching and making sharp bends in cable.
- .4 Prevent damage by sharp rocks, metal, or other objects during installation.
- .5 Do not install heating cable and mat across expansion or construction joints.
- .6 Do not cross heating cable over itself.
- .7 Cable Spacing in Concrete: 75mm (3 inch) centres, minimum; 225mm (9 inch) centres, maximum.
- .8 Depth in Concrete: 50mm (2 inches) below finished surface.
- .9 Installation on Roof and in Ceiling: Do not begin until roofing work is complete. Route and fasten cable to manufacturer's written instructions. Select and install cable based on maximum safe temperature for materials used.
- .10 Provide 30mA trip GFCI breaker(s) for all circuits feeding heating cables and mats.

3.3 Field Quality Control

- .1 Section 01 45 00: Field inspection and Testing.
- .2 Test continuity of heating cable.
- .3 Perform continuity and insulation resistance test on completed cable installation. For cables embedded in concrete, perform tests immediately before and after concrete placement.
- .4 Measure voltage and current at each unit.
- .5 Submit written test report showing values measured on each test for each cable.

3.4 Closeout Activities

- .1 Demonstration: Demonstrate operation of heating cable controls.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Electric unit heaters.
- .2 Electric cabinet heaters.
- .3 Electric baseboard heaters.
- .4 Thermostats and accessories.

1.2 References

- .1 NEMA DC 3-2008 - Residential Controls - Electric Wall-Mounted Room Thermostats.

1.3 Submittals or Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide unit size, finish, and performance data.

1.4 Submittals or Information

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.5 Closeout Submittals

- .1 Section 01 78 10: Submission procedures.
- .2 Operation and Maintenance Data:
 - .1 Include instructions for safe operating procedures.
 - .2 Include instructions for replacement parts and troubleshooting diagnostics.
 - .3 Include recommended cleaning methods, cleaning materials, and waxes for interior parts and exterior finishes.

Part 2 Products

2.1 Manufacturers

- .1 Manufacturers:
 - .1 Ouellet
 - .2 Chromalox
 - .3 Stelpro
 - .4 Q-Mark
 - .5 Substitutions: Refer to Tender No. 543-2022B; Part B Bidding Procedures.

2.2 Electric Horizontal Discharge Unit Heaters

- .1 Description: Electric unit heater for suspended mounting, with fan forced air distribution over electric resistance heating coils and horizontal discharge.
- .2 Input Voltage: Refer to Schedule.
- .3 Output Rating: Refer to Schedule.
- .4 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centred in tubes and embedded in refractory material.
- .5 Input Fuses: Provide integral fuses for units rated more than 48 amperes full load.
- .6 Provide line voltage disconnect switch for each input circuit.
- .7 Fabrication: Fabricate cabinet of heavy welded steel.
- .8 Provide hinged and latched panel for electrical connection and control compartment.
- .9 Provide internal shroud around heating elements to assure uniform air flow and delivery temperature across heater face.
- .10 Provide suitable fan blade protection using wire guard.
- .11 Cabinet Finish: Use corrosion-resisting primer and finish with baked enamel, colour beige.
- .12 Contactor: Provide contactor control for unit.
- .13 Thermostat: Provide remote low voltage thermostat to control contactor.
- .14 Provide low voltage control transformer.
- .15 Operating Stages: One.
- .16 Provide terminal blocks for power and control wiring connections.
- .17 Louvre: Provide discharge louvre with individually adjustable blades.

2.3 Electric Downflow Discharge Unit Heaters

- .1 Description: Electric unit heater for suspended mounting, with fan forced air distribution over electric resistance heating coils and vertical discharge.
- .2 Input Voltage: Refer to Schedule.
- .3 Output Rating: Refer to Schedule.
- .4 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centred in tubes and embedded in refractory material.
- .5 Input Fuses: Provide integral fuses for units rated more than forty-eight (48) amperes full load.
- .6 Provide line voltage disconnect switch for each input circuit.
- .7 Fabrication: Fabricate cabinet of heavy welded steel.
- .8 Provide hinged and latched panel for electrical connection and control compartment.

- .9 Cabinet Finish: Use corrosion-resisting primer and finish with baked enamel.
- .10 Contactor: Provide contactor control for unit.
- .11 Thermostat: Refer to Schedule.
- .12 Provide low voltage control transformer.
- .13 Operating Stages: One.
- .14 Provide terminal blocks for power and control wiring connections.
- .15 Diffuser: Louvre type, adjustable from 0 degrees to 45 degrees (0 to 50 grads).

2.4 Electric Cabinet Heaters

- .1 Description: Surface wall or ceiling mounted and Recessed cabinet heater with fan forced air distributed over resistance heating element.
- .2 Input Voltage: Refer to Schedule.
- .3 Output Rating: Refer to Schedule.
- .4 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centred in tubes and embedded in refractory material.
- .5 Provide line voltage disconnect switch integral with thermostat to directly control heater element.
- .6 Fabrication: Fabricate cabinet of heavy welded steel.
- .7 Grille: Fabricate from extruded aluminum
- .8 Provide captive-screw held panel for electrical connection and control compartment.
- .9 Cabinet Finish: Use corrosion-resisting primer and finish with baked enamel.
- .10 Grill Finish: Use corrosion-resisting primer and finish with baked enamel.
- .11 Provide terminal blocks for power and control wiring connections.

2.5 Electric Base Board Heaters

Description: Wall mounted electric convector heater with resistance heating element.

- .1 Input Voltage: Refer to Schedule.
- .2 Output Rating: Refer to Schedule.
- .3 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome wire embedded in refractory material.
- .4 Element Hangers: Ball bearing cradle type.
- .5 Provide line voltage disconnect switch integral with thermostat to directly control heater element.
- .6 Fabrication: Fabricate cabinet of extruded aluminum.
- .7 Grille: Fabricate from extruded aluminum.
- .8 Provide captive-screw held panel for electrical connection and control compartment.
- .9 Cabinet Finish: Use corrosion-resisting primer and finish with anodized enamel.

- .10 Grille Finish: Use corrosion-resisting primer and finish with anodized enamel, colour beige.
- .11 Provide terminal blocks for power and control wiring connections.

2.6 Accessories

- .1 Room Thermostat: heating only single line break line voltage thermostat with control point reset.

Part 3 Execution

3.1 Examination

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that field measurements are as instructed by manufacturer and shown on Drawings.
- .3 Verify that field conditions are acceptable and are ready to receive work.
- .4 Verify that required utilities are available, in proper location, and ready for use.
- .5 Beginning of installation means installer accepts existing conditions.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Locate each unit in position indicated.
- .3 Install unit with sufficient clearance from adjacent construction, piping, ductwork, and other obstructions to allow access for service and maintenance.
- .4 Support unit heaters and ceiling mounted cabinet heaters from structure. Install manufacturer supplied vibration isolation as required.

3.3 Field Quality Control

- .1 Section 01 45 00: Field adjusting and testing.
- .2 Verify operation of each electric heating unit by measuring input voltage and current simultaneously for period of ten minutes of continuous operation.

3.4 Closeout Activities

- .1 Demonstration: Demonstrate location of circuit breakers and switches serving electric heating branch circuits, and location and setting procedures for thermostats and other heating controls.

END OF SECTION

Part 1 General

1.1 Related Requirements

- .1 Section 26 05 26 □ Grounding and Bonding.

1.2 References

- .1 American National Standards Institute
 - .1 ANSI/TIA-607-D-2019, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- .2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-606-2002, Administration Standard for the Commercial Telecommunications Infrastructure.

1.3 System Description

- .1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.
- .2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.
- .3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

Part 2 Products

2.1 Telecommunications Main Grounding Bus Bar (TMGB)

- .1 Predrilled copper busbar, electrotin plated with holes 8 mm diameter for use with standard-sized lugs to: ANSI J-STD-607-A.
- .2 Dimensions 0.5□(6 mm) thick, 4□(100 mm) wide, 24□(600 mm) long to: TIA-607.

2.2 Bonding Conductor for Telecommunications

- .1 3/0 AWG copper conductor, green marked to: TIA-607.

2.3 Warning Labels

- .1 Non-metallic warning labels in English to: TIA-607.
- .2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

Part 3 Execution

3.1 Telecommunications Main Grounding Bus Bar (TMGB)

- .1 Install TMGB in entrance room on insulated supports 25(50mm) high at location close to electrical power panel if one is installed in same room.
- .2 Install 3/0 AWG copper bonding conductor from TMGB to alternating current equipment ground (ACEG) of serving electrical power panel (panelboard).

3.2 Bonding Conductors General

- .1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using grounding bushing and #6 AWG copper conductor.

3.3 Bonding Conductor for Telecommunications

- .1 Install bonding conductor for telecommunications from TMGB to service equipment (power) ground.
- .2 Use approved 2 hole compression lugs for connection to TMGB.

3.4 Bonding To TMGB

- .1 Bond metallic raceways in telecommunications entrance room to TMGB using #3AWG copper conductor.
- .2 For cables within telecommunications entrance room having shield or metallic member, bond shield or metallic member to TMGB using #6 AWG copper conductor.
- .3 Bond all equipment racks and cabinets located in telecommunications entrance room to TMGB using #3 AWG copper conductor.

3.5 Labeling

- .1 Apply warning labels to telecommunications bonding and grounding conductors.
- .2 Apply additional administrative labels to: TIA/EIA-606.

END OF SECTION

Part 1 General

1.1 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 communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 Delivery, Storage and Handling

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

Part 2 Products

2.1 System Description

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, terminal and distribution cabinets, conduits, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.
- .2 Overhead distribution system.

2.2 Material

- .1 Conduits: EMT type, in accordance with Section 26 05 33 - Conduits.

Conduit Fill Chart (0 Bends)							
Size		Category Cables			Coaxial	Fiber Multimode	
inch	mm	Cat5e	Cat6	Cat6A	RG6	12 strands OM3	12 strands OM4
1/2	16	3	2	1	2	2	2
3/4	21	5	4	3	3	4	4
1	27	9	7	5	6	7	7
1-1/4	35	15	13	8	9	13	12
1-1/2	41	21	18	12	14	18	17
2	53	35	30	20	23	30	29

2-1/2	63	50	42	28	33	42	41
3	78	77	65	44	51	65	63
3-1/2	91	105	89	60	70	89	86
4	103	135	114	77	90	114	110

Conduit fill shall be de-rated by 15% per bend between pull boxes.

- .2 Underground cable ducts: PVC type.
- .3

Cable Tray Fill Chart							
Size		Category Cables			Coaxial	Fiber Multimode	
inch	mm	Cat5e	Cat6	Cat6A	RG6	12 strands OM3	12 strands OM4
2"D x 2"W	56mm x 50mm	56	47	32	37	48	46
2"D x 4"W	56mm x 100mm	113	95	65	75	96	92
2"D x 6"W	56mm x 150mm	170	143	97	113	145	139
2"D x 8"W	56mm x 200mm	227	191	130	151	193	185
2"D x 12"W	56mm x 300mm	341	287	195	227	290	278
4"D x 12"W	102mm x 300mm	682	574	390	454	580	556
6"D x 12"W	152mm x 300mm	1023	861	585	681	870	834

- .4 Overhead distribution system: in accordance with J-hooks.

J Hook Fill Chart							
Size		Category Cables			Coaxial	Fiber Multimode	
inch	mm	Cat5e	Cat6	Cat6A	RG6	12 strands OM3	12 strands OM4
1	27	20	15	10	13	16	16
1-5/16	33	50	40	25	27	35	34
2	53	90	60	35	48	61	59
3	78	200	150	80	113	144	138
4	103	330	220	140	189	241	231

- .5 Junction boxes, cabinets: In accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .6 Outlet boxes: In accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .7 Fish wire: polypropylene type.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems 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 Install empty raceway system, including overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.
- .2 Size raceway system to accommodate all cable drops as shown, refer to Fill Chart for minimum sizing requirements unless size is otherwise indicated on drawings.
- .3 Maintain the following clearances from all electrical equipment as follows:
 - .1 Transformers above 5kVA □ 1000mm
 - .2 347/600V power □ 1000mm
 - .3 120V power □ 50mm
 - .4 208/240V power □ 300mm
 - .5 Motors □ 1000mm
 - .6 120V fluorescent lighting □ 300mm
 - .7 347V fluorescent lighting □ 1000mm

3.3 Cleanin

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 □ Cleaning and Waste Processing.
 - .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 Processing.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 19 □ Construction 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 pathways for communications systems installation.

END OF SECTION

Part 1 General

1.1 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
 - .2 CSA-C22.2 No. 232-[M1988(R2004), Optical Fiber Cables.
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-568-C.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - .2 TIA/EIA-568-C.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - .3 TIA/EIA-568-C.3-(2000), Optical Fiber Cabling Components Standard.
 - .4 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.
 - .5 TIA TSB-140-2004, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
 - .6 TIA-598-C-(2005), Optical Fiber Cable Color Coding.

1.2 Definitions

- .1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.3 System Description

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fiber cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems.
 - .1 Horizontal cables link work areas to telecommunications room[s] located on same floor.
 - .2 Telecommunications rooms linked to main terminal/equipment room (MT/ER) by backbone cables.
 - .3 MT/ER also linked to Entrance Room by backbone cables.

1.4 Action and Informational Submittals

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

- .2 As-built Records and Drawings: in accordance with Section 01 78 10 □ Closeout Submittals.

1.5 Deli er □, Storage and Handlin

- .1 Waste Management and Disposal: separate waste materials for reuse or recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 Four-Pair 100 Ω Balanced Twisted Pair Cable

- .1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or MPP or CMP to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-C.
- .1 Cabling must be packaged on reel inside of the box, complete with a Brake Box braking system to prevent kinking of the cable during installation. Breaking system to have two resistance mechanisms on both sides of the reel, each of which has three resistance settings to allow for back-tension, over-spin control and preventing tangling.
- .2 Cabling reel to also include Quick Count cable product that provides footage marking on the cable jacket counting down from 1,000 feet.
- .3 Colour Coded as follows:
 - .1 Data Outlets □ Blue
 - .2 Wireless Access Points □ Green
 - .3 Video or CCTV □ Red
 - .4 Phone or Voice Outlets □ Yellow
 - .5 Access Control Systems □ Purple
 - .6 Paging and Intercom □ Black
 - .7 Lighting Controls □ White

2.2 Work Area UTP 4-Pair Modular Jack

- .1 Eight-position modular jack ("RJ-45"), type T568A Category 6 to: TIA/EIA-568-C:
 - .1 In self-contained surface-mount box, 2 jacks per box.
 - .2 Mounted in compatible single gang faceplate, flush entry, 4 jack positions per faceplate.

2.3 Termination and Cross-Connection Hardware or UTP

- .1 IDC Terminal strips, 25 pair, for terminating multi pair 100 Ω balanced twisted pair cables and supporting cross-connections using jumper wires or compatible plug-ended patch cords: Category 6 to: TIA/EIA-568-C.
- .2 Mount or block for housing 12 IDC terminal strips, mounted on wall.

- .1 Distribution rings or channels capable of externally mating with the above mount for managing cross-connection wires.
- .3 Patch panel, 2 rack units high, 48 ports:
 - .1 Each port equipped with factory installed "RJ-45" jacks, type T568A Category 6 to: TIA/EIA-568-C.
 - .2 Horizontal cable-management unit for every 48 ports.
- 2.4 UTP Cross-Connect Wire**
 - .1 Category 6, 4 pairs to: TIA/EIA-568-C.
- 2.5 UTP Patch Cords**
 - .1 3 metres long, with factory-installed male plug at one end to mate with "RJ-45" jack and with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs to: TIA/EIA-568-C.
 - .2 Colour Coded as follows:
 - .1 Data Outlets □ Blue
 - .2 Wireless Access Points □ Green
 - .3 Video or CCTV □ Red
 - .4 Telephone or Voice Outlets □ Yellow
 - .5 Access Control Systems □ Purple
 - .6 Paging and Intercom □ Black
 - .7 Lighting Controls □ White
- 2.6 UTP Endpoint Cable**
 - .1 4 pair "pigtail", 3 metres long, with factory-installed male plug on one end to mate with "RJ-45" jack and other end equipped with factory-installed male plug to mate with "RJ-45" jack: Category 6 to: TIA/EIA-568-C.
- 2.7 UTP Work Area Cords**
 - .1 3 metres long, each end equipped with "RJ-45" plug Category 6 to: TIA/EIA-568-C.
- Part 3 Execution**
 - 3.1 Installation of Termination and Cross-Connect Hardware**
 - .1 Install termination and cross-connect hardware in rack as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.
 - 3.2 Installation of Horizontal Distribution Cables**
 - .1 Install horizontal cables as indicated in "J" hooks from telecommunication rooms to individual work-area jacks. Identify and label as indicated to: TIA/EIA-606-A.

- .2 Support horizontal cables at intervals not exceeding 2 metres.
 - .1 Where raceways are used to distribute cables to each zone, provide supplementary "J" hooks to support cables at intervals not exceeding 2 metres.
- .3 Terminate horizontal cables in telecommunications room and at individual work-area jacks
 - .1 Identify and label as indicated to: TIA/EIA-606-A.
- .4 Coil spare cables and store in ceiling space in zone.
- .5 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.

3.3 Installation of Backbone Cables

- .1 Install backbone cables from each telecommunications room to main terminal/equipment room (MT/ER) as indicated and according to manufacturers' instructions.
 - .1 Identify and label as indicated to: TIA/EIA-606-A.
- .2 Install backbone cables from MT/ER to carrier demarcation point in [Entrance Room] as indicated and according to manufacturer's instructions.
 - .1 Identify and label as indicated to: TIA/EIA-606-A.

3.4 Installation of Equipment Cables

- .1 Install equipment cables from equipment patch panel as indicated.
 - .1 Identify and label as indicated to: TIA/EIA-606-A.

3.5 Implement Cross-Connections

- .1 Implement cross-connections using patch cords as specified.

3.6 Field Quality Control

- .1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy, electronic record on CD.
 - .1 Perform tests for Permanent Link on installed cables, including spares:
 - .1 Category 6 using certified level III tester to: TIA/EIA-568-C.
 - .2 Perform the following tests: wire map, length, insertion loss, NEXT loss, ELFEXT, PSELFEXT, ACR, PSACR, propagation delay, delay skew, return loss.
 - .2 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room: should more than 5% of tested cables fail, test remaining cross-connected data cables.
 - .1 Category 6 using certified level III tester to: TIA/EIA-568-C.

- .2 Perform the following tests: wire map, length, insertion loss, NEXT loss, ELFEXT, PSELFEXT, ACR, PSACR, propagation delay, delay skew, return loss.
- .2 Test backbone Category 3 voice cables as specified below and correct deficiencies: provide record of results as hard copy, electronic record on CD.
 - .1 Perform Wire Map tests on multi-pair Category 3 cables to: TIA/EIA-568-B.1.
 - .2 Provide loop resistance measurements in ohms and dB at 1KHz, 8KHz, and 256 KHz.
 - .3 Test multi-pair Category 3 cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors.
- .3 Test Optical-fiber strands for attenuation to: TIA/EIA-568-C and correct deficiencies: provide record of results as hard copy, and electronic record on CD.
 - .1 Test backbone links in both directions. Backbone links:
 - .1 Test multi-mode fiber at both applicable wavelengths (850nm and 1300nm).
 - .2 Maximum attenuation: Cable attenuation + Connector loss + Splice loss.
 - .1 Multi-mode-fiber attenuation coefficients:
 - .1 3.5 db/km 850nm; and
 - .2 1.5 db km 1300nm
 - .2 Maximum connector insertion loss: 0.75 db per pair and maximum splice insertion loss: 0.3 db.
- .4 Perform additional Tier 2 tests using optical time domain reflectometer (OTDR) on backbone fiber pairs.
 - .1 Correct deficiencies.
 - .2 Provide record of results as described in SUBMITTALS.
- .5 Provide record of results as electronic record on CD to: TIA/TSB-140.
- .6 Provide record of results as [hard copy] [electronic record on CD to: TIA/TSB-140.

3.7 Contractor Certification

- .1 The cabling system shall be installed by a contractor or sub-contractor certified by the cable manufacturer.

3.8 Warrant

- .1 The installation Contractor shall support the installed system for a period of two years from the date of acceptance by the City.
- .2 Contractor shall be responsible for obtaining all documentation necessary to achieve manufacturer's warranty
- .3 The manufacturer shall provide a minimum 20 year warranty for the complete cabling system.

- .4 The manufacturer's warranty shall be provided directly to the City and shall be independent of the installation contractor.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Access control panel.
- .2 Proximity Readers
- .3 Door Controllers
- .4 Power Supplies
- .5 Request to Exit Motion Detectors
- .6 Software Management
- .7 Wiring
- .8 Hardware and Software Integration with Door Hardware

1.2 Codes and Standards

- .1 Work shall be performed in accordance with the applicable National, Provincial and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:
 - .1 UL 294, UL 1076, ULC
 - .2 CE
 - .3 FCC-Part 15, Part 68
 - .4 NFPA70, NEC
 - .5 IEEE, RS170 variable standard
 - .6 IEEE, NTSC (colour camera broadcast)
- .2 Where more than one code or regulation is applicable, the more stringent shall apply.
- .3 Cable installation, identification and termination shall be performed in accordance with the manufacturer's technical installation guidance, in addition to the applicable codes above.
- .4 In the absence of the manufacturer's recommendations on conductor application, the contractor shall ensure that the cable selected meets all technical requirements of the equipment to be installed.

1.3 Related Sections

- .1 Section 08 71 00 - Door Hardware - General.
- .2 Section 08 36 27 - Folding Bay Doors.
- .3 Section 26 05 19 - Building Wire and Cable.

1.4 Syste Description

- .1 Access Control System: Control access through building as follows:
 - .1 Provide access control at all controlled door points complete with door controllers, proximity readers, interconnection to door hardware, request to exit motion sensors, and power supplies.

- .2 Provide access control on all doors as noted on drawings. Readers shall allow access through controlled doors for registered users.
- .3 Provide software for user control of system complete with hardware for programming of proximity cards.
- .4 Provide all hardware and software for a complete solution.
- .5 System shall integrate with door hardware systems. Refer to Division 08 specifications.
- .6 System shall integrate with folding bay doors. Refer to Division 08 Specifications.
- .7 Zones:
 - .1 Main building
 - .2 Evidence D121
 - .3 Investigator's Office D114.
- .8 Users & Groups:
 - .1 Minimum 1000 users.
 - .2 Minimum 100 user groups.
 - .3 The building manager shall have the capability to assign individual users to multiple access control schemes in each zone.
- .2 The system shall require one master control file server station and be able to support a minimum of 20 additional concurrent (logged on) control locations, badging stations, or workstations, utilizing LAN/WAN network software and hardware.
- .3 The system shall be expandable in modular increments to total capacity. The software shall not require installation of any modules or any other upgrading to achieve above stated capacities. Additional communication server licenses shall be made available to expand the system capacity as needed. Upgrading a user license or the number of communication servers shall not require any additional software.

1.5 Submittals or Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide electrical characteristics and connection requirements.
- .3 Shop Drawings: Indicate system wiring diagram showing each device and wiring connection required.

1.6 Submittals or Information

- .1 Section 01 33 00: Submission procedures.
- .2 Test Reports: Indicate satisfactory completion of required tests and inspections.
- .3 Installation Data: Manufacturer's special installation requirements.
 - .1 Indicate application conditions and limitations of use stipulated by Product testing agency.
 - .2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.7 Closeout Submittals

- .1 Section 01 78 10: Submission procedures.
- .2 Maintenance Contracts: Provide service and maintenance of intrusion detection system for one (1) year from Date of Substantial Completion.
- .3 Operation Data: Operating instructions.
- .4 Maintenance Data: Maintenance and repair procedures.
- .5 Record Documentation: Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years experience and with service facilities within 160km (100 miles) of Project.

1.9 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Manufacturers

- .1 Mercury
- .2 Altronix
- .3 Substitutions: Refer to Tender No. 543-2022B; Part B - Bidding Procedures.

2.2 Alarm Access Control Panel

- .1 Control Panel: Modular construction with surface wall-mounted enclosure with adequate power supply to serve control panel modules, alarm signaling devices, remote detectors, relays, and card readers. Include battery-operated emergency power supply with capacity for operating system in standby mode for twenty-four hours.
 - .1 Products:
 - .1 Mercury LP1502
 - .2 Mercury MR52
 - .2 Cabinets
 - .1 Altronix Trove 2M2
 - .2 Altronix Trove 1M1
 - .3 Altronix T2MK38D
 - .4 Altronix T2MK78D
 - .5 Altronix T2M7XK3D
- .2 BASIC SYSTEM CAPABILITIES

- .1 The following functional capabilities are considered essential for the system described in this specification. The capabilities are to be considered standard, without the need for add-on software or hardware.
- .2 General
 - .1 All databases will have the ability to ADD, DELETE, REPORT, VIEW or EDIT information.
 - .2 Provide storage of all system transactions in a retrievable file.
 - .3 Log all events by time and date.
 - .4 Provide capability to store all or selected system transaction to a disk file.
 - .5 Provide ability for CITY to make system configuration changes such as, but not limited to door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases at any time.
 - .6 Support Global Anti-passback allowing cardholder to enter/exit any such defined card reader on the same intelligent control panel.
 - .7 Anti-passback modes shall include hard (no forgiveness), soft (allows access but generates an alarm event) and timed for all readers on the intelligent controller, on specified reader or card for a definable period of time up to 32,000 seconds.
 - .8 Duress feature where when a PIN is used in conjunction with a card read the numbers of digits are selected at the keypad where the PIN number is a value of one different from the normal PIN.
 - .9 Two cardholder rule, where two valid, non-identical cardsmust be used within a 20 second period of time to grant access.
 - .10 Ability to display when a cardholder who uses the reader has accessed (opened) the door or if the card was used but the door was not opened.
 - .11 Latch mode operation where the first card read unlocks the door and the second causes it to lock the door.
 - .12 Provide mode of system operation that stores system commands that were not accepted by the hardware.
 - .13 Provide mode of system operation that requires the operator to enter a response to an event when Acknowledging it from the alarm view window.
 - .14 Provide mode system operation that allows acknowledged alarms to be automatically cleared.
 - .15 Provide mode of system operation where un-acknowledged events will cause the computer to continuously emit a pulsating beep until all un-acknowledged alarms are acknowledged. A momentary silence feature shall allow the beeping to cease for up to 60 seconds. The silence feature shall also provide a visual count down to when the beeping will begin again.
 - .16 Provide mode of system operation where when an acknowledged, but not cleared event will be reissued requiring acknowledgement when the event changes to an alarm or trouble state.

- .17 Provide mode of system operation that does not allow the operator to clear an alarm prior to it being restored to normal.
- .18 Provide ability for manual operator control of system output relays. The manual functions shall include the ability to energize, de-energize, return to time zones, or pulse the output relay. The pulse time shall be a programmable setting.
- .19 Provide ability for manual operator control of system doors. The manual functions shall include the ability to Lock, Un-Lock, Disable, Card only, Card-Pin only, Pin only, Exit only and Site Code only.
- .20 Provide ability to automatically display stored video image of cardholder, and switch real-time camera from CCTV or digital video server to card reader location for specific card usage.
- .21 The cardholder video image pop-up shall be activated based on a priority level set to the cardholder or reader. Information in the pop-up shall include, but not be limited to the cardholder's primary image a live video pop-up showing the person who initiated the pop-up, entrance name, time, date, cardholder name, and status. User shall be able to display up to 40 note fields. The size of the pop-ups shall be adjustable by the operator.
- .22 Support multiple card reader technology including:
 - .23 Proximity
 - .1 Wiegand effect
 - .2 Biometrics
 - .3 Magnetic stripe
 - .4 Bar Code
 - .5 Keypad
 - .6 Card/Keypad (PIN)
 - .7 High-speed long range Vehicle ID
 - .8 Smart Card
- .24 Provide a means for scheduled automatic backups of any or all database system files. A means to restore these files from a simple menu shall exist.
- .25 Provide the ability to address up to 225 serial communication ports per communication server, where each port can be configured for either hardwired or dial-up. When configured for dial-up, any one port can support multiple dial-up locations.
- .26 Communication from the access control communication server to the remote intelligent control panels shall be selectable. Communication options shall be RS-232 directly to the intelligent control, via RS-485 converter, dial-up, leased line from a defined communication port or by LAN/WAN using an IP address for direct connection to the intelligent controller via network interface card. When using IP addressing it shall be un-acceptable to use a communication port converter device on the communication port converter device on the communication server side of the transmission. A minimum of 225 such IP connections shall be allowed per communication server.

- .27 All commands and updates to the panels shall be verified and shall automatically retry if communications have failed.
- .28 Provide a system scheduler that shall automatically:
 - .1 Call remote locations to retrieve history transactions and update panel information, including time and date.
 - .2 Activate or deactivate cards locally or at remote dial-up sites.
 - .3 Initiate a pre-programmed command event/action.
 - .4 Synchronized system to intelligent controller time.
 - .5 Frequency shall be defined as Never, Now, Once, Hourly, Daily, Weekly, Once per 2 weeks, and Monthly.
- .3 Provide drop boxes for all system-required information that the user has previously entered.
- .4 A host grant mode of operation shall exist that requires the host computer to grant accesses to validcards. An alternate host grant mode shall allow the card access information to be downloaded along with unlocking the door for validcards.
 - .1 Card Database
 - .1 Cardholder information shall include unique card number up to 15 digits and optional Personal Identification Number.
 - .2 Allow multiple cards per cardholder.
 - .3 Provide 40 user definable fields.
 - .4 Provide special card options that include, but are not limited to:
 - .1 Time zone reference, which defines valid time.
 - .2 Visitor use, which provides a specified activation date and expiration date (spanning years).
 - .3 Trigger control value, which can initiate a predefined procedure at the intelligent control independent from any control function from the system computer.
 - .5 Provide a card Tracefunction. The trace function shall allow normal access control, but will provide a tracking alarm at the system monitor.
 - .6 Provide ability to store digital images of cardholder or other digital images such as property of family members. Up to 99 such images shall be associated with the cardholder.
 - .7 Provide ability to store a written signature of the cardholder or other signatures such as family members. Up to 99 such signatures shall be associated with the cardholder.
 - .8 Provide the ability to prioritize specific card usage from 1 to 99 with separate priority options shall included but not be limited to Anti-passback, Trace, PIN Violation, Normal, Not Found, Expired, Host Grant, Site Code and Time Zone card activities or violations.
 - .9 Allow the user the ability to assign an operator message per card Event State and that a procedure for the intelligent control shall perform per Event State.

- .10 Upon editing card information, the updated information shall be sent automatically to the appropriate access control panel, when hardwired, with no other user intervention. If the port is dial-up, the entry will be stored on disk and shall be updated when connection is made to the remote loop. If the scheduler is used, then card updates shall be sent based on scheduling.
 - .11 In a traditional (Wiegand) 5 digit card database, the numbers 0 and 65,535 shall not be valid card numbers as some devices transmit these numbers on an improper read.
 - .12 In a 15-digit card database, the number 0 shall not be a valid card number as some devices transmit this number on an improper read.
 - .13 A card shall have the ability to be allowed to access one or selected accounts up to all available accounts.
- .2 Access Levels
- .1 Provide the ability to define specific times of access.
 - .2 Provide the ability to define specific readers for access.
 - .3 Provide a template of a defined access level detail, where changes can be made to the template and saved as a new access level detail.
 - .4 Provide an access control tree structure that allows groupings of entrances. User shall have the ability to group program all entrances on the branch or make specific changes to individual entrances.
- .5 Panel
- .1 Provide ability to program Action messages and assign an alarm event priority. A specific action message may be displayed for each alarm, system alarm (communication, ground fault, power, panel reset, low voltage, panel tamper), card, or reader usage state. States shall include but not be limited to: Incorrect Password, Panel Configuration Error, Panel Remote Dial-up Failed, Panel Remote Dial-up Successful, Poll Response Alarm, Poll Response Normal, Primary Power Failure, Primary Power Normal, Tamper Switch Alarm, Tamper Switch Normal, Unsupported Panel Version, Anti-Passback Violation, Anti-Passback Violation Door Not Used, Anti-Passback Violation Door Used, Card Not Found, Door Normal, Door Alarm, Door Trouble, Door Ajar, Door locked, Door Unlocked, Duress Request Denied, Duress Request Door Not Used, Duress Request Door Used, Forced Open, Free Egress Door Not Used, Free Egress Door not Verified, Free Egress Door Used, Host Grant Card Downloaded, Host Grant Door Unlocked, Invalid Format, Invalid Format Reverse Read, Invalid Pin, Invalid Site Code, Invalid Time Zone, Issue Code, Never Allowed at this Door, No Second Card Presented, Site Code Verified Door Not Used, Site Code Verified Door Used Trace Card, Valid Card Door Not Used, Valid Card Door Used.
 - .2 Provide ability to program descriptions, shunt times, and momentary shunt times for all system alarm points.
 - .3 Provide ability to program descriptions, pulse times, and energize times for all system output relays used for door control and other auxiliary functions.

- .4 Provide ability to program descriptions for all system card readers.
 - .5 Monitor both supervised and non-supervised alarm points with the ability to select by point which point shall be supervised and define if the point is a normally closed or normally open point contact.
 - .6 Provide ability to interlock any alarm point condition to an output relay.
 - .7 Provide ability to interlock any alarm point condition to another alarm point.
 - .8 Provide ability to interlock any alarm point to switch a camera to a system monitor.
 - .9 Provide ability to program alarms and associate incoming alarms with related outputs.
 - .10 Provide a programmable "delay" setting up to 255 seconds for all system alarm points. The system shall not report the alarm condition until the delay setting has expired.
 - .11 Allow for up to 8 different site codes to be used in the system.
 - .12 Support up to 16 readers per Intelligent Control Module.
- .6 Reports
- .1 Provide reporting capability for printing of selected system transactions from the disk files by specific time and date selection, range from time and date to time and date, or from start time to end time each day of the selected date range.
 - .2 Provide feature to generate a history report for an alarm point(s) state. An alarm point state shall be defined as Normal, Alarm, Trouble, or Ajar.
 - .3 Provide feature to generate a history report of system alarms. A system alarm state shall be defined by panel and include any of the following information: communication, ground fault, power, panel reset, low voltage, panel tamper, and loop communication.
 - .4 Provide feature to generate a history report for a card(s) state. A card state shall be defined as Normal, Trace, Not Found, Anti-passback Violation, PIN Violation, Time Zone Violation, Site Code Violation, or Expired card. Additional search criteria shall include cardholders that meet up to at least 3-note field restriction and filter the report with defined reader location(s).
 - .5 Provide feature to generate a history report for system operator(s) activities. The report shall include time, date, and operator name the device associated with the action the type of action performed by the operator. Activities shall include but not limited to:
 - .1 acknowledge and clear transactions, camera control, door mode, door and relay control such as unlock, lock; door and input control such as shunt, unshunt; login, logout, panelization, panel buffer and panel unbuffer.
 - .2 Provide complete database reporting of all data programmed into the system data files.
 - .6 Tracking/Muster Report
 - .1 A tracking feature shall allow the system operator to identify an area and the person(s) in that area.

- .2 Areas shall be defined by readers representing an IN or OUT read status.
 - .3 An area defined as an exit shall remove the person from the tracking area.
 - .4 A Muster area shall be defined by a reader(s) used to "muster" individuals in the event of an emergency.
 - .5 Reports can be generated for the defined muster or tracking area.
 - .6 Reports can be generated for all muster or tracking areas in the system.
 - .7 Tracking areas can include "nested" areas. Nesting allows for various reports from a large area to smaller areas within the large area.
 - .8 A Tracking and Muster area screen shall be continually updated with the most recent card activity, therefore minimizing the time required generating a report.
 - .9 A history priming feature shall load history activities for the defined amount of hours when the software is started. This priming feature shall be implemented in the event that the system computer is offline when a muster call is initiated, therefore allowing the implementation of the tracking and muster features of the software. The history priming time shall be operator selectable in 1-hour increments up to 99 hours.
- .7 Time Zones
- .1 Time zone definitions shall include Starting time, Ending time, Days of the week, and Holiday override.
 - .2 Time shall be definable in either AM/PM or 24-hour (military) time.
 - .3 Minimum time zones that can be assigned to a panel shall be 63.
 - .4 Maximum time zones that can be defined in a system shall be unlimited.
- .8 Floor Plan Graphic
- .1 Provide the ability to import floor plan graphics stored in a WMF format.
 - .2 Provide the ability to associate all ADV's to floor plan graphics allowing the user to control and monitor the system.
 - .3 Provide the ability to link floor plan graphics together in a hierarchy fashion.
 - .4 Allow multiple floor plan views to be displayed simultaneously.

2.3 Proximity Reader

- .1 Products:
 - .1 Mullion Mount □ HID Signo 20NKS-T0-000000
 - .2 Single Gang Mount □ HID Signo 40NKS-T0-000000
- .2 Substitutions:
 - .1 Mullion Mount □ HID Signo 20NKS-T2-000000
 - .2 Single Gang Mount □ HID Signo 40NKS-T2-000000
 - .3 Mullion Mount □ HID RP15 □ 910PTNNEK00000

- .4 Single Gang Mount HID RP30 920TNNEK00000Signo 40NKS-T0-000000
- .5
- .3 Supplied by Division 28.
- .4 Installed and wired by Division 28
- 2.4 Proximity Card**
- .1 Provide three hundred (300) compatible proximity cards.
- 2.5 Proximity Card Programmer**
- .1 PC
- 2.6 Electric Strikes**
- .1 Products:
 - .1 Exterior Door Von Duprin 6 Series
 - .2 Exterior Door RIM HES 9600 or HES 9400 as required for low profile applications.
 - .3 Interior Door HES 5400 Series Strike
- .2 Supplied by Division 28.
- .3 Installed and wired by Division 28
- 2.7 Power Supply**
- .1 Products:
 - .1 Altronix eFlow 6N8X 24VDC, 8 Output.
 - .2 Altronix eFlow 104N16 24VDC, 16 Output.
- .2 Substitutions:
 - .1 Altronix Pre-wired Trove Cabinet, T2M7XK3D only.
- .3 Provide dedicated 120VAC 15A/1P circuit c/w lockable disconnect switch within 1m (3') of cabinet.
- .4 Power supply wiring to be 18/4 AWG or 18/2 Stranded AWG.
- 2.8 Request to Exit Detector**
- .1 Manufacturer: T.Rex
- .2 Infrared adjustable detector mounted on wall above door wired to system to detect door-forced-open events.
- Part 3 Execution**
- 3.1 Installation**
- .1 Install to manufacturer's written instructions.

- .2 Use 16 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in conduit. Multi-conductor access control cabling to be Honeywell Profusion 3195 FT6 rated or approved equal.
- .3 Make conduit and wiring connections to door hardware devices provided under Section 08 71 00.
- .4 Label outputs and connected wiring to clearly identify device and location.
- .5 Mount access control cabinets no higher than (5'10") to the top of the cabinet.
- .6 Install cabinets free and clear of obstructions or impairments to accessing or servicing.
- .7 Refer to Client Access Control riser for typical equipment layout.

3.2 Syste Pro ra in

- .1 Database: The contractor shall assist the City in setting up the system database requirements and formats. Forms to be utilized in collecting and entering all data shall be included. Examples of the sequence of completion for all related forms shall be provided. the City shall be responsible for the actual data collection and entry to ensure a complete understanding of the system and its contents.
- .2 Programming: The contractor shall initially configure the system in accordance with the design shown in the drawings. All the access control requirements, alarm point definitions, camera/monitor, alarm point call up and in/out relationships, individual component descriptions, and any other programmable parameters required shall be as shown in the appropriate drawings and schedules. The City shall perform any additional programming with the assistance of the contractor.

3.3 Trainin

- .1 The contractor shall supply personnel to create a cadre of key City employees in the operation and maintenance of the installed system. A training program shall be designed to provide a comprehensive understanding and basic level of competence with the system. It shall be sufficiently detailed to allow City personnel to operate the system independent of any outside assistance.
- .2 The training plan shall include detailed session outlines and related reference materials. The City personnel shall be able to utilize these materials in the subsequent training of their co-workers.
- .3 Training time shall not be less than a total of sixteen (16) hours, and shall consist of:
 - .1 Two periods: four (4) hours during a 8:00 AM to 4:00 PM period, four (4) hours during a 4:00 PM to 12:00 AM period. Specific schedules shall be established at the convenience of the City.
 - .2 Four (4) hours of system training shall be provided to City supervisory personnel so that they are familiar with the system operation.
 - .3 Four (4) hours of system maintenance familiarization training shall be provided to City telecommunications personnel.
- .4 The specified training schedule shall be co-ordinated with the City and will follow the training outline submitted by the contractor as part of the submittal process.

3.4 Syste Testin

- .1 System Testing: The contractor shall demonstrate the functionality of the system upon completion of installation, and shall document the result of all tests and provide these results to the City.

3.5 Manu acturer s Field Ser ices

- .1 Section 01 75 16 □ Start-Up Procedures.
- .2 Include services of technician to supervise installation, adjustments, final connections, system testing, and City training.

3.6 De onstration

- .1 Section 01 79 00: Systems demonstrations.
- .2 Demonstrate normal and abnormal modes of operation, and required responses to each.
- .3 Training: Provide two (2) hours of training to City personnel. Provide sign-off sheet from City personnel to confirm acceptance of training.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Network Video recorder.
- .2 Cameras.
- .3 Software.

1.2 REFERENCES

- .1 Underwriters Laboratories of Canada (ULC)
 - .1 ULC-S317-1996, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems.

1.3 Related Sections

- .1 Section 28 13 28 - Security Access Components.
- .2 Section 28 16 00 - Intrusion Detection.

1.4 S□ste Descri tion

- .1 Description: Provide network video recorder (NVR) system, video cameras, and video communications between points of surveillance as scheduled and indicated on Drawings.

1.5 Action and In or ational Su ittals

- .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 video surveillance equipment and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit:
 - .1 Functional description of equipment.
 - .2 Technical data sheets of all devices.
 - .3 Device location plans and cable lists.
 - .4 Video camera surveillance chart.
 - .5 Video interconnection detail drawings.
 - .6 Camera mounting details specific to location.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
 - .2 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labeling scheme

- .3 Submit zone layout drawings indicating number and location of zones and areas covered.
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit 1 sample of each camera selected complete with housing, brackets and mounting hardware.
 - .4 Camera will be returned for incorporation into work as appropriate.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit UL Product safety Certificates.
 - .2 Submit verification Certificate that service company is "UL List alarm service company".
 - .3 Submit verification Certificate that monitoring facility is "UL Listed central station".
 - .4 Submit verification Certificate that video surveillance system is "Certified alarm system".
- .6 Test and Evaluation Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .8 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 Closeout Submittals

- .1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 01 78 10 Closeout Submittals. Include following:
 - .1 System configuration and equipment physical layout.
 - .2 Functional description of equipment.
 - .3 Manufacturer's Instructions for operation, adjustment and cleaning.
 - .4 Illustrations and diagrams to supplement procedures.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years experience.
- .2 Supplier: Authorized distributor of manufacturer with minimum five (5) years experience.
- .3 Installer Qualifications: Contractor shall have been in business for a minimum of five (5) years and have successfully completed one or more projects of scope 50% of the magnitude specified by these documents. Authorized installer of specified manufacturer with service facilities within 160km (100 miles) of the project.

1.8 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 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.
- .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 video surveillance materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.9 Warranty

- .1 For materials the 12 month warranty period prescribed in subsection GC 32.1 of General Conditions is extended to 60 months.
- .2 Extended warranty period must include warranty meeting specified performance requirements, for specified time period.
- .3 Manufacturer's Warranty: submit, for Contract Administrator's acceptance, manufacturer's standard warranty document executed by authorized company official.

Part 2 Products

2.1 Design Criteria

- .1 Support: camera functions such as pan/tilt and zoom fully supported by Closed Circuit Television (CCTV) system.
 - .1 Provide operator with ability to control all camera functions.
- .2 Alarm point monitoring: system capable, upon alarm recognition, of switching CCTV cameras associated with alarm point.
- .3 Switching:
 - .1 Provision to switch any camera in system to any monitor in system manually or automatically.
 - .2 Provision to switch system video recorders to selective monitor outputs in system.
- .4 Control: provision for any camera equipped with pan, tilt, and/or motorized zoom lens:
 - .1 Manually control pan, tilt and lens functions.
 - .2 Set pan and tilt home position.
 - .3 Set and clear movement limits of pan and tilt mechanism.
 - .4 Adjust motorized zoom lens.
- .5 Enter and edit CCTV programs and save them for future use.
- .6 Provide ability to display stored 'video image' of cardholder, and switch real-time camera to card reader location for specific card usage.

- .7 Overall control of CCTV provided through software control, which provides complete integration of security components.
- .8 Environment: design video components and systems to operate with specified requirements under following ambient temperatures:
 - .1 Indoor installations:
 - .1 Temperature: 0 degrees C to 30 degrees C.
 - .2 Humidity: 10 to 90%.
 - .2 Outdoor installations:
 - .1 Temperature: -50 degrees C to 60 degrees C.
 - .2 Humidity: 10 to 100%.
- .9 Manufacturers:
 - .1 Hanwha.
 - .2 Substitutions: Refer to Tender No. 543-2022B; Part B □ Bidding Procedures.

2.2 Net or Video Recorder

- .1 Digital Video Recorder: 32 channel digital video recorder c/w PoE, rack mounted.
- .2 Products:
 - .1 XRN-3210RB2
 - .2 XRN-3210B2
 - .3 XRN-3210B4
- .3 Features
 - .1 Scheduled backup to NAS
 - .2 Display: Web 3 users minimum
 - .3 Compression: H.264/H.265
 - .4 Bandwidth: 180Mbps
 - .5 Event Trigger: Alarm, Video loss, Camera event (Sensor, Video analytics), Tampering, Enter/Exit, Passing, Face detection, Audio Detection, Defocus.
 - .6 Event Action: E-mail, PTZ preset, Alarm out, Buzzer, Monitor out
 - .7 Digital storage for 30days of continuous recording in 5MP, variable bitrate, and motion activated recording.
 - .1 Hard drives shall be designed and rated for continuous read-write application.
 - .8 Remote connection through LAN unity Remote PC Client Application.

2.3 Cameras

- .1 C1 - General purpose interior 180/360deg fisheye panoramic video camera with smoked dome housing:
 - .1 Products:
 - .1 QNF-9010 12MP Fisheye Panoramic Camera.
- .2 C2 - General purpose interior/exterior vandal resistant video camera with smoked dome housing:

- .1 Products:
 - .1 QNV-6082R/R1 2MP Dome Camera.
 - .2 QNV-8080R 5MP Dome Camera.
- .3 C3 Wet area general purpose indoor/outdoor flat eye camera.
 - .1 Products:
 - .1 QNE-8011R 5MP flat eye camera.
 - .2 QNE-8021R 5MP flat eye camera.
- 2.4 Cabinets**
 - .1 Products:
 - .1 Hammond HLP6U31BK.
 - .2 Tripp-Lite SRWF6U.
- 2.5 Decoder**
 - .1 Products:
 - .1 Hanwha SPD-151 48 Channel Decoder.
- 2.6 Software**
 - .1 The web viewer shall provide a monitoring screen which displays live camera video and simultaneously provides same-screen access to the following functions:
 - .1 Live view window size
 - .2 Resolution setting
 - .3 Image (snapshot) capture
 - .4 Manual recording to SD or NAS
 - .5 Audio/microphone control
 - .6 Access Playback and Setup menus
 - .2 The web viewer shall provide a playback screen which provides access to the following functions:
 - .1 Search date and time range
 - .2 Search event type
 - .3 Play an event video
 - .4 Set resolution
 - .5 Play audio if present
 - .6 Generate a backup copy of saved video data
 - .3 The web viewer shall provide a setup screen which provides access to the following configuration settings and functions in the camera:
 - .1 Digital video profile to include compression type, maximum or target bit rate, frame rate, multicast parameters, crop encoding area
 - .2 User profile to include password, access level, authentication
 - .3 Date and time
 - .4 Network settings and IP version
 - .1 DDNS

- .2 SSL, including certificate management
- .3 802.1x authentication
- .4 Quality of Service settings
- .5 SNMP to include version selection and settings
- .6 Auto configuration
- .5 Video setup to include flip and mirror mode, hallway view mode, video type, privacy zone
- .6 Audio setup to include source, audio codec type, gain, and bit rate
- .7 Camera settings to include image preset, sensor frame capture, dynamic range, white balance, back light, exposure, day/night operation, on-screen display, IR illumination, sharpness, contrast, color level, lens distortion correction.
- .8 Event detection setup to include notification parameters, recording rules, time schedule, tamper protection, motion detection, event triggers
- .9 System function to include reboot, upgrade, check system and event logs, application (SDK) management
- .10 View profile information
- .4 Minimum client hardware requirement:
 - .1 Processor: Intel Core i3, AMD Ryzen 3
 - .2 Ram: 4GB
 - .3 OS: Windows 7, 8, 10, Mac OS X 10.8
 - .4 Display: 1920 x 1080 (32bit)
 - .5 Web browsers: Internet Explorer, Edge, Firefox, Chrome, Safari
- .5 Licensing requirement: included with hardware package.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for video surveillance 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 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheet.
- .2 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.

- .3 Install components secure, properly aligned and in locations shown on reviewed shop drawings.
- .4 Connect cameras to cabling in accordance with installation instructions.
- .5 Install ULC labels where required.
- .6 Mount all surface mount devices to a device box, junction box or back box. Conduit entry into camera is not permitted. Conduit back box must be installed.
- .7 All flush mounted devices must be installed in a manufacturer's flush mount enclosure/mount.
- .8 Do not mount dome cameras vertically on walls. Vertical wall installation shall include a pendant style mount.
- .9 Provide patch panels as required for terminations inside cabinets. Patch panels to be minimum 24 ports.
- .10 All communications wiring shall be CAT6 FT6 rated cabling.
- .11 Refer to Client Network surveillance riser for typical equipment layout.

3.3 Net or Setting

- .1 Coordinate network plan with City.
- .2 Where IP (Network) type cameras are installed, coordinate network addresses and camera settings with City. Contractor is responsible for configuring camera.
- .3 Provide documentation horizontal cabling identifying on which Patch Panel port each camera cable is terminated (e.g. Camera X = port Y).

3.4 Interface With Other Products

- .1 Interface installation of closed-circuit television system with security access and intrusion detection systems.

3.5 Field Quality Control

- .1 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 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 Work, after cleaning is carried out.

3.6 Site Start-up

- .1 Perform verification inspections and test in the presence of Departmental Representative.
 - .1 Provide all necessary tools, ladders and equipment.

- .2 Ensure appropriate subcontractors , and manufacturer's representatives are present for verification.
- .2 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - .1 Sturdiness of equipment fastening.
 - .2 Non-existence of installation related damages.
 - .3 Compliance of device locations with reviewed shop drawings.
 - .4 Compatibility of equipment installation with physical environment.
 - .5 Inclusion of all accessories.
 - .6 Device and cabling identification.
 - .7 Application and location of ULC approval decals.
- .3 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
 - .1 Measurements of tension and power.
 - .2 Connecting joints and equipment fastening.
 - .3 Measurements of signals (dB, lux, baud rate, etc).
 - .4 Compliance with manufacturer's specification, product literature and installation instructions.
- .4 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
 - .1 Operation of each device individually and within its environment.
 - .2 Operation of each device in relation with programmable schedule and or/specific functions.
 - .3 Operation control of camera lens, pan, tilt and zoom.
 - .4 Switching of camera to any monitor.
 - .5 Switching of system video recorder to selective monitor.
 - .6 Set dwell times.
 - .7 Demonstrate:
 - .1 Sequence viewing of cameras on each monitor.
 - .2 Bypass capability.
 - .3 Display of stored image to cardholder.

3.7 Ad ustin

- .1 Adjust manual lens irises to meet lighting conditions.
- .2 Adjust lens angle and zoom to meet City's requirements. Review all camera views with City and acquire written signoff.

3.8 Cleanin

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 □ Cleaning and Waste Processing.

- .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 00 50 - General Instructions.
 - .1 Clean camera housing, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 19 □ Construction Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 Protection

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by video surveillance installation.

3.10 Closeout Activities

- .1 Demonstration:
 - .1 Demonstrate system operation and provide two (2) hours of instruction with manufacturer's training personnel.
 - .2 Conduct walking tour of Project and briefly describe function, operation, and maintenance of each component.
 - .3 Provide written signoff from City to confirm accepted camera views.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Fire alarm control panels.
- .2 Fire alarm initiating and signaling devices.
- .3 Auxiliary fire alarm equipment and wiring.
- .4 Modifications to existing system.

1.2 Related Sections

- .1 Section 08 71 00 - Door Hardware - General: Door closers, electric locks, electric releases.
- .2 Section 08 36 13 - Sectional Doors.
- .3 Section 21 12 00 - Standpipe and Fire Hose.
- .4 Section 21 13 00 - Sprinklers.
- .5 Section 26 05 00 - Common Work Results for Electrical
- .6 Section 26 05 19 - Building Wire and Cable.

1.3 References

- .1 The latest version of the following including all amendments:
 - .1 CAN/ULC S524 - Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC S525 - Audible Signal Devices for Fire Alarm Systems, Including Accessories.
 - .3 CAN/ULC S526 - Visible Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC S527 - Control Units for Fire Alarm Systems
 - .5 CAN/ULC S528 - Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC S529 - Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC S530 - Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .8 CAN/ULC S536 - Inspection and Testing of Fire Alarm Systems.
 - .9 CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.
 - .10 CAN/ULC S541 - Speakers for Fire Alarm Systems, Including Accessories.
 - .11 ULC ORD-C386-1990 - Flame Detectors.

1.4 System Description

- .1 Fire Alarm System: Fully supervised, manual and automatic, single stage addressable fire alarm system.
- .2 The fire alarm system shall carry out fire alarm and protection functions consisting of receiving alarm signals, initiating alarm and trouble sequences, continuous supervision of fire alarm components and wiring, actuation of annunciators and auxiliary functions and signals to remote monitoring agency.

- .3 Fire alarm system shall be modular in design complete with 15% spare capacity to allow for future system expansion
- .4 The fire alarm system shall include, but not be limited to the following:
 - .1 Control panel
 - .2 Trouble signal devices
 - .3 Power supplies and booster facilities
 - .4 Manual alarm stations
 - .5 Automatic alarm initiating devices
 - .6 Audible and visual signal devices
 - .7 End-of-line devices
 - .8 Annunciators
 - .9 Ancillary devices
 - .10 Input and output modules
 - .11 Isolator modules

1.5 Su itttals or Re ie

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide electrical characteristics and connection requirements.
- .3 Shop Drawings:
 - .1 Provide control panel and annunciator layout
 - .2 Provide system wiring diagram showing each device and wiring connection required.
 - .1 Wiring diagram shall be specific to the project and shall meet manufacturers recommendations and required building codes and standards.

1.6 Su itttals or In or ation

- .1 Section 01 33 00: Submission procedures.
- .2 Test Reports: Indicate satisfactory completion of required tests and inspections.
- .3 Installation Data: Manufacturer's special installation requirements.
 - .1 Indicate application conditions and limitations of use stipulated by Product testing agency.
 - .2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.7 Closeout Su itttals

- .1 Section 01 78 10: Submission procedures.
- .2 Maintenance Contracts: Provide service and maintenance of fire alarm system for one (1) year from Date of Substantial Completion.
- .3 Operation Data: Operating instructions.
- .4 Maintenance Data: Maintenance and repair procedures.

- .5 Record Documentation: Record actual locations of initiating devices, signaling appliances, and end-of-line devices. Include zone number and device number for each device installed. Include circuit number for signalling appliances.
- .6 Test reports from CAN/ULC S536 and CAN/ULC-S537 verification testing.

1.8 Maintenance Material Submittals

- .1 Section 01 78 10: Maintenance and extra material requirements.
- .2 Extra Stock Materials:
 - .1 Provide six (6) keys of each type.
 - .2 Provide three (3) of the following devices:
 - .1 Addressable manual station
 - .2 Addressable heat detector
 - .3 Ceiling mounted smoke detector
 - .4 Ceiling mounted combination smoke detector and fixed temperature heat detector
 - .5 Ceiling mounted ionization smoke detector
 - .6 Wall mounted combination horn/strobe, standard cd rating
 - .3 Provide one (1) duct mounted photoelectric smoke detector.
 - .4 Provide two (2) addressable multi-criteria fire/CO detector

1.9 Quality Assurance

- .1 Design and install fire alarm system to CAN/ULC S524.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum fifteen (15) years documented experience and with service facilities within 160 km (100 miles) of Project.

1.10 Regulator Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by ULC and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Manufacturers

- .1 The fire alarm system as described here-in is based on the Notifier NFS Series fire alarm system. Approved equals are: Simplex Grinnell, Mircom, and Siemens.
- .2 Substitutions: Refer to Tender No. 543-2022B; Part B - Bidding Procedures.

2.2 Fire Alarm and Smoke Detection Control Panel

- .1 Control Panel: CAN/ULC S527, modular construction with flush or surface wall-mounted enclosure.
- .2 Power supply: Adequate to serve control panel modules, door holders, relays, remote detectors, smoke dampers, remote annunciators, and alarm signaling devices. The control unit shall be connected to a supervised, dedicated 120V/15A dedicated circuit complete with a lockable circuit breaker and red

- lamacoid using white lettering showing FIRE ALARM PANEL affixed adjacent the circuit breaker. Utilize circuit as indicated. Painted circuit breakers are not permitted.
- .3 Emergency power supply: Include battery-operated emergency power supply with capacity for operating the entire system in standby mode for twenty-four (24) hours followed by alarm mode for thirty (30) minutes. The emergency power supply shall be supervised for low battery or depleted battery condition, or disconnection of the battery.
 - .4 System Supervision: Component or power supply failure places system in trouble mode.
 - .5 Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode, but does not disable that circuit from initiating an alarm.
 - .6 Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.
 - .7 Remote Station Signal Transmitter: Electrically supervised alarm communicator transmitter, capable of transmitting alarm and trouble signals to central station receiver. Typical transmitter arrangement to include ALARM, TROUBLE, SUPERVISORY, and CO DETECTION.
 - .8 Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
 - .9 Switches: Provide the following:
 - .1 Trouble Acknowledge
 - .2 Test Bell Drill
 - .3 Public/Common Alarm Silence
 - .4 Public/Common Visual Alarm Silence
 - .5 SYSTEM RESET
 - .10 System Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 - .1 Visual and audible trouble alarm indicated by zone at fire alarm control panel.
 - .2 Visual and audible trouble alarm indicated by zone at remote annunciator panel.
 - .3 Trouble signal transmitted to remote station.
 - .4 Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visual alarm is displayed until initiating failure or circuit trouble is cleared.
 - .5 Trouble condition on any circuit in system shall not initiate alarm conditions.
 - .11 System Supervisory Sequence of Operation: Actuation of supervisory device places system in supervisory alarm mode, which causes the following system operations:
 - .1 Electronic latch will lock-in supervisory mode at fire alarm control panel.

- .2 Visual and audible supervisory alarm indicated by zone at fire alarm control panel.
- .3 Visual and audible supervisory alarm indicated by zone at remote annunciator panel.
- .4 Supervisory signal transmitted to remote station.
- .5 Manual acknowledge function at fire alarm control panel silences audible supervisory alarm; visual alarm is displayed until supervised device is cleared.
- .6 Supervisory condition on any circuit in system shall not initiate alarm conditions.
- .12 Single Stage Alarm Sequence of Operation: Actuation of initiating device places system in alarm mode, which causes the following system operations:
 - .1 Electronic latch will lock-in alarm mode at fire alarm control panel.
 - .2 Sound and display local fire alarm signaling devices with signal.
 - .3 Transmit signal to remote monitoring station equipment.
 - .4 Indicate location of alarm zone on fire alarm control panel and on remote annunciator panel.
 - .5 Transmit signals to building elevator control panel(s) to facilitate emergency operation of elevator. Signals shall include General Alarm, Activation of Elevator Lobby Smoke Detector, Activation of Elevator Hoistway Smoke Detector, Activation of Elevator Machine Room Smoke Detector. Recall all elevators to main floor or alternate floors.
 - .6 Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation. Shut down all make up air units except in corridor servicing residential suites for the purpose of maintain corridor pressurization as per OBC 3.2.6.2.
 - .7 Transmit signal to release door hold-open devices.
 - .8 Cause all current troubles on system to be suppressed during course of alarm.
- .13 Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.
- .14 Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- .15 Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- .16 Zoning: As indicated.
- .17 History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- .18 Recording of Events: The system shall be capable of recording all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout shall differentiate alarm signals from all other printed indications.

2.3 Manual Initiatin De ices

- .1 Single Stage Manual Station: Non-coded type, double action manual station with key-operated reset lock constructed of red-colored polycarbonate. The station shall be designed that after emergency operation they cannot be restored to normal without key.
 - .1 Addressable manual station shall be complete with loop polling LED (Green), and shall be equal to Notifier NBG-12LX.
 - .2 Non-Addressable manual station shall be equal to Notifier NBG-12. Non-Addressable stations shall be used in crawlspaces only, or as indicated. Connect to addressable zone module as indicated.
 - .3 Provide manufacturer's standard backbox for surface applications. Backbox finish to match station finish.

2.4 Auto atic Initiatin De ices

- .1 Heat Detector: Combination rate-of-rise and fixed temperature, rated 57 degrees C (135 degrees F) and temperature rate of rise of 8.3 degrees C (15 degrees F).
 - .1 Addressable heat detector shall be complete with inter-changeable plug-in base and loop polling LED (Green), and shall be equal to Notifier FST-851A.
 - .2 Non-Addressable moisture-proof heat detector shall be equal to Mircom CR-135-MP. Non-Addressable, moisture-proof heat detectors shall be used in crawlspaces only, or as indicated. Connect to addressable zone module as indicated.
- .2 Ceiling Mounted Smoke Detector: Addressable photoelectric type with adjustable sensitivity with inter-changeable plug-in base and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Provide auxiliary relay contact as indicated. Provide sounder bases as indicated. Smoke detector shall be equal to Notifier FSP-851A.
- .3 Ceiling Mounted Combination Smoke Detector and Fixed Temperature Heat Detector: Addressable photoelectric type smoke detector with adjustable sensitivity with inter-changeable plug-in base and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Fixed temperature shall be rated 57 degrees C (135 degrees F). Provide auxiliary relay contact as indicated. Provide sounder bases as indicated. Smoke detector shall be equal to Notifier FSP-851TA.
- .4 Duct Mounted Photoelectric Smoke Detector: Addressable photoelectric type with key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide auxiliary relay contact as indicated. Housing shall be complete with tamper signal and shall be suitable to mount on square or rectangular duct. Provide addressable relay. Duct smoke detector shall be equal to Notifier DNR series.
- .5 Multi-Criteria Fire/CO Detector: Addressable combination detector combines smoke, CO, light/flame, and heat sensing technology in one device with adjustable sensitivity settings, and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Unit shall be complete with separate CO detection signal, and built-in CO cell end-of-life warning and fault. CO cell

shall be listed for applications in life safety. Provide sounder base for local CO alarm only. Multi-Criteria Fire/CO Detector shall be equal to Notifier FCO-851(A).

- .6 Stand-Alone CO Detector: Non-Addressable complete with an audible and visual alarm, test/silence switch, built-in CO cell end-of-life warning and alarm/trouble relay outputs connected to an addressable zone monitor module and supervised power supply from the battery-backed up fire alarm system. The detector shall be suitable for wall or ceiling mounting. CO detector shall be equal to System Sensor CO1224A.

2.5 Monitor Modules

- .1 Fully addressable modules to facilitate the monitoring of auxiliary devices intended to be monitored for alarm, supervision and trouble conditions by the fire alarm system using normally open dry contacts.

2.6 Control Modules

- .1 Fully addressable modules to facilitate the control of ancillary devices intended to be controlled by the fire alarm system using dry contacts.

2.7 Zone Modules

- .1 Fully addressable modules to facilitate connecting conventional non-addressable devices to addressable circuits.

2.8 Fault-isolation Modules

- .1 Fully addressable fault-isolation modules on an SLC style device loop to identify wire-to-wire short circuits and to suit CAN/ULC S524 and CAN/ULC S537.

2.9 Signaling Appliances

- .1 Alarm Horns and Strobes: The signalling device shall be 2-wire, and shall operate at 24VDC. Horn sound rating shall be rated at a sound level of at least 95dB at 3m (10ft). Horn tones and volume shall be field adjustable by way of integral switch. Strobe candela (cd) rating shall be field adjustable by way of integral switch. Standard strobe cd shall be field adjustable from 15 □ 115cd. High cd strobes shall be field adjustable from 135 □ 185cd. Provide ceiling or wall mounted, standard or high cd, indoor or outdoor units as indicated. All devices shall be red in color. Alarm horns and strobes shall be equal to Notifier SpectrAlert Advance series.
- .2 Interior Remote Annunciator: Provide semi-flush mounted, lockable supervised remote annunciator(s) complete with minimum eighty (80) character backlit LCD display. The annunciator(s) shall display all alarm, trouble and supervisory conditions in the system and will provide an audible indication of the alarm. The annunciator shall include control switches for Trouble Acknowledge, Test Bell Drill, Public/Common Alarm Silence, Public/Common Visual Alarm Silence, SMOKE DETECTOR ZONE BYPASS, SMOKE DUCT DETECTOR BYPASS, and SYSTEM RESET. Include LEDs for ALARM, TROUBLE, SUPERVISORY, and CO DETECTION. All annunciator components shall be mounted in a common cabinet enclosure complete with lockable cover. Cabinet shall be modularly sized based on required zones and annunciator components.

2.10 Auxiliaries

- .1 Door Release: Magnetic door holder with integral diodes to reduce buzzing. Coil voltage 24 VDC.
- .2 Door Release: Door closer as specified in Section 08 71 00.

2.11 Remote Signal Power Supplies/Signal Circuit Boosters

- .1 Solid state microprocessor based power supply complete with integral transient protection, connected to the local addressable initiating circuit.
- .2 Signal circuits shall be supervised using integral addressable output modules.
- .3 Power supply shall be 120 VAC input. Interface power supply with battery charger and batteries to provide uninterruptible transfer of power to standby source during primary power failure or loss. Batteries shall be sized to suit ULC requirements.

2.12 End-of-Line Devices

- .1 End-of-line devices shall control supervisory current where required, and sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, initiating an alarm or trouble condition.

2.13 Fire Alarm Wire and Cable

- .1 Fire Alarm Power Branch Circuits: Building wire as specified in Section 26 05 19.
- .2 Initiating Device and Indicating Appliance Circuits:
 - .1 Description: Type FAS solid conductor, complete with red tinted interlocking armour as required
 - .2 Conductor: Copper unless otherwise noted.
 - .3 Insulation Voltage Rating: 300 volts.
 - .4 Insulation: Coded PVC insulation and with overall red PVC jacket in accordance with the Canadian Electrical Code, rated 105 degrees C. Use shielded cable as per manufacturer's recommendations only.
- .3 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To audible signal circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
- .5 To visual signal circuits: 12 AWG minimum, and in accordance with manufacturer's requirements.
- .6 Wiring shall be as per manufacturer's recommendations. All wiring shall be in conduit unless noted otherwise. All wiring shall be armoured securex unless noted otherwise.

2.14 Accessories

- .1 Manual Station Vandal Guard: Clear vandal resistant, UV Stabilized polycarbonate shield and frame complete with integral 95db piezo horn and battery. Flush mounted or surface as indicated. Outdoor rated as required. Vandal guard shall be equal to STI Stopper II series.

- .2 Wire Guard: ULC listed 9 gauge steel wire complete with corrosion resistant polyester coating and tamper resistant hardware where indicated. Wire guard to be suitably sized to accommodate device and/or equipment being protected.

Part 3 Execution

3.1 Installation

- .1 Install products to manufacturer's written instructions and CAN/ULC S524, local and national codes, as indicated, and as recommended by the manufacturer.
- .2 All initiating and signalling devices, control panels and remote annunciators shall be flush mounted unless indicated otherwise.
- .3 Install devices at heights indicated in Section 26 05 00.
- .4 Locate detectors minimum 0.45m (18") from air discharge or return grille as measured from the edge of the detector, and not closer than 300 mm (12") to lighting fixtures.
- .5 Locate ceiling mounted detectors minimum 100mm (4") from edge of ceiling where it meets the wall as measured from the edge of the detector.
- .6 Detectors shall be located such that a clear space of 450mm is maintained between the detector and any obstructions except where ceiling mounted obstructions protrude less than 100 mm (4") from the ceiling.
- .7 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.
- .8 Mount end-of-line devices in separate box adjacent to last device in circuit.
- .9 Mount outlet box for electric door holder to withstand 36 kg (80 lbs) pulling force.
- .10 Make conduit and wiring connections to duct smoke detectors, sprinkler valve tamper and flow switches, fire suppression system control panels, door release devices, smoke control fans and equipment.
- .11 Circuiting for fire alarm devices shall be as follows:
 - .1 Provide Class **A** addressable initiating/alarm circuits throughout unless indicated otherwise.
 - .2 Provide Class **B** audible/visual signal circuits for signal circuits throughout unless indicated otherwise.
 - .3 Provide Class **A** audible/visual signal circuits for residential dwelling unit signal circuits only.
 - .4 Circuits shall have a minimum 15% spare capacity for future system expansion.
 - .5 All SLC, signal and power riser wiring shall be supervised, including internal wiring between modules.
- .12 Where wiring is required to be surface mounted within finished areas, wiring shall be installed in a single piece metal raceway unless noted otherwise. Color of raceway shall be white unless noted otherwise.
- .13 Where devices are surface mounted in finished areas, provide a surface mounted metal raceway device box. Color of box shall match the device.

- .14 Where initiating devices are located within an attic space, and crawlspace, non-addressable type devices shall be used, connected to an addressable zone module located outside the attic space and/or crawlspace in an accessible location. Associated EOL's and Modules shall be clearly labelled.
- .15 Where attic spaces and crawlspaces are compartmentalized, each compartment shall be wired in such a manner that each compartment is on a separate fire alarm zone. Provide additional zone modules as required.
- .16 Branch circuit breakers supplying fire alarm equipment shall be lockable in the ON position. A red lamacoid nameplate shall be affixed on the electrical panel adjacent the associated circuit breaker indicating FIRE ALARM PANEL or other approved wording.
- .17 Programming of room names and numbers shall match City's name and numbering scheme.

3.2 Wirin Met ods

- .1 Concealed Dry Interior Locations: Use FAS wire in raceway for all main runs. Armoured Securex for individual device drops only.
- .2 Exposed Dry Interior Locations: Use only FAS wire in raceway.
- .3 Above Accessible Ceilings: Use FAS wire in raceway for all main runs. Armoured Securex for individual device drops only.
- .4 Wet or Damp Interior Locations: Use only FAS wire in raceway.
- .5 Exterior Locations: Use only FAS wire in raceway.
- .6 Underground Installations: Use only FAS wire in raceway.

3.3 Interconnections

- .1 Interconnect with all systems and devices as identified on the drawings.
- .2 Interconnect with all high volume low speed fans as provided by mechanical to shut down on fire alarm signal.
- .3 Interconnect with all electromagnetic locks to release on fire alarm signal. Provide a manual release/reset keyswitch adjacent the fire alarm panel.
- .4 Interconnect with automatic door operators (ADO) on fire doors
 - .1 Where fire doors equipped with power-operators are installed in rated wall assembly partitions, wire and connect the power-operator fire alarm releasing device to the fire alarm system using an addressable relay control module. Power-operator shall release on ALARM event only.
- .5 Interconnect with generator to provide notification of generator:
 - .1 Common warning
- .6 Interconnect with transfer switch to provide notification of:
 - .1 Status.

3.4 Field Qualit Control

- .1 Section 01 45 00: Field inspection and testing.

- .2 Test to CAN/ULC S536 and CAN/ULC-S537 and local inspection authority requirements.
- .3 Include services to re-test system one (1) month prior to completion of warranty.

3.5 Manufacturer's Field Services

- .1 Section 01 75 16 □ Start-Up Procedures.
- .2 Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.6 Closeout Activities

- .1 Demonstration: Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Provide all labour, materials, methods, equipment, and accessories for the protection of existing trees within the limits of construction and trees that have drip lines that are within 3 metres of the limits of construction.

1.2 RELATED SECTIONS

- .1 N/A

1.3 REFERENCES

- .1 N/A

1.4 SUBMITTALS

- .1 N/A

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Barrier Material: plastic UV stabilized, high density polyethylene web snow fence, international orange colour, 1.22m height, or approved equal.
- .2 Snow Fence Supports: rolled steel T-bar fence posts, or approved equal.

Part 3 Execution

3.1 TREE PROTECTION

- .1 Construction work will occur in close proximity to existing trees that are to remain. The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing trees within the limits of the construction area. If you require further information on these specifications, please contact the City of Winnipeg Forestry Branch at 204-986-2044:
 - .1 For trees greater than 100mm in diameter, attach wood strapping material having a minimum thickness of 25mm and minimum length of 2440mm around tree trunks in a manner that will not harm the trees. Do not use nails or other fasteners that penetrate trees. The width of strapping should suit the size of the tree being protected. Length of strapping may be reduced to suit tree being protected as approved by the Contract Administrator.

- .2 For trees less than 100mm in diameter, install snow fencing around the tree to a 2.0m radius complete with installation hardware. The 2.0m radius of the snow fencing may be reduced to suit the tree being protected as approved by the Contract Administrator.
 - .3 Operation equipment within the dripline of the trees shall be kept to the minimum required to perform the Work. Equipment shall not be parked, repaired, refueled; construction materials shall not be stored, and earth materials shall not be stockpiled within the driplines of the trees. The dripline of a tree shall be the ground surface directly beneath the tips of its outermost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.
 - .4 Repair, replace and maintain tree protection material during construction of the Work.
 - .5 Remove snow fencing and strapping material without harming trees as soon as the construction and restoration work is completed.
- .2 Obtain approval from the Contract Administrator to excavate within 2.0 meters of a tree.
 - .3 Root Protection, Cutting and Care
 - .1 Avoid cutting roots. If root cutting appears to be necessary, obtain approval from the Contract Administrator before proceeding. If required and approved, root pruning must be performed under the direction of the Forestry Branch.
 - .2 Cut roots cleanly with sharp, sterilized hand tools to promote quick wound closure and regeneration.
 - .3 Minimize damage by avoiding excavation during hot, dry weather.
 - .4 Keep protected plants well watered before and after digging.
 - .5 Cover exposed roots with approved temporary root cover material such as soil, mulch, or damp burlap immediately after exposure. Temporary root covers shall be kept damp for as long as they are in place.
 - .4 Take precautions to ensure tree limbs overhanging the Site are not damaged by construction equipment. Contact the Forestry Branch for consultation on pruning of overhanging or damaged limbs and branches and other unanticipated problems with trees during construction of the Works.
 - .5 American elm trees are not to be pruned between April 1st and August 1st and Siberian elm trees between April 1st and July 1st of any year under provisions of The Dutch Elm Disease Act.
 - .6 All damage to existing trees caused by Contractor activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the Forestry Branch. Damages must be repaired by an individual with a Manitoba Arborist licence or by the Forestry Branch.
 - .7 The Forestry Branch will remove and replace any trees deemed to have died or that are dying due to damage from carelessness during construction. Removal and replacement costs will be determined by size, market price of the largest transplantable tree of same or different species and may include appraised value of existing tree as determined by current International Society of Arboriculture evaluation procedure presently used by Forestry Branch in conjunction with City Claims Branch. Estimated replacement cost of a 250mm and 600mm diameter American elm on a boulevard based on an appraised value is approximately \$4,700.00 and \$27,000.00 respectively.

3.2 ACCEPTANCE

- .1 The Contract Administrator will inspect the placement of tree protection barriers when initially installed and determine acceptance. Protection barriers shall be reviewed regularly by the Contractor to ensure they remain in place during construction activities on site.
- .2 Contractor to notify Contract Administrator when soft landscape contractor is ready for tree protection removal to occur. Protection shall only be removed when express instruction to do so is received from the Contract Administrator.

3.3 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 General

1.1 REFRENECES

- .1 The City of Winnipeg
 - .1 The latest revisions of the City of Winnipeg Standard Construction Specifications shall apply to the work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.
- .2 ASTM International
 - .1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.
- .3 Stockpiling:
 - .1 Place stockpile in an area of site not prone to flooding,
 - .2 Maintain moisture content of materials stored on site such that the material is not oversaturated or become too dry.
 - .3 Ensure the stockpiles do not cause nuisance dust on site.
 - .4 Stockpiling of aggregates on site is permitted as long as the stockpiles do not interfere with operation. Do not stockpile on completed pavement surfaces.
 - .5 Stockpile aggregates in sufficient quantities to meet project schedules.
 - .6 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .7 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
 - .8 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
 - .9 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by the Contract Administrator within 48 hours of rejection.
 - .10 Stockpile materials in uniform layers of thickness as follows:
 - .1 Maximum 1.5 m for coarse aggregate and base course materials.
 - .2 Maximum 1.5 m for fine aggregate and sub-base materials.

- .3 Maximum 1.5 m for other materials.
- .11 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .12 Do not cone piles or spill material over edges of piles.
- .13 Do not use conveying stackers.
- .14 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.
- .15 Ensure stockpile locations do not interference with required operations of the adjacent properties.

2 Products

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension not to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of the following:
 - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of the following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
- .5 No recycled concrete or asphalt products are being pursued for this project.

3 Execution

3.1 PREPARATION

- .1 Processing:
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, as required, in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.
- .2 When operating in stratified deposits use excavation equipment and methods that produce uniform homogeneous aggregate gradation.
- .3 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

3.2 SAMPLING AND TESTING

- .1 Unless otherwise specified, test procedures shall be in accordance with The City of Winnipeg Standard Construction Specifications.
- .2 The test procedures in effect on the closing date of the tenders shall apply.
- .3 All costs related to the sampling and testing of materials and Works shall be borne solely by the Contractor.
 - .1 The City may hire an independent inspection agency at random to conduct quality assurance tests.
 - .2 Notify the Contract Administrator of any testing onsite 24 hours in advance of performing the tests.

3.3 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Remove any excess aggregate from site following completion of the Work.

END OF SECTION

1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D698-91(1998), Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³) or latest.
- .2 These Specifications shall also apply to the Work.
 - .1 The City of Winnipeg Standard Construction Specifications shall apply to the Work. In particular, Spec CW 3170.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.

1.2 EXITING CONDITIONS

- .1 If the Geotechnical report for this project is not bound into the front of this specification, it may be available for viewing at the Contract Administrator's office.
- .2 Any known underground or surface utility lines, and buried objects, are shown on the drawings, but do not include any unknown items.

1.3 PROTECTION

- .1 Protect existing pavement and surface or underground utility lines, which are to remain as indicated on the drawings. If damaged, restore to original or better condition.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

2 Products

2.1 MATERIALS

- .1 Fill material: as specified in Section 31 23 10 – Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Geotechnical Engineer. Submit samples.

3 Execution

3.1 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
 - .1 as indicated for grassed areas and asphalt paving, concrete paving, walks, and precast paving units.
- .3 Slope rough grade away from building as indicated and at a minimum of 2% generally.
- .4 Grade ditches to depth required for maximum run-off.
- .5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .6 Unless otherwise noted, compact filled and disturbed areas to ASTM D698 maximum dry density, as follows:
 - .1 85% under soft landscape areas.
 - .2 95% under hard landscape areas including pavers/concrete sidewalk areas.
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.2 TESTING

- .1 The inspection and testing of soil compaction will be carried out by a testing agency, designated and paid for by the City, through the Cash Allowances. The Construction Manager shall coordinate the timing of this testing in an efficient way.

3.3 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping, to approved facilities off site.

END OF SECTION

PART 1 GENERAL

1.2 SECTION INCLUDES

- .1 Excavation and backfill for structures.

1.3 RELATED SECTIONS

- .1 Section 00 31 00 Available Project Information : Geotechnical Investigation

1.4 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ;) (600 kN-m/m ;).
 - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ;) (2,700 kN-m/m ;).
 - .6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Green Building Council (CaGBC)
 - .1 GG (TRM-NC) - Green Globes for New Construction Technical Reference Manual
- .1 Version 1.0 February 2022.Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 SITE CONDITIONS

- .1 Sub-surface investigation report has been not been included as part of this specification. The foundation design as of the 95% submission drawings is subject to change to suit requirements of forthcoming sub-surface investigation report.

1.4 UTILITY LINES

- .1 Before commencing work, establish location and extent of underground utility lines in areas of excavation. Notify Contract Administrator of findings.
- .2 Remove abandoned utility lines to distance of 1800 mm from foundations. Cap or otherwise seal lines at cut-off points.
- .3 Record locations of maintained, re-routed and abandoned underground utility lines.
- .4 Make good and pay for damage to existing utility lines resulting from work.

1.5 PROTECTION

- .1 Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with compacted Type 5 Fill.
- .2 Protect bottoms of excavations from freezing.
- .3 Construct banks in accordance with local by laws.
- .4 Provide adequate protection around bench marks, and geodetic monuments.
- .5 Provide protection to ensure no damage to existing facilities and equipment situated on site.
- .6 Effect approved measures to minimize dust as result of work.
- .7 Do not stockpile excavated material to interfere with site operation or drainage.
- .8 Provide shoring as required to protect adjacent property and structures. All shoring design and drawings to be submitted under seal for review and approval.

1.6 COMPACTION DENSITIES

- .1 Compaction densities are percentages of maximum densities obtainable from ASTM D698-70 and correct as noted.

1.7 UNSATISFACTORY SOIL CONDITIONS

- .1 Any unsatisfactory or questionable soil conditions revealed during excavation shall be reported immediately to the Contract Administrator.
- .2 All foundation and sub-structural work shall cease until the condition has been examined and approval to proceed has been issued.

1.8 MATERIAL UNSUITABLE FOR BACKFILL

- .1 The Contractor shall be responsible for all costs associated with the excavation and removal of all materials unsuitable for backfill.

1.9 WATER

- .1 Keep excavation free from water at all times. Provide drainage trenches and sumps as necessary and pump water well away from excavation. Do not discharge water onto private property.

1.10 INSPECTION AND TESTING

- .1 Testing of materials and compaction will be carried out by testing laboratory designated by Contract Administrator and as described in Division 0.
- .2 Sieve analysis: Proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.
- .3 Frequency of Tests
 - .1 Excavated surfaces: When undisturbed excavated surface is being prepared, make a series of 3 test of surface for each 500m² area.
 - .2 Fills under floor or other slabs on grade: Make 3 tests for every 2 lifts of compacted fill.

PART 2 MATERIALS

2.1 GRANULAR MATERIALS:

- .1 Type 1 Fill (Base Course): (Grade A) Clean, angular crusher run natural stone, free from shale clay, friable materials, roots and vegetable matter and graded within the following limits:

<u>Screen Size:</u>	<u>% Passing:</u>
25.4 mm	100
19 mm	85 – 100
13.2 mm	65 – 90
9.5 mm	50 – 73
4.75 mm	35 – 55
1.18 mm	15 – 40
300 um	5 – 11
75 um	2 – 8

- .2 Type 2 Fill (Sub-base): (Granulars – Type 1) Hard, durable, granular aggregate to be within the following limits when tested to ASTM C117-80 and ASTM C136-76 (aashto T27-78 and T11-78) and giving smooth curve without sharp breaks when plotted on semi-log grading chart:

<u>Screen Size:</u>	<u>% Passing:</u>
75 mm	95 - 100
25.4 mm	50 – 90
4.75 mm	20 – 60
425 um	5 - 35
75 um	0 – 5

- .3 Type 3 Fill: Low plastic clay or low plastic clay till.
.4 Type 4 Fill: Clean, washed, coarse sand free from clay, shale and organic matter and less than 5% passing the 75 um sieve.
.5 Type 5 Fill: Pitrun gravel free from silt, clay, loam, friable or soluble materials, vegetative matter and graded as follows:

<u>Screen Size:</u>	<u>% Passing:</u>
75 mm	100
4.75 mm	40 – 80
0.075 mm	3 – 10

- .6 Type 6 Fill: Durable and well graded, crushed stone, maximum sieve size 100 mm with 5 – 10% passing the 75 um sieve.
.7 Type 7 Fill (Filter Gravel): Free draining, river washed “pea” gravel, clean natural stone, free from shale, clay, friable materials, sand and fine particles, organic matter and other deleterious materials. Maximum size aggregate 12mm.

2.2 STOCKPILING

- .1 If required stockpile fill materials in areas designated by Contract Administrator. Stockpile granular materials in manner to prevent segregation. Protect stockpile fill materials from freezing.
- .2 Protect fill materials from contamination.

PART 3 EXECUTION

3.1 REMOVAL OF TOPSOIL

- .1 Remove topsoil of horticulture value from areas to be excavated, paved, re-graded.
- .2 Strip topsoil when dry enough to prevent contamination of sub-grade material.
- .3 Stockpile topsoil on site where directed.

3.2 EXCAVATING

- .1 Excavate to elevations and dimensions indicated for installation, construction and inspection of work specified.
- .2 Excavate to well defined lines to minimize quantity of fill material required.
- .3 Earth bottoms of excavations to be dry undisturbed soil, level, free from loose or organic matter.
- .4 Excavation must not interfere with normal 45 degree splay of bearing from bottom of any footing.
- .5 For trench excavation, unless otherwise authorized by Contract Administrator in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .6 Dispose of surplus and unsuitable excavated material off site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Contract Administrator when soil at bottom of excavation appears unsuitable and proceed as directed by Contract Administrator.
- .10 Obtain Contract Administrator approval of completed excavation.
- .11 Remove unsuitable material from trench bottom to extent and depth directed by Contract Administrator.
- .12 Correct unauthorized excavation at no extra cost as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified.
 - .2 Fill for trenching with Type 4 fill compacted to minimum of 95% maximum dry density to ASTM D698-78.
 - .3 Fill under other areas with Type 2 fill compacted to 100% maximum dry density to ASTM 0698-78.
- .13 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.
- .14 Remove concrete, masonry, paving, walks, demolished foundations, and rubble and other obstructions encountered in the course of excavation. Excavate trenches to lines and grades shown to a minimum of 150 mm below underside of pipe, conduit, cable. Provide recesses for bell and spigot pipe to ensure bearing will occur along barrel of pipe.

- .15 Cut trenches 300 mm wider than maximum pipe, conduit, cable, diameter. Trim and shape trench bottoms and leave free of irregularities, lumps or projections.
- .16 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .17 Provide shoring to Provincial Safety Standards.

3.3 BACKFILLING

- .1 Do not commence backfilling until areas of work to be backfilled have been inspected and approved by Contract Administrator.
- .2 Areas to be backfilled shall be free from debris, snow, ice, water or frozen ground. Backfill and filling material shall not be frozen or contain ice, snow or debris.
- .3 Do not backfill around or over cast-in-place concrete within 2 days of placing.
- .4 Backfill simultaneously each side of walls and other structures to equalize soil pressure.
- .5 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.
- .6 Place and compact fill materials in continuous horizontal layers not exceeding 300 mm loose depth. Use methods to prevent disturbing or damaging buried services, insulation, dampproofing. Make good any damage.
- .7 Do not use frozen material for backfilling or filling.

3.4 FILL TYPES AND COMPACTION

- .1 Dimensions specified in following paragraphs are minimum dimensions of fill after compaction.
- .2 Exterior side of perimeter beams: Use Type 2 fill to subgrade level. Compact to 95% density.
- .3 Within building areas / Under Basement Slab:
 - .1 Once excavation has reached the design subgrade elevation, the subgrade should be inspected by the geotechnical Contract Administrator prior to placement of fill.
 - .2 Where inspection does not indicate the presence of localized soft conditions, the clay subgrade should be scarified, moisture conditioned and compacted to a minimum of 95% of SPMDD, using a heavy sheepsfoot (padfoot) roller, prior to placing sub-base. In order to limit the potential swell, the clay should be moisture conditioned on the wetter side of optimum.
 - .3 Sub-base material can be placed directly on the compacted sub-grade.
 - .4 The sub-base shall consist of 200mm of Type 2 Fill compacted to 98% of SPMDD.
 - .5 The base course shall consist of 150mm of Type 1 fill compacted to 100% of SPMDD.
 - .6 Provide polyethylene vapour barrier under slab as per section 033000.
 - .7 Protect sub-grade from frost, desiccation and inundation prior to, during, and after construction.
 - .8 Any fill materials required between the approved subgrade and the underside of the slab section noted above should consist of additional granular sub-base, uniformly compacted to 98% of SPMDD.
- .4 Under slabs on grade (walks) and pavers that occur over backfill areas: Provide minimum 150 mm Type 1 Fill compacted to 95% density. Allow for sand layer under precast concrete pavers.

- .5 Underground Services:
 - .1 Pipe and conduit bedding and immediate protective cover: cradle half diameter of pipe or conduit using Type 4 fill. After pipe or conduit is in place, cover with 300 mm depth of Type 2 Fill.
 - .2 Cable and cable duct bedding and immediate protective cover: cover bottom of trench with 150 mm of Type 4 Fill. After cables and ducts are in place, side fill ducts with hand tampers and cover with 150 mm of same material.
 - .3 Fill above protective cover: in areas within buildings and where paving and walks occur, fill remainder of trench with Type 2 Fill. In other areas, fill to subgrade level using Type 2 Fill.
 - .4 Compaction (unless noted otherwise): compact bedding and immediate protective cover to 95% density, in areas within buildings and where paving and walks occur, compact remainder of fill to 95% density. In other non-loaded areas compact remainder of fill to 90% density.
 - .5 Notify Contract Administrator and Contract Administrator prior to backfilling of trenches for electrical services.
 - .6 If, during progress of work, tests indicate that fills do not meet specified requirements, remove defective fills, replace and retest at no extra cost.
- .6 Backfill for foundation walls and structures:
 - .1 Install weeping tile as per section 33 46 21 – Foundation and Underslab Drainage. Cover Pipe with Type 7 Fill (Filter Gravel). Hand place surrounding material in uniform layers not exceeding 150mm compacted thickness. Do not drop material directly on pipe. Compact each layer from pip invert to mid-height of pipe to at least 95% density. Compact each layer from mid-height of pipe to underside of backfill to at least 90% density. Compact to a width of at least 250mm on each side of the pipe and 200mm over the pipe.
 - .2 Place backfill material above pipe surround. Use Type 5 fill (pit-run) in layers not more than 200mm in thickness and compact to 95% of the maximum density as determined by the Standard Proctor Compaction Test.
 - .3 Control moisture content of the backfill material by adding water or drying the material, at the Contractor's expense.
 - .4 Keep heavy equipment at least 1.5m away from the foundation wall.
 - .5 Stop type 5 fill at depth required by landscaping. See landscaping specification for the required depth of landscaping materials.
 - .6 Install 600mm clay cap over granular backfill extending 600mm from foundation wall.
 - .7 Backfill evenly around structures to minimize unbalanced lateral earth pressure.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Excavation and backfill for the construction of water and sewer pipes, their associated structures (manholes, catchbasins, water retention tanks, gate vales, hydrants, etc.) and site grading.

1.2 REFERENCES

- .1 These Specifications shall apply to the Work.
 - .1 *The City of Winnipeg Standard Construction Specifications* in its entirety shall apply to the Work. In particular CW 2030 (Excavation Bedding and Backfill)
 - .2 *The City of Winnipeg Standard Construction Specifications* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, and Materials Management Branch internet site at:
http://www.winnipeg.ca/finance/findata/matmgt/std_const_spec/current/Standard_Construction_Specifications.pdf
 - .3 Specifications, Drawings and Details included in this document shall govern over *The City of Winnipeg Standard Construction Specifications*.
 - .4 The sub-sections within *The City of Winnipeg Standard Construction Specifications* are to be used solely for their technical content regarding approved materials, products and construction methods.
 - .5 Any reference to “The Contract Administrator” and its definition written within *The City of Winnipeg Standard Construction Specifications* shall refer to the City or their designated on-site representative on this project.
 - .6 “Work Practices for Asbestos-Cement Pipe”, AWWA No. M16, published by the American Water Works Association.
 - .7 “Recommended Work Practices for AC Pipe”, 1977, published by the AC Pipe Producers Association.
 - .8 “GG (TRM-NC) – Green Globes for New Construction Technical Reference Manual,” published by Canadian Green Building Council (CaGBC).

1.3 EXISTING CONDITIONS

- .1 Examine geotechnical report as available from the City.
- .2 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate utility for relocation of any buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Confirm locations of buried utilities by careful soil hydro vac methods.
 - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Of particular note are two critical duct banks that run through the footprint of the new building footprint that carry

- electrical cables and communication lines. These are identified on the drawings and require due care and protection when working in their proximity.
- .7 Existing known sewer and watermain to be re-routed around the excavation is noted on the drawings. Where utility lines or structures exist in area of excavation, obtain direction of the Contract Administrator to confirm before removing and re-routing prior to construction. Costs for such Work to be paid by Contractor.
 - .8 Existing known conduit pipe for electrical/communication ducts has been identified as being asbestos-cement (AC) pipe. The Contractor's attention is directed to the possible health dangers associated with working with AC pipe and all work associated with the existing AC pipes shall conform to the appropriate publications as per 1.01.1.6-7 and the following best practices:
 - .1 The Contractor shall state in the "job specific safe work plan" the proposed procedure for working with AC Pipe.
 - .2 At a minimum the Contractor must ensure that: all staff working in proximity of the AC pipe work must wear appropriate PPE; airborne particulates from AC pipe are to be mitigated by use of water sprayed on the pipe, AC pipe is to be cut cleanly where it is being removed and capped; pieces of AC pipe removed from the trench are to be bagged immediately for disposal at a suitable facility.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
- .1 Conduct, with Contract Administrator condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey benchmarks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by the Contract Administrator.
 - .3 Where required for excavation, cut roots or branches in accordance with *The City of Winnipeg Standard Construction Specifications* and as directed by the Contract Administrator and the City.

2 Products

2.1 MATERIALS

- .1 Materials shall be as specified on the drawings and in *The City of Winnipeg Standard Construction Specifications*.

3 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, according to sediment and erosion control plan, specific to site, that complies with requirements of authorities having jurisdiction and sediment and erosion control drawings, and Green Globes requirements (if applicable), as directed by the Contract Administrator.
- .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.

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated and directed by the Contract Administrator.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with *The City of Winnipeg Standard Construction Specifications* and limits of work on design drawings.

3.3 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with *The City of Winnipeg Standard Construction Specifications*, as directed by the Contract Administrator and the City, and in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Contract Administrator's approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STOCKPILING

- .1 Stockpile fill materials in areas designated by the Contract Administrator.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 EXCAVATION

- .1 Advise the Contract Administrator at least 7 days in advance of excavation operations for initial cross sections to be taken.
 - .2 Excavate to lines, grades, elevations and dimensions as directed by the Contract Administrator and indicated on the drawings.
 - .3 Excavation must not interfere with bearing capacity of adjacent foundations.
 - .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
 - .5 For trench excavation, unless otherwise authorized by the Contract Administrator in writing, do not excavate more than 30m of trench in advance of installation operations and do not leave open more than 15m at end of day's operation.
 - .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by the Contract Administrator.
 - .7 Restrict vehicle operations directly adjacent to open trenches.
 - .8 Dispose of surplus and unsuitable excavated material off site as directed by the Contract Administrator and in accordance with *The City of Winnipeg Standard Construction Specifications*.
 - .9 Do not obstruct flow of surface drainage or natural watercourses.
 - .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
 - .11 Notify the Contract Administrator when bottom of excavation is reached.
 - .12 Obtain the Contract Administrator's approval of completed excavation.
 - .13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by the Contract Administrator.
 - .14 Correct unauthorized over-excavation as directed by the Contract Administrator and in accordance with *The City of Winnipeg Standard Construction Specifications*.
 - .15 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of the Contract Administrator.
- 3.6 Install geotextiles in accordance with design drawings and in accordance with *The City of Winnipeg Standard Construction Specifications*.

3.7 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated on the design drawings and in accordance with *The City of Winnipeg Standard Construction Specifications*.

3.8 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services in accordance with the latest revision of *The City of Winnipeg Standard Construction Specifications*.
- .2 Place bedding and surround material in unfrozen condition.

3.9 BACKFILLING

- .1 Backfill as indicated on the design drawings and in accordance with *The City of Winnipeg Standard Construction Specification*.
- .2 Do not proceed with backfilling operations until completion of following:
 - .1 The Contract Administrator has inspected and approved installations.
 - .2 The Contract Administrator has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
 - .6 Installation and review of damp proofing, sheet waterproofing and insulation is complete.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfilling around installations:
 - .1 Place bedding and surround material as in accordance with *The City of Winnipeg Standard Construction Specifications*

3.10 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 19 – Construction Waste Management and Disposal, trim slopes, and correct defects as directed by the Contract Administrator.
- .2 Replace topsoil as directed by the Contract Administrator and as indicated on landscape design drawings.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by the Contract Administrator.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 32 11 16.01 – Granular Sub-Base
- .2 Section 32 12 17 – Asphalt Paving
- .3 Sections 32 13 13 – Concrete Paving
- .4 Sections 32 11 23 – Aggregate Base Courses
- .5 Sections 32 16 00 – Curbs, Gutters and Sidewalks

1.2 REFERENCES

- .1 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW 3130 – Supply and Installation of Geotextile Fabrics.
- .2 ASTM International
 - .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D4491-99a (2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .3 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .4 ASTM D4716-08, Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .5 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2 No. 11.2-2004, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
 - .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
 - .1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
 - .3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles under No Compressive Load.
 - .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
 - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .4 CSA International
 - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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 Store and protect geotextiles from direct sunlight, UV rays, excessive heat, mud, dirt, dust, debris and rodents.
 - .3 Replace defective or damaged materials with new.

2 Products

2.1 MATERIAL

.1 Separation Geotextile Fabric

Separation Fabric will be non-woven and meet or exceed the following requirements:

Physical Property	Standard	Test Method
Grab Tensile Strength	900 N – minimum	ASTM D4632
CBR Puncture	2200 N - minimum	ASTM D 6241
Trapezoid Tear	350 N - minimum	ASTM D4533
Apparent Opening Size	0.18mm – maximum	ASTM D4751
Permittivity	1.4 sec-1 – minimum	ASTM D4491
Flow Rate	4000 l/min/m2 – minimum	ASTM D4491
U.V. Resistance	70% per 500 hrs - minimum	ASTM D4355

When CBR Puncture and Trapezoid Tear material property values are not available from the manufacturer, the following material property values for Puncture Strength* and Mullen Burst** must be met as alternatives to CBR Puncture and Trapezoid Tear in Table CW 3130.1.

*Puncture Strength	575 N – minimum	ASTM D4833
**Mullen Burst	2000 kPa – minimum	ASTM D3786

All physical property requirements are MARV (Minimum Average Roll Values) determined in accordance with ASTM 4759.

Approved Products are as indicated below:

Product Name	Supplier
Skaps GT 180	Brock White Canada
BW 180	Brock White Canada
Propex 861	Brock White Canada
Propex 861	Nilex Incorporated
Armtec 250W	Armtec Limited
Carthage Mills FX-86HS	Canada Culvert

- .2 **Separation/reinforcement geotextile will be woven fabric and meet or exceed the following requirements:**

Physical Property	Requirements	Test Method
Grab Tensile Strength	1400 N – minimum	ASTM D4632
Puncture Strength	530 N – minimum	ASTM D4833
Trapezoid Tear	500 N – minimum	ASTM D4533
Apparent Opening Size	0.430 mm – maximum	ASTM D4751
Permittivity	0.05 sec ⁻¹ – minimum	ASTM D4491
U.V. Resistance	70% per 500 hrs - minimum	ASTM D4355
Mullen Burst	3500 kPa - minimum	ASTM D3786

All physical property requirements are MARV (Minimum Average Roll Values) determined in accordance with ASTM 4759.

Approved Products are as indicated below:

Product Name	Supplier
Armtec 855	Armtec Limited
Layfield LP315	Layfield Geosynthetics & Industrial Fabrics Limited
Skaps W315	Brock White Canada
BW 315	Brock White Canada
Propex 315ST	Brock White Canada
Propex 315ST	Nilex Incorporated
CC315	Canada Culvert

- .3 **Securing pins and washers:** to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164.

3 Execution

3.1 INSTALLATION

1. Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with retaining pins/ nails.
 - .1 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
 - .2 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

- .3 Overlap each successive strip of geotextile 900 mm over previously laid strip.
- .4 Join successive strips of geotextile by overlapping.
- .5 Pin successive strips of geotextile with securing pins at 600 mm interval at mid-point of lap.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within four (4) hours of placement.
- .8 Replace damaged or deteriorated geotextile to approval of the Contract Administrator.

3.2 CLEANING

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.3 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This specification shall include the supply and installation of rock mulch including geotextile fabric.

1.2 RELATED SECTIONS

- .1 N/A

1.3 REFERENCES

- .1 City of Winnipeg Standard Construction Specifications:
 - .1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction
 - .2 CW 3130 – Supply and Installation of Geotextile Fabrics

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Submit samples of:
 - .1 Rock Mulch (all sizes).
 - .2 Geotextile Fabric.

1.5 DELIVERY AND STORAGE

- .1 Deliver and store materials on site no earlier than one week prior to installation. Store stones in neat piles not exceeding 3m in height, within the staging area designated by the Contract Administrator.

1.6 CLEANING AND WASTE MANAGEMENT

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Granular base course to CW 3110.
- .2 Rock Mulch: Hard, dense, durable rounded granite boulders (no limestone) free from seams, cracks or other structural defects, to the following sizes:
 - .1 300 – 500mm dia., rounded granite boulders.
 - .2 75 – 100mm dia., rounded granite boulders.
- .3 Geotextile Fabric: Non-woven fabric to CW 3130.

Part 3 Execution

3.1 GENERAL

- .1 Obtain approval of rough grading and sub-grade conditions from Contract Administrator prior to installation.

- .2 Fine grade area to be finished excavating or filling to depths indicated on the Drawings and ensure positive drainage to outlet.

3.2 SAMPLE AREA

- .1 Install a 3 x 3m square sample area of rock mulch for Contract Administrator approval as the standard of performance for all rock mulch installations on site prior to proceeding with installation.

3.3 ROCK MULCH INSTALLATION

- .1 Place geotextile fabric over sub-grade or sub-base as indicated on the Drawings.
- .2 Obtain approval of geotextile fabric placement from Contract Administrator prior to proceeding with granular base placement and compaction.
- .3 Place rock mulch over geotextile fabric in a stable mass. Ensure larger 300-500mm diameter boulders are evenly distributed and well heeled into the sub-grade or sub-base throughout the rock mulch area. Infill gaps between large stones with 75-100mm diameter boulders.

3.4 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from site.

3.5 ACCEPTANCE

- .1 Rock mulch will be accepted once a heavy rain has demonstrated positive drainage occurs with no low spots collecting water on the surface or above the top of the loose rip rap surface.
- .2 Obtain approval from Contract Administrator of rock mulch installation prior to proceeding with landscape installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 62 14 – Precast Concrete Piles.

1.2 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Contract Administrator and await further instructions.
- .4 Submit schedule of planned sequence of driving to Contract Administrator for review, not less than 2 weeks prior to commencement of pile driving.
- .5 Equipment:
 - .1 Submit prior to pile installation for review by Contract Administrator, list pertinent details of equipment for use in installation of piles.
 - .2 Impact hammers: submit manufacturer's written data as specified.
 - .3 Non-impact methods; submit characteristics to evaluate performance.
- .6 Quality assurance submittals:
 - .1 Test reports: submit 2 copies of certified test reports for piles from approved independent testing laboratories, indicating compliance 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.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's instructions.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles to satisfaction of Contract Administrator..

1.5 EXISTING CONDITIONS

- .1 Refer to subsurface Geotechnical Report.
- .2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Contract Administrator. Do not proceed with

pile locations / sizes / extensions, etc. where not on drawings without written approval from the Contract Administrator.

1.6 SCHEDULING

- .1 Provide schedule of planned sequence of driving to Contract Administrator for review, not less than two weeks prior to commencement of pile driving.

Part 2 Products

2.1 MATERIALS

- .1 Material requirements for piles are specified in Section 31 62 14 – Precast Concrete Piles.
- .2 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.
- .3 Splice piles only with written approval of Contract Administrator.
 - .1 When permitted, provide details for Contract Administrator review.
 - .2 Design details of splice to bear dated signature stamp of professional Contract Administrator registered or licensed in Province of Manitoba, Canada.

2.2 EQUIPMENT

- .1 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 Non-impact methods of installation such as augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .3 Hammer:
 - .1 Drop hammers will not be permitted.
 - .2 Hammers to be capable of developing a blow at operating speed with energy specified in Geotechnical Report. Hammer is to be capable of being adjusted to deliver reduced impact. When required bearing capacity is not obtained by use of hammers complying with minimum requirements, use larger hammer only as approved by Contract Administrator. For diesel hammers, provide independent calibrated pressure gauges on hammer side of all valves. Provide calibration certificate dated within 6 months of calibration.
- .4 Leads:
 - .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven. Inclined heads to be used for battered piles.
 - .2 Length: provide length of leads so that use of a follower is unnecessary.
 - .3 Swing leads:
 - .1 Not permitted.
- .5 Followers:
 - .1 Obtain written approval from Contract Administrator prior to using followers. When permitted, provide followers of such size, shape, length and mass to

permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

- .2 Drive applicable load test piles using similar follower.

Part 3 Execution

3.1 PREPARATION

- .1 Protection:
 - .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
 - .2 Arrange sequencing of pile driving operations and methods to avoid damages to adjacent existing structures.
 - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation.
 - .1 Make provision for access and support of piling equipment during performance of Work.
- .3 Prebore piles to 4 metres depth, or as required by geotechnical Contract Administrator.
- .4 Drive piles within embankments only when embankment has been placed and compacted to at least bottom elevation of pile cap.
- .5 Do not drive piles until excavation has been completed.
- .6 In areas requiring fill, either place and compact fill after piles are installed or drive piles after fill has been placed and compacted to at least bottom elevation of pile cap.

3.2 DESIGN LOAD CAPACITY

- .1 Allowable design load capacity of pile at working load is as indicated on drawings.
- .2 Installation of each pile will be subject to review of Contract Administrator. Contract Administrator will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration or other criteria used to determine bearing capacity. Pile driving rig shall not be removed from site prior to Contract Administrator's review of final driving of all piles.
- .3 Drive each pile to final set as directed by Contract Administrator, and in accordance with Geotechnical Report.
- .4 Determine required final driving resistance using formula approved by Contract Administrator.
- .5 Drive each pile to practical refusal in glacial till.

3.3 APPLICATION / DRIVING

- .1 Drive precast piles only when concrete has attained strength of 35 MPa.

- .2 Use driving caps and cushions to protect piles.
 - .1 Reinforce pile heads if necessary. Piles with damaged heads will be rejected by Contract Administrator.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile. Ensure pile is not overstressed.
- .5 Do not drive piles within 8 m of masonry or concrete which has been in place less than 7 days.
- .6 Ensure no contact between pile and structure takes place when driving batter piles adjacent to existing structures.
- .7 Do not drive batter piles until vertical piles within radius of 8m have been fully driven.
- .8 Restrike already driven piles lifted during driving of adjacent piles to confirm set.
- .9 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .10 Cut off piles neatly and squarely at elevations to tolerance of plus or minus 25 mm.
 - .1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
 - .2 Do not cut tendons or other reinforcement, which will be used to tie pile caps to pile.
- .11 Remove cut-off lengths from site on completion of work.

3.4 DRIVING TOLERANCES

- .1 Pile heads to be within 50 mm of locations as indicated.
- .2 Piles not to be more than 2% of length out of vertical alignment.

3.5 OBSTRUCTIONS

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, remove obstruction.

3.6 DAMAGED OR DEFECTIVE PILES

- .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
- .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

3.7 PROTECTION

- .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.

- .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.

3.8 FIELD QUALITY CONTROL

- .1 Independent review of piling operations shall be done by an qualified geotechnical Contract Administrator under a cash allowance and retained by the City.
- .2 Maintain accurate records of driving for each pile, including:
 - .1 Type and make of hammer, stroke or related energy.
 - .2 Other driving equipment including water jet, driving cap, cushion.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Sequence of driving piles in group.
 - .5 Number of blows per metre for entire length of pile and number of blows per 25mm for final sets, over the last 75 mm.
 - .6 Final tip and cut-off elevations.
 - .7 Other pertinent information such as interruption of continuous driving, pile damage.
 - .8 Record elevation taken on adjacent piles before and after driving of each pile.
- .3 Provide Contract Administrator with three copies of records.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 61 13 – Pile Foundations, General Requirements.

1.2 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82/A82M-05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A416/A416M-05, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - .3 ASTM A421/A421M-05, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .3 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.
 - .4 CAN/CSA-A23.4/A251, Qualification Code for Architectural and Structural Precast Concrete Products.
- .3 Precast/Prestressed Concrete Institute (PCI)
 - .1 PCI MNL-116-[1999], Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.5 DESIGN REQUIREMENTS

- .1 Design loads as indicated on Structural Drawings.

- .2 Do not splice piles without Contract Administrator's permission. When permitted, provide details for Contract Administrator review. Design details of splice to bear signature and stamp of professional Contract Administrator registered or licensed in Province of Manitoba.

1.6 TEST REPORTS

- .1 Upon request, submit certified copies of quality control tests related to this project as specified in CSA A251.

1.7 QUALITY ASSURANCE

- .1 Manufacturer of precast concrete components: certified by CSA as meeting requirements of CSA A251.
- .2 A Contractor experienced in the related type or work and having at their disposal all necessary equipment shall perform all work.
- .3 Allowable tolerances:
 - .1 Lateral tolerances: all units shall be located so as to have a maximum lateral deviation at the top of the unit of 50 mm.
 - .2 Vertical tolerance: all piles shall be driven without varying more than 2% from the vertical.
 - .3 Pile cutoffs at elevations indicated +/- 25 mm.
 - .4 Piles not meeting these requirements will be rejected.
- .4 Drive all units to develop loads indicated on drawings to the criteria in the Geotechnical Report.
- .5 Comply with all local and provincial safety codes and regulations.

1.8 SITE CONDITIONS

- .1 Visit the site to ascertain any special conditions that may affect the work.
- .2 Refer to sub-surface investigation report.

1.9 DELIVERY, STORAGE, AND HANDLING

- .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.
- .3 Ensure handling and installation stresses are within safe limits.
- .4 Avoid damage to piles during handling, placing pile in leads, and during pile driving operations.
- .5 Support piles laterally during driving, but allow rotation in leads.
- .6 Where pile or projecting reinforcement orientation is essential take precautionary measures to maintain orientation during driving.
- .7 Support battered piles to prevent excessive bending stresses in pile.
- .8 Square top of pile to longitudinal axis of pile.

- .1 Maintain axial alignment of pile hammer with that of pile.
- .9 Provide identification for points of lifting by painted stripes or lift hooks set in.
- .10 Provide identification for points of support for storage. Store all units at site in such a way as to avoid undue stresses before driving.
- .11 During delivery and storage support long piles continuously along their lengths.
- .12 All foundation units delivered to site that do not conform to terms of this specification may be rejected by Contract Administrator.

1.10 PROTECTION

- .1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributable to pile driving operations.
- .2 Protect pile surfaces from damage and spalling.

Part 2 Products

2.1 MATERIALS

- .1 All piles standard hexagonal, precast, prestressed, to sizes indicated on drawings by an approved supplier.
- .2 Cement: Type HS or HSb, sulphate resistant.
- .3 Concrete strength: minimum 35 MPa at the time of driving. Concrete strength at transfer of prestress: as required by manufacturer.
- .4 Prestressing steel: to ASTM A416, uncoated seven-wire stress-relieved strand, grade 270.
 - .1 Prestressing steel: free of grease, oil, wax, paint, soil, dirt, and loose rust.
 - .2 Do not use prestressing strands or wire having kinks, bends, or other defects.
- .5 Welded wire mesh: to ASTM A-185.
- .6 Spiral reinforcement: to ASTM A82, cold drawn steel wire.
- .7 Cementitious materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .8 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing 400 MPa yield.

2.2 Fabrication

- .1 Fabricate precast concrete piles to lengths, cross sectional areas, reinforcement as required to meet capacities indicated.
- .2 Fabricate piles to following finish tolerances:
 - .1 Length: ± 3 mm per metre of length.
 - .2 Cross section: solid section -6 to +12 mm.
 - .3 Deviation from straight line: not more than 3 mm per metre of length, nor 12 mm in full length.
 - .4 Pile head: +/- 10 mm per metre from true right angle plane. Surface irregularities +/- 3 mm.
 - .5 Location of reinforcing steel: Main reinforcing cover: -3mm to +6 mm. Spacing of spiral +/- 12 mm.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Provide approved type of protection cap with cushion block to top of pile when driving. Cushion block material softwood such as green hemlock. Plywood not acceptable.
- .2 Do not typically splice piles. If splicing of piles should be required, only pre-manufactured cast-in splice shoes approved by the Contract Administrator will be considered.
- .3 On completion of driving, cut off pile at required elevation. Make circumferential cut with concrete saw to prevent spalling of pile below cut-off elevation. Make pile cut off absolutely horizontal.
- .4 Drive piles at locations indicated and to depth sufficient to develop required loading.
- .5 Minimum prebored depth for piles from excavation 4.0 metres.
- .6 Prebored holes to have 50 mm larger diameter than piles to be placed unless indicated otherwise on the drawings.
- .7 Remove boulders encountered in prebored holes using a core barrel or other approved method.
- .8 Remove, relocate, redrive and provide additional piles where directed when boulders or other obstructions prevent driving piles to an adequate bearing strata or within allowable tolerances in locations indicated on the drawings. Perform such work at no additional cost to the Contract.
- .9 Perform pile driving with a hammer capable of delivering the rated energy specified in the Geotechnical Report.
- .10 Refusal criteria for driving piles shall be established by inspection at time of driving, and in accordance with the criteria in the Geotechnical Report.
- .11 Replace piles that are excessively damaged through driving or which are believed to be broken with new piles at a suitable location at no additional cost to Contract.
- .12 Piles shall be of sufficient length to allow 450 mm of strand to extend into the structure above.
- .13 If a pile or piles should be driven below required elevation to accommodate exposed strand requirements, cut off such piles 450 mm below the top of pile (except at single pile caps) and install an extension to details as supplied by the Contract Administrator at no extra cost to the Contract.
- .14 Drive all piles to required final set in competent hard glacial till deposit.
- .15 Drive piles continuously, without intermission until driven to required final set, at depth adequate to support the loads indicated on the drawings.
- .16 Observe and check pile upheaval. Redrive pile to refusal and final set any piles showing uplift after driving adjacent piles.

3.3 CLEAN-UP

- .1 After installation of foundation units, remove all excess concrete and other debris and leave site in clean condition.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 32 11 23 – Aggregate Base Courses
- .2 Section 31 05 17 – Aggregate: General

1.2 REFERENCES

- .1 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW3110-Sub-grade, Sub-base and Base course construction.
- .2 ASTM International
 - .1 ASTM C117-13, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-14e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 31 05 17 – Aggregate: general. Stockpile minimum fifty (50%) of total aggregate required prior to beginning operation.

2 Products

2.1 MATERIALS

- .1 Crushed sub-base material will be crushed aggregate, crushed granite and crushed limestone.
- .2 The granular sub-base material should be a 50 mm down crushed material that is placed over a uniformly prepared subgrade.
- .3 Where significantly more than 300 mm of sub-base material is required to achieve the design grades, a 100 mm or 150 mm down crushed material can be considered to build up the sub-base to the underside of the sub-base material recommended above.
- .4 Crushed sub-base material will be well-graded and conform to the following grading requirements:

CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE		
	50 mm MAX.	100mm	150 mm
200 000			100%
150 000			90% - 100%
100 000		97% - 100%	65% - 85%
50 000	100%		
25 000		30% - 50%	0% - 40%
5 000	25% - 60%		
80	4% - 15%	8% max.	

- .5 150 and 100 millimetre crushed sub-base material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading 1 of ASTM C535, Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .6 50 millimetres crushed sub-base material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading A of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

2.2 TESTING

- .1 A minimum of one sample shall be tested for gradation (sieve analysis) and LA abrasion for sub-base course material prior to starting construction. The material shall be sampled from stockpiles designated to be used for the contract and shall be tested in accordance with this Specification.
- .2 If one test fails to meet the requirements of this Specification, the material shall be re-tested. If the material fails a second test, the Contract Administrator shall designate a new source for supply of the material.
- .3 All testing required meeting specifications to be conducted by a certified material and testing agencies to be engaged and paid by contractor.
- .4 The Contract Administrator may engage an independent testing laboratory to conduct random Quality assurance testing.

3 Execution

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by the Contract Administrator.
- .2 Construct granular sub-base to depth and grade in areas indicated as shown on Drawing C04 of the sub-base material recommended above.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Contract Administrator may authorize thicker lifts (layers) if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Place and compact sub-base materials in layers to a depth of 3 times the maximum aggregate size or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Density, for the full width of the excavation, and each layer must be leveled before the succeeding layer may be placed. Compaction equipment to be capable of obtaining required material densities.
- .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from the Contract Administrator before use.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Contract Administrator.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 PROOF ROLLING

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain approval from the Contract Administrator to use non standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated. If non standard proof rolling equipment is approved, the Contract Administrator to determine level of proof rolling.

- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove sub-base and subgrade material to depth and extent as directed by the Contract Administrator.
 - .2 Backfill excavated subgrade with common material and compact in accordance with this section.
 - .3 Replace sub-base material and compact.
- .6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.4 QUALITY CONTROL

- .1 Determine the Standard Proctor Density for the base course materials at the optimum moisture content in accordance with ASTM Standard D698. The field density of each sub-base layer will be a percentage of the applicable Standard Proctor Density, in Section 3.2 of this specification.
- .2 Utilize quality control tests to determine the acceptability of the base course layer, as placed and compacted before the succeeding layer may be applied.
- .3 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- .4 Fill promptly, holes made by the removal of samples from the layers with appropriate material and thoroughly compact so as to conform in every way with the adjoining material.
- .5 The frequency and number of compaction density tests will be as directed by the Contract Administrator.
- .6 Testing of materials and compaction of granular sub-base and fill will be carried out by testing laboratory designated by Contractor and approved by the Contract Administrator.
- .7 Not later than one week before backfilling or filling, provide to designated testing agency, samples of backfill as described in PART 1 – SUBMITTALS.
- .8 Do not begin placing operations until material has been approved for use by the Contract Administrator.
- .9 Pay costs of testing and sampling.

3.5 SITE TOLERANCES

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.6 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Contract Administrator.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 17 – Aggregate: General
- .2 Section 32 11 16.01 – Granular Sub-Base

1.2 REFERENCES

- .1 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW3110-Sub-Grade, Sub-Base and Base Course Construction.
- .2 ASTM International
 - .1 ASTM C117-13, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-[09], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-14, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 31 05 17 – Aggregates: General. Stockpile minimum fifty (50%) of total aggregate required prior to beginning operation.

2 Products

2.1 MATERIALS

- .1 Base course material will consist of sound, hard, crushed rock and crushed gravel.
- .2 Crushed rock and crushed gravel will be free from organic or soft material that would disintegrate through decay or weathering.
- .3 Base course material will consist of sound durable particles produced by crushing, screening and grading of recovered materials, free from soft material that would decay or disintegrate from weathering.
- .4 The granular base should be a 19 mm down crushed bedrock material.
- .5 The base course material will be well graded and conform to the following grading requirements:

CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE	
	Granular	Crushed Limestone
25 000	100%	
20 000	80% - 100%	100%
5 000	40% - 70%	40% - 70%
2 500	25% - 55%	25% - 60%
315	13% - 30%	8% - 25%
80	5% - 15%	6% - 17%

Base course material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with grading B of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

Test base course material using an Atterberg Limits Test in accordance with ASTM D4318. The material passing the 315 sieve will have a liquid limit not greater than 25 and a plasticity index not greater than 6.

- .6 Where base course is being placed under an asphaltic concrete pavement, the aggregate retained on a No. 5 000 sieve will contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate will be considered as that aggregate having at least one fractured face.

2.2 TESTING

- .1 A minimum of one sample shall be tested for gradation (sieve analysis) and LA abrasion for sub-base course material prior to starting construction. The material shall be sampled from stockpiles designated to be used for the contract and shall be tested in accordance with this Specification.
- .2 If one test fails to meet the requirements of this Specification, the material shall be re-tested. If the material fails a second test, the Contract Administrator shall designate a new source for supply of the material.
- .3 All testing required meeting specifications to be conducted by a certified material and testing agencies to be engaged and paid by contractor.
- .4 The Contract Administrator may engage an independent testing laboratory to conduct random Quality assurance testing.

3 Execution

3.1 PREPARATION

- .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, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005.
 - .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.

3.2 PLACEMENT

- .1 Place and compact base course material for pavement and approaches to a minimum of 100% Standard Proctor Density for the full width of the excavation unless otherwise shown on the Drawings or as directed by the Contract Administrator.
- .2 Level the compacted base course to the finished base course elevation.
- .3 Maintain the finished base course until the pavement is placed.
- .4 Spread base course material uniformly to avoid segregation, free of pockets of fine and coarse material.
- .5 Place and compact leveling course for sidewalks, renewal of existing curbs and miscellaneous concrete slabs, to 95% Standard Proctor Density.

3.3 QUALITY CONTROL

- .1 Determine the Standard Proctor Density for the base course materials at the optimum moisture content in accordance with ASTM Standard D698. The field density of each sub-grade, sub-base and base course layers will be a percentage of the applicable Standard Proctor Density.
- .2 Utilize quality control tests to determine the acceptability of the base course layer, as placed and compacted before the succeeding layer may be applied.
- .3 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- .4 Fill promptly, holes made by the removal of samples from the layers with appropriate material and thoroughly compact so as to conform in every way with the adjoining material.
- .5 The frequency and number of compaction density tests will be as directed by the Contract Administrator.
- .6 Testing of materials and compaction of base course and crushed stone surfacing will be carried out by testing laboratory designated by Contractor and approved by the Contract Administrator.
- .7 Not later than one week before backfilling or filling, provide to designated testing agency, samples of backfill.
- .8 Do not begin placing operations until material has been approved for use by Departmental Representative.

- .9 Pay costs of testing and sampling.

3.4 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.5 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by the Contract Administrator.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 22 00 - Site Grading
- .2 Section 31 23 33 – Excavating, Trenching, and Backfill
- .3 Section 31 32 21 – Geotextiles

1.2 REFERENCES

- .1 These Specifications shall also apply to the Work.
 - .1 The latest revision of the City of Winnipeg Standard Construction Specifications shall apply to the Work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.

1.3 LEVELS

- .1 It is the Contractor's responsibility to secure and maintain grade stake levels of existing or proposed roadways, sidewalks, catch basins, etc., from the municipality before starting excavation and base all levels on approved benchmarks or reference points.

1.4 CO-OPERATION

- .1 This Contractor shall co-operate with other trades so that all underground services, utilities, and sewer work are complete before paving is started.

1.5 SAMPLES

- .1 Upon request, submit samples to the Contract Administrator.
- .2 Upon request, submit samples of material for sieve analysis at least 4 weeks before beginning Work to the Contract Administrator.

2 Products

2.1 PAVEMENT MATERIALS

- .1 Bridging fill: well graded, clean, 150 (6") down crushed limestone conforming to City of Winnipeg Standards.
- .2 Sub-grade and Sub-base fill material shall be 50mm minus crushed limestone conforming to City of Winnipeg Standards.
- .3 Base course material shall be 20mm minus crushed limestone conforming to City of Winnipeg Standards.
- .4 Asphaltic prime oil shall be low viscosity liquid asphalt type M.C.O. or M.C.I.

- .5 Asphalt mix shall conform to City of Winnipeg specification for surface mix (Type 1A).

2.2 GEOTEXTILE FABRIC

- .1 As per Specification Section 31 32 21 – Geotextiles.

3 Execution

3.1 EXCAVATION AND SUB-GRADE PREPARATION

- .1 Strip organics, silts, fill soils, and other deleterious material from areas intended for asphalt pavement (see Geotechnical Report) and stockpile for reuse on the site.
- .2 Excavate to levels below existing grades as required to achieve new finished design grades as shown on the drawings and to depths as noted in the Geotechnical Report for asphalt pavement.
- .3 Protect the exposed subgrade from frost, dessication, drying, inundation, and excessive wheel loads at all times. After excavation, notify the Contract Administrator to arrange for inspections by Geotechnical personnel.
- .4 Proof roll the sub-grade with a fully loaded tandem axle truck and compact to 95% of SPMDD to detect weak or soft areas. Repair such soft areas with bridging fill as specified, compacted to 98% SPMDD.
- .5 Coordinate inspection of sub-grade by Geotechnical personnel.
- .6 Place the geotextile fabric down over the entire area of exposed sub-grade surface achieving joint overlaps of 150 (6") minimum.
- .7 Without operating construction equipment directly on the sub-grade or the geotextile, place the bridging fill material over the entire area of the geotextile. Use non-vibratory equipment to provide sufficient but not excessive compaction.

3.2 SUB-GRADE/SUB-BASE FILL

- .1 Light Traffic Areas (car parking): 50 mm down crushed limestone for 350 mm (13.8") compacted layer thickness minimum. Place in maximum lifts of 150 mm (6") and compact to 100% SPMDD, after trimming.
- .2 Heavy Traffic Areas (Approaches, driveways, fire lanes, and bus parking): 50mm down crushed limestone for 450 mm (17.7") compacted layer thickness minimum. Place in maximum lifts of 150 mm (6") and compact to 100% SPMDD, after trimming.

3.3 BASE COURSE FILL

- .1 Light Traffic Areas (car parking): 20 mm down crushed limestone for 100 mm (4") compacted layer thickness minimum. Place in maximum lifts of 150 mm (6") and compact to 100% SPMDD.
- .2 Heavy Traffic Areas (Approaches, driveways, fire lanes, and bus parking): 20 mm down crushed limestone for 150 mm (6") compacted layer thickness minimum. Place in maximum lifts of 150 mm (6") and compact to 100% SPMDD.

3.4 ASPHALT PAVEMENT

- .1 Provide prime coat as necessary for asphalt pavement.

- .2 Provide hot laid, plant mixed asphalt to design grades as noted on the drawing, by means of an approved asphalt finishing machine. Where hand raking is necessary, use a heated iron to obtain a uniform surface texture. Roll the asphalt pavement with a tandem steel wheel roller of at least eight (8) tonnes static weight, and continue rolling until 97% average compaction is achieved, with no test result less than 95%.
- .3 Asphalt pavement thicknesses:
 - .1 Light Traffic Areas (car parking): 76 mm (3") minimum, compacted in 2 lifts to 98% Marshal Density (as per Geotechnical Report).
 - .2 Heavy Traffic Areas (Approaches, driveways, fire lanes, and bus parking): 100mm (4") minimum, compacted in 2 lifts to 98% Marshal Density (as per Geotechnical Report).

3.5 DRAINAGE

- .1 All points in paving areas shall have a minimum slope of 2% for positive surface drainage, unless shown otherwise on the Drawings.

3.6 FIELD QUALITY CONTROL

- .1 Marshall analysis of three samples during construction to be undertaken by independent inspection service as per Cash Allowances.

END OF SECTION

1 General

1.1 REFERENCE

- .1 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specifications CW3310 - Portland Cement Concrete Pavement Works.
- .2 ASTM International
 - .1 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .2 ASTM C171-07, Standard Specification for Sheet Materials for Curing Concrete.
 - .3 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .4 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .5 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .6 ASTM C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
 - .7 ASTM Standard D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .8 ASTM D2628-91(2011), Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
 - .9 ASTM D6690 -12, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
 - .10 ASTM C295 / C295M – 12, Standard Guide for Petrographic Examination of Aggregates for Concrete
- .3 CSA Group
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA-A3000-13, Cementitious Materials Compendium.
 - .3 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.2 QUALITY ASSURANCE

- .1 Certifications:
 - .1 Submit to the Contract Administrator manufacturer's test data and certification that following material meets criteria and requirements of this section prior to starting concrete work:
 - .1 Portland Cement.
 - .2 Blended Hydraulic Cement.
 - .3 Supplementary Cementing Material.
 - .4 Admixtures.
 - .5 Joint Sealants.
 - .6 Curing Materials.
 - .7 Joint Filler.

- .2 Submit certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of CAN/CSA-A23.1.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry, indoor location and in accordance with manufacturer's recommendations in clean, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
 - .3 Cement shall be stored in weatherproof buildings to protect the cement from dampness, except that cement in sacks may be stored on a raised platform and protected with a weatherproof covering.
 - .4 Aggregates shall be stockpiled in accordance with requirements for Stockpiling Aggregates.
- .4 All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of CAN/CSA-A23.1.

2 Products

2.1 DESIGN REQUIREMENTS

- .1 Mix design requirements:
 - .1 Submit concrete mix design to the Contract Administrator for review two weeks prior to commencing work.

2.2 MATERIALS

- .1 Portland cement:
 - .1 All cement shall be Type GU General Use Hydraulic conforming to the requirements of CSA A3001, Portland Cement. Cement shall be kept in weather tight storage that will protect it from moisture and contamination, and in such a manner as to permit inspection, sampling and identification, where required, of each lot.
 - .2 Check tests of the cement may be undertaken by a Testing Laboratory designated by the Contract Administrator. Any cement which fails to comply with the requirements of CSA A3001 will be rejected, notwithstanding any certificate of acceptance that may have been previously given. Remove cement that has been rejected immediately.
- .2 Aggregates: to CSA A23.1, Section 5 and to following requirements:
 - .1 Provide in writing to the Contract Administrator, the location of the sources where aggregate will be obtained. Changes in the source of aggregate supply will not be permitted without approval of the Contract Administrator.
 - .2 Coarse aggregate:
 - .1 Petrographic examination – PN: to ASTM C295, maximum 125.
 - .2 LA abrasion loss to CSA A23.2-16A, maximum 35%
 - .3 Unconfined Freeze-Thaw to CSA A23.2-24A, maximum 6%
 - .4 Micro-Deval to CSA A23.2-29A, maximum 17%
 - .5 Clay Lumps to CSA A23.2-3A, maximum 0.25%
 - .6 Low Density Granular Material to CSA A23.2-4A, maximum 0.5%
 - .7 Alkali-Silica Reactivity to CSA A23.2-25A, maximum 0.15%
 - .3 Fine aggregate:
 - .1 Petrographic examination – PN: to ASTM C295. The petrographic report shall include a comment on the suitability of the material for use in the production of concrete paving mix.
 - .2 Micro-Deval to CSA A23.2-23A, maximum 20%
 - .3 Clay Lumps to CSA A23.2-3A, maximum 1%
 - .4 Low Density Granular Material to CSA A23.2-4A, maximum 0.5%
 - .5 Alkali-Silica Reactivity to CSA A23.2-25A, maximum 0.15%
 - .6 Organic Impurities to CSA A23.2-7A, free from injurious amounts
 - .4 For concrete mix designs that will utilize two coarse aggregates and both coarse aggregates are from the same source, only the larger nominal maximum size coarse aggregate shall be tested for the parameters shown in the table above. If the coarse aggregates are from different sources, both materials shall be tested for the parameters shown above.

- .5 The Coarseness Factor of the combined aggregate shall be between 45 and 65.
- .6 Quarried limestone and dolomite shall not be acceptable as aggregate materials.
- .7 Gradation

- .1 The combined grading for the concrete aggregates shall comply with the following requirements:

TABLE 1 Design Combined Aggregate Gradation Limits		
Sieve Size	Type 1 - All Portland Cement Concrete, except for Sidewalks	Type 2 - Portland Cement Concrete Sidewalks
28 000	100%	100%
20 000	90% - 100%	90% - 100%
14 000	75% - 95%	75% - 95%
10 000	60% - 75%	60% - 75%
5 000	25% - 50%	35% - 55%
2 500	27% - 35%	27% - 40%
1 250	20% - 30%	20% - 35%
630	10% - 20%	10% - 20%
315	5% - 10%	5% - 10%
160	1% - 4%	1% - 4%
80	0% - 2%	0% - 2%

- .2
- .3 Supplementary cementing materials:
 - .1 Fly ash for use in Portland Cement Concrete shall conform to the requirements of CSA A3001 for Class CI fly ash, except that the maximum allowable loss on ignition shall be three (3%) percent.
 - .2 Fly ash shall be sampled and tested with copies of test results submitted to the Contract Administrator.
 - .3 Fly ash shall be added to concrete mixtures as a separate constituent material. The use of blended hydraulic cement is not permitted
- .4 Water:
 - .1 Water used for concrete mixing water shall conform to ASTM C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
 - .2 Maintain documentation on the characteristics of the mixing water in compliance with the requirements of Tables 1 and 2 in ASTM C1602M.
 - .3 Testing to verify compliance with the requirements in Table 1 shall be conducted on the Type 1 hand placement paving mix with fly ash.
 - .4 The testing frequency for mixing water shall be in accordance with Appendix X1 of ASTM C1602M.
 - .5 Include information on the testing frequency of the concrete mixing water in the quality control program.
 - .6 The source(s) of concrete mixing water and test data indicating compliance with ASTM C1602M shall be provided with the Mix Design Statement submitted to the Contract Administrator.
- .5 Admixtures:

- .1 Air entraining admixtures shall conform to the requirements of ASTM C260.
- .2 Chemical admixtures shall conform to the requirements of ASTM C494. Chloride-based chemical admixtures will not be permitted under any circumstances.
- .6 Joint sealant, hot poured:
 - .1 Hot poured joint sealer shall be low modulus Type IV Material Conforming to the requirements of ASTM Standard D 6690-01, Specification for Joint and Crack Sealants, Hot-poured, for Concrete and Asphalt Pavements.
- .7 Preformed Neoprene Compression Joint Seals:
 - .1 Use of preformed neoprene joint seals are subject to the approval of the Contract Administrator. Preformed neoprene compression joint seals are to be used on transverse joints only and are to be installed according to the manufacturer's recommendations. Preformed neoprene compression joint seals must meet ASTM Standard D2628
- .8 Expansion / Isolation Joint Filler
 - .1 Fibre Joint Filler shall be rot-proof and of the preformed, non-extruding, resilient type made with a bituminous fibre and shall conform to the requirements of ASTM Standard D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .2 Plastic Expansion Joint Filler is to be the fluted polypropylene type and 6 mm in thickness.
- .9 Reinforcing Steel
 - .1 Reinforcing steel shall be deemed to include all reinforcing bars, tie bars, dowel bars and bar mat reinforcement, including all bar accessories.
 - .2 All reinforcing steel shall be supplied according to the type and dimensions as indicated.
 - .3 All reinforcing steel shall conform to the requirement of CSA Standard G30.12, Billet-Steel Bars for Concrete Reinforcement.
 - .4 If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete works exhibits flaws in manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.
 - .5 Bar Mat Reinforcement:
 - .1 Shall be Grade 300 bars with all bar intersections welded by an electric resistance spot welder, Welding shall be done in such a manner that the minimum requirements for tensile strength and yield point of the reinforcing steel shall be met when a specimen is tested across points of weld.
 - .2 Longitudinal bars shall be plain bars. Transverse bars may be plain bars or deformed bars.
 - .3 Bar mats with defective spot welds or with spot welds that have been broken while in transit, or during handling or placing operations, shall be replaced or repaired to the satisfaction of the Contract Administrator prior to installation.
 - .6 Deformed Reinforcing Bars and Tie Bars shall be Grade 300 deformed bars.
 - .7 Dowel Bars shall be Grade 300 plain bars.
 - .8 Bar Accessories shall be of a type approved by the Contract Administrator.

- .9 All reinforcing steel shall be straight and free from paint, oil, mill scale and injurious defects. Rust, surface seams, or surface irregularities will not be cause for rejection provided that the minimum dimensions, cross-sectional area and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard G30.12M.
- .10 Epoxy Coating
 - .1 Tie bars, dowels and stirrups (for separate curbs) shall be shop-coated with epoxy conforming to the requirements of ASTM Standard D3963. All bar ends shall be free of burs and distortions. All visible defects in the epoxy coating shall be field-coated with epoxy.
- .11 Liquid Membrane-Forming Curing Compound
 - .1 Curing compound shall be Type 2, white-pigmented, and water based liquid membrane-forming curing compound conforming to the requirements of ASTM Standard C309.
- .12 Polyethylene Film
 - .1 Polyethylene film shall be clear or white opaque and conform to the requirements of ASTM Standard C171.
- .13 Bonding Agent
 - .1 Epoxy resin shall be of a type listed in the approved products list conforming to the requirements of ASTM Standard C881. Type 1, Grade 3 epoxy shall be used for bonding tie bars and dowels into hardened concrete.
 - .2 Bonding agents for bonding tie bars and dowels into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within two days (48 hours) after installation. Alternative bonding agents are listed in the approved products list.
- .14 Form Coating
 - .1 Form coating shall be of a type approved by the Contract Administrator.
- .15 Evaporation Retardant
 - .1 Evaporation retardant shall be water based, the monomolecular type and shall be applied in accordance with the manufacturer's recommendations.
 - .2 If the evaporation retardant application film is broken by brooming, tinning or other finishing procedures, the application film shall be reapplied.
- .16 Backer Rod
 - .1 Backer rod shall be Type 1, heat-resistant, round foam rod sized to approximately 25% larger than joint width so as to employ wall tension to allow backer rod installation at required depth in accordance with ASTM D5249.
 - .2 Acceptable Products will be:
 - .1 HBR XL as manufactured by NOMACO Inc. supplied by Road Products Manitoba Inc;
 - .2 Hot Rod XL as manufactured by Industrial Thermo Polymers Limited supplied by Brock White Canada, Johnson Construction Materials and Wearing Williams Limited; or
 - .3 An approved equal.
- .17 Bonding Grout

- .1 Bonding agent shall be Acryl-stix or approved equal as accepted by the Contract Administrator. Polyvinyl acetate-based latexes will not be permitted.
- .2 The bonding grout shall be well mixed and will consist of the following constituents, by weight:
 - .1 1 part water
 - .2 1 part bonding agent
 - .3 2 parts Type 10 Normal Portland Cement
- .3 The consistency of the bonding grout shall be such that it can be applied in a thin, even coating on the slab so that it will not run or puddle in low spots.
- .18 Protective covers and insulation for cold weather concreting: to CSA A23.1/A23.2.

2.3 MIXES

- .1 Mix Design Statement
 - .1 Job mix formula to be approved by the Contract Administrator in accordance with CSA A23.1, Table 13 and as specified below.
 - .2 To obtain approval, submit the following information to the Contract Administrator:
 - .1 Names of suppliers and sources for aggregates, cement and fly ash
 - .2 Names of manufacturers and products for admixtures with letter certifying that the admixtures comply with the relevant ASTM standards
 - .3 Concrete mix designs with unique mix design codes signed and dated by person selecting the mix proportions
 - .4 Copy of SRMCA certificate for concrete batch plant
 - .5 Copies of most recent scale calibration reports for the concrete batch plant
 - .6 Test data for aggregates (in accordance with Clause 2.2.2)
 - .7 Test reports for the cement and fly ash that are representative of the materials to be used during concrete production.
 - .8 A minimum of five (5) sets of concrete compressive strength tests for the hand placement paving (Type 1) mix with and without fly ash and the sidewalk (Type 2) mix with and without fly ash to demonstrate the concrete mix will achieve the required strength level. The strength test data may be obtained from either Quality Control testing during production or trial batches.
 - .9 Air-void parameters for the Type 1 slipform paving mix. If fly ash is to be used in the concrete mix, air-void parameters shall be submitted for the Type 1 slipform paving mix with and without fly ash. The concrete will be considered to have a satisfactory air-void system if the spacing factor does not exceed 260 µm. In no case shall the tests be more than twelve (12) months old.
 - .10 Sieve analysis test reports for the individual aggregates and the combined aggregate gradations to be used in the Portland Cement Concrete. The sieve analysis test reports shall be representative of the material to be used during concrete production.
 - .11 Quality control program for all constituent materials and concrete mix.
 - .3 Once the design gradation has been approved, allowable deviations in gradation shall be as follows:

Allowable Deviation From The Job Mix Formula	
Sieve Size	Deviation in % By Mass Passing Sieve
20 000	+/- 3%
14 000	+/- 4%
10 000	+/- 5%
5 000	+/- 5%
2 500	+/- 4%
1 250	+/- 4%
630	+/- 3%
315	+/- 3%
160	+/- 2%
80	+/- 1%

- .4 Once approved, all concrete shall be supplied in accordance with this Mix Design Statement.
- .5 No changes in the concrete mix designs will be permitted without following the above procedure.
- .2 Concrete Strength and Workability
 - .1 Type 1 - Concrete for Pavements, Commercial Approaches, Curb and Gutter Sections, Curbs, Monolithic Curb and Sidewalks, Splash Strips and Bull-noses:
 - .1 Class of Exposure: C-2
 - .2 Minimum Specified Compressive Strength @ 28 days = 35 MPa
 - .3 Minimum Cementitious Content = 340 kg/m³
 - .4 Maximum Water/Cementitious Ratio = 0.45
 - .5 Slump
 - .1 50 ± 20 mm (for slip form paving),
 - .2 70 ± 20 mm (for hand placement)
 - .6 Aggregate Size = 20 mm Nominal
 - .7 Air Content = 5.0% to 8.0%
 - .2 Type 2 - Concrete for Sidewalks, Residential Approaches, Median Slabs and Other Related Concrete Works:
 - .1 Minimum Specified Compressive Strength @ 28 days = 32 MPa
 - .2 Minimum Cementitious Content = 300 kg/m³
 - .3 Maximum Water/Cement Ratio = 0.49
 - .4 Slump = 80 ± 20 mm
 - .5 Aggregate Size = 20 mm Nominal
 - .6 Air Content = 5.0% to 8.0%
- .3 Restrictions on the Use of Fly Ash in Concrete
 - .1 Class CI fly ash shall not replace Portland Cement by more than fifteen (15%) percent by mass of total cementitious content in the mix.
 - .2 The use of fly ash as a partial replacement for Portland cement shall not be permitted between October 1 and May 15, unless authorized in writing by the Contract Administrator.

- .4 Concrete for Early Opening of Pavements
 - .1 Modify the mix design, as required, in order to ensure that the minimum compressive strength of the concrete pavement is 20 MPa and is achieved within the following early opening requirements:
 - .1 24 hours early opening after placement
 - .2 72 hours early opening after placement
 - .2 Submit the Mix Design Statements for this concrete to the Contract Administrator for approval in accordance with Clause 2.3.1
 - .3 The requirements of Clause 2.3.2 shall also apply to concrete for early opening pavement.
- .5 Plant Quality Control
 - .1 Provide quality control at the plant to ensure all materials meet the approved mix designs. Submit the proposed quality control program with the Mix Design Statement for approval.

3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for concrete paving installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of the Contract Administrator.
 - .2 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 EQUIPMENT

- .1 Ready Mixed Concrete Production Facilities
 - .1 Commercial ready-mixed concrete plants and batch plants supplying Portland Cement Concrete under this Specification shall be certified in accordance with the Manitoba Ready Mix Concrete Association's "Production Facilities Certification Program".
 - .2 Submit proof of certification with the Mix Design Statement.
 - .3 Equip batch plants with batch weight recorders and provide results to the Contract Administrator upon request.
- .2 Paving Equipment
 - .1 For construction of pavements with widths between 5.0 m and 8.0 m:
 - .1 Use a self-propelled slip form paver with a minimum gross weight of 25,000 kg driven by an engine having a minimum 150 kW.
 - .2 For construction of pavements with widths less than 5.0 :
 - .1 Use a self-propelled slip form paver with a minimum gross weight of 15,000 kg and driven by an engine having a minimum 100 kW.
 - .3 Where slip form paving is used, equipment shall:
 - .1 Be self-propelled with crawler type tracks, designed to spread, consolidate, screed and float finish fresh concrete to required cross section, lines and grades

- .2 Include automatic controls capable of controlling both the elevation and direction of the machine within a tolerance of 5 mm from the specified grade and alignment.
- .3 Extend slip forms the full depth of the pavement with sufficient length that the concrete will not deform at the edges by the time the forms have passed.
- .4 Be approved by the Contract Administrator.
- .4 Where fixed form paving is used provide equipment with following features:
 - .1 Mechanical self-propelled spreader capable of moving concrete forward and laterally.
 - .2 Vibrator locations and spacings whether surface or internal to be installed as per manufacturer's specifications.
 - .3 Mechanical, self-propelled finisher with two independently operated transverse screeds.
 - .4 Float to be aluminum or magnesium, straight, smooth, sufficiently light to avoid sinking into concrete surface, operated mechanically or manually from edge to edge while advancing longitudinally.
- .5 The Contract Administrator shall reject any paving equipment should the paving equipment not field perform within the specified tolerances.
- .3 Paving Equipment Vibratory Devices
 - .1 Vibratory devices shall be checked in the presence of the Contract Administrator, by use of a vibrating reed tachometer prior to commencement and during the paving operations.
 - .2 Performance and checking of the vibrators shall conform to the paving equipment manufacturer's specifications.
- .4 Moveable Work Bridges
 - .1 Where more than one lane is being paved at a time, two moveable work bridges independent of the paving machine shall be required, one for finishing and one for curing operations.
- .5 Bull Floats
 - .1 Bull floats used for initial finishing of the in-place concrete pavement, shall be constructed of wood and approved by the Contract Administrator prior to construction. The use of magnesium floats is not permitted.
- .6 Use following equipment on approval of the Contract Administrator:
 - .1 Hand operated transverse screeds spanning side forms.
 - .2 Mechanically powered vibrating beam spanning side forms.
 - .3 Hand operated floats and fluting tools used by skilled workers.
- .7 Provide following miscellaneous equipment where required:
 - .1 Edging tool.
 - .2 Water truck equipped with pump, hose line and fine spray nozzle.
 - .3 Self-propelled concrete saws equipped with rubber-tired wheels, readily adjustable blade depth controls, and sawing line guide pointers both front and rear. Provide adequate number of units to complete sawing at rate required and have ample supply of suitable saw blades and at least one standby sawing unit available on job site before concrete placement is started.
 - .4 Heating kettle or tank for heating sealing compound:

- .1 Double boiler with space between inner and outer shells filled with oil, asphalt or other material for heat transfer.
- .2 Equip for positive temperature control of sealing compound.
- .3 Equip with readily calibrated device which accurately registers temperature of sealing compound.

3.3 FORMWORK

- .1 For fixed form paving:
 - .1 Provide steel or wood forms of sufficient strength to support and keep alignment under weight of spreading and finishing machines.
 - .2 Set forms true to line and grade, join neatly and tightly and stake securely to resist concrete pressure and impact from tampers without springing.
 - .3 All formwork in place shall be subject to inspection and correction of grade and alignment prior to, and at any time during concrete placement.
 - .4 Clean and treat wood formwork with form coating before concrete placement. Apply form coating by brush or spray so as to give the forms an even coating without excess or drip.
 - .5 The form coating shall not cause a softening or permanent staining of the concrete surface and, further, it shall not impede the proper functioning of the curing compound.
 - .6 Obtain the Contract Administrator's approval of forms before placing concrete.
 - .7 Do not remove forms for a period of at least twenty-four (24) hours after concrete placement. Remove forms in a manner in order to avoid damage to, or spalling of, the concrete.
- .2 For slip form paving:
 - .1 Provide sufficient length of slip form trailing behind paver to prevent slumping at slab edge. Ensure rigid lateral support.
 - .2 Set grade and line for control string or wire from bench marks.

3.4 BASE AND SUBBASE PREPARATION

- .1 Prepare Base in accordance with Section 32 11 23 – Aggregate Base Courses.
- .2 Prepare Subbase in accordance with Section 32 11 16.01 – Granular Sub-base.
- .3 Base and Subbase to consist of specified material and have a compacted thickness of not less than specified.
- .4 For slip-form paving, subbase travelled by tracks in paving machine shall be firm and have a smooth surface.
- .5 Base and Subbase shall be compacted to specified density.
- .6 Prepared Base and Subbase shall be checked for conformity with the cross-section and grad tolerances. Finished surface of subbase shall not deviate more than 5 mm above and 10 mm below specified grade and cross-section, and surface shall not deviate more than 10 mm at any place on a 3 mm template.
- .7 Repair damage to Base and Subbase resulting from hauling or equipment operations.
- .8 Prior to placing concrete, subbase shall be thoroughly wetted. Wetting shall be carried out, such that standing water is not present on grade.
- .9 Surface condition of Base and Subbase to be approved by the Contract Administrator before placing concrete.

3.5 REINFORCING STEEL AND DOWELS

- .1 Reinforced Concrete Pavement
 - .1 Place reinforcing steel by positive and satisfactory means so that the correct position of the reinforcing steel will be maintained after the concrete has been placed, vibrated and finished.
 - .2 If reinforcing steel is displaced during concrete placing operations, concrete placement shall cease and shall not resume until the displaced reinforcing steel has been reset to its true design position
 - .3 Securely wire or clip field lap joints. Splices are not permitted unless approved by the Contract Administrator.
 - .4 Align longitudinal steel bars parallel to the centerline when crossing transverse joints.
 - .5 Align longitudinal steel bars to the surface of the slab with a maximum tolerance of 6 mm from the transverse joint to the end of bar.
 - .6 Obtain the Contract Administrator's approval of reinforcing steel placement before placing concrete. If concrete is placed prior to receiving approval, the Contract Administrator reserves the right to have concrete removed and redone at no expense to the contract.
- .2 Plain-Dowelled Concrete Pavement
 - .1 Place dowels at all transverse contraction joints by means of dowel assembly positioned and approved by the Contract Administrator.
 - .2 Align dowels to the surface of the slab with a maximum tolerance of 6 mm from the transverse joint to the end of bar.
 - .3 Provide fabricated and rigid dowel assemblies that hold dowels within the specified tolerance both horizontally and vertically.
 - .4 For dowel assemblies with side members and ties, fasten the dowels at alternate ends to the side members to prevent any movement of the dowels.
 - .5 Coat all dowels full-length with a thin uniform coating of MC-250 cut-back asphalt or approved equal bond breaker. Ensure the bond breaker coating is smooth and free of voids
 - .6 Clearly mark the position of the dowel assembly on the forms or by stakes so that the location of the transverse joint can be accurately located for joint construction.
 - .7 Position tie-bars at mid-depth of the pavement and parallel to the pavement surface and transverse joints.
 - .8 Bent tie-bars are not permitted for placement.
 - .9 Obtain the Contract Administrator's approval of dowel and tie-bar placement prior to placing concrete. If concrete is placed prior to receiving approval, the Contract Administrator reserves the right to have concrete removed and redone at no expense to the contract.
 - .10 If dowels or tie bars are displaced during concrete placing operations, cease concrete placement. Resume placement only when the displaced dowels or tie bars are reset to the true design position.
- .3 Tying into Existing Pavement
 - .1 Drill holes and install tie-bars into existing slabs along longitudinal joints.
 - .2 Drill holes and install dowel into existing slabs along transverse joints.

3.6 PLANTS AND MIXING REQUIMENTS

- .1 If crusher screenings are approved as mixture component, proportion separately from sand.
- .2 If washing of aggregate required, allow aggregate to drain for 24 hours or longer as required to stabilize moisture content.
- .3 For truck mixers, mixing to be in accordance with CSA A23.1/A23.2.

3.7 TRANSPORT AND DELIVERY OF MIX

- .1 Time from initial mixing to final placing to be not more than 90 minutes if mix is transported by agitating equipment (e.g. truck mixer) in accordance with CSA A23.1/A23.2, clause 18.4.2 - Delivery with Agitating Equipment.

3.8 PLACING

- .1 No concrete shall be placed until the Contract Administrator has examined and approved the layout of the forms, reinforcing steel, dowels, tie bars and joints and the condition and grade of the compacted base course. Placement without the approval may result in full removal of the concrete at no cost to the contract.
- .2 Do not place concrete on a base course which is too wet or too dry, or which is frozen. Prepare grade as sufficiently moist to prevent absorption of water from the freshly placed concrete, but free from mire or water pondage. Place fresh concrete at a temperature not less than 10.0°C nor greater than 30.0°C, as measured at time of placing.
- .3 Deposit concrete as nearly as practicable to its final position in a rapid and continuous operation in such a manner as to require as little rehandling as possible and to avoid segregation and separation of the materials.
- .4 Arrange the sequence of placement so that no concrete, which has partially hardened, will be subjected to injurious vibration or shock
- .5 Place concrete while fresh and before it has taken its initial set. Do not retemper partially hardened concrete with additional water.

3.9 CONSOLIDATION

- .1 Spread concrete by means of a mechanical spreader or by an approved hand method. Strike off the surface of the concrete by mechanical means in a manner such that when the concrete is vibrated and screeded the finished concrete will conform to the cross-section and elevation indicated.
- .2 In areas inaccessible to mechanical equipment, after the concrete has been vibrated, strike off the surface of the concrete manually with appropriate tools and in an approved manner so that the concrete will conform to the cross-section and elevation indicated. DO not finish surfaces with neat cement or mortar.
- .3 Use mechanical vibrators only to consolidate concrete. Do not spade, hand-tamp, puddle-rod or use other similar methods to vibrate concrete.
- .4 Apply vibration at the point of deposit and in areas of freshly deposited concrete. Insert vibrators vertically into and withdrawn vertically out of the concrete slowly. Vibrate with sufficient duration to thoroughly consolidate the concrete but not so long as to cause segregation. Do not use vibrators for flowing the concrete or spreading it into place.
- .5 Work concrete thoroughly around any reinforcement, dowels, tie bars and around embedded fixtures and into the angles and corners of the forms. Eliminate entrapped air voids, and to ensure a homogeneous structure and adequate consolidation. Pay

particular care to placing and vibrating the concrete along the faces of the forms to ensure a dense, smooth surface devoid of imperfections.

- .6 Do not walk in the screeded concrete. Perform remedial work from the sides of the concrete pour or on work bridges.

3.10 FINISHING

- .1 Once the placing and vibrating of the concrete is complete, do not jar the forms or disturb the reinforcement for a period of at least twenty-four (24) hours. At the end of a slip form paving pour, saw-cut the end concrete full-depth and remove.
- .2 Apply bonding grout to the surface of the slab immediately prior to placement of plastic concrete for separate curb. Use compressed air that has an oil free air jet having sufficient volume and pressure to remove dust and loose particles immediately prior to applying bonding grout. Apply in a thin, even coating so that the bonding grout does not run or puddle.
- .3 Apply bonding grout where the concrete pavement will not be overlaid with asphalt.
- .4 Regulate finishing so that quality of the surface is not impaired by overworking or by bringing excessive fines and water to the surface. The use of steel trowels is not permitted.
- .5 Prior to final finishing, check the surface grade of concrete slabs to an accuracy of +/- 5 mm, with a rounded shape 3.0 metre long metal straight edge. Draw the straight edge across the pavement in a scraping motion to identify deviations for immediate correction. Advance the straight edge one-half of its length for successive checks.
- .6 Where placement of the concrete pavement is facilitated by use of a slip form paving machine, additional floating of the surface by hand methods shall only be done if required to correct surface imperfections identified by checking with the 3.0 metre long metal straight edge.
- .7 When drying conditions are greater than or equal to 0.75 kg/m²/hr as estimated by use of Figure D1, Appendix D, Guidelines for Curing and Protection, of CSA A23.1, protect the plastic concrete surface from drying by application of an evaporation retardant. Apply the evaporation retardant immediately after checking the surface with a 3.0 m long metal straight edge and reapply between finishing operations.
- .8 Following completion of floating operations, but prior to initial set of the concrete, carefully finish the edges of all formed concrete slabs with an appropriate edging tool.

3.11 SURFACE TEXTURING

- .1 Commence texturing immediately after float finishing.
- .2 Use stiff bristled broom to produce nonslip concrete surface finish to the approval of the Contract Administrator, with fine granular texture free from disfigurements.
- .3 Provide grooves at right angles to the direction of traffic.
- .4 Provide surface texture by transverse wire comb leaving grooves in surface of plastic concrete not more than 3 mm deep.
- .5 Texturing to be straight, precise and not damaging to pavement edges.
- .6 Provide broom finishing for surfaces of private approaches, gutters, bull-nose slabs, boulevard and median slabs, and other related slabs.
- .7 Broom finishing is not required when the concrete does not form the finished surface.

3.12 CURING

- .1 Cure for minimum 7 days by following method:
 - .1 Curing compound:
 - .1 Apply in two coats with approved spray equipment to form complete and unbroken film on surface of concrete. Mechanically agitate compound before and during use.
 - .2 For hand application apply first coat immediately after texturing operations, second coat to be applied immediately after first coat in a perpendicular direction.
 - .3 For machine application curing compound to be applied in accordance with manufacturers' specifications.
 - .4 Apply each spray at application rate recommended by manufacturer.
 - .5 Spray slab edges immediately after removal of forms.
 - .6 Protect formed or sawed joints from evaporation during curing period.
 - .7 Respray areas where membrane is damaged during curing period.

3.13 PROTECTION

- .1 Do not open concrete pavement to traffic or construction equipment until joints have been sealed and concrete reaches a minimum compressive strength of 20 MPa.
- .2 When placing concrete in lanes adjacent to existing concrete, operate placing equipment on rubber wheels or pads to prevent damage to existing surface.

3.14 TOLERANCES

- .1 Finished concrete surface to be within 5 mm of design grade but not uniformly high or low.
- .2 Finished concrete surface not to have irregularities exceeding 5 mm when checked with 3.0 m straight edge placed in any direction.
- .3 Horizontal deviations of slab edge from alignment of pavement not to exceed 10 mm.
- .4 Remove and replace concrete not meeting the requirements specified to the nearest joint.

3.15 JOINTS

- .1 General:
 - .1 Construct joints plumb, straight and square to details indicated.
 - .2 Transverse joints to coincide with those in adjacent pavement unless indicated otherwise.
 - .3 Install preformed joint filler at locations and to details indicated.
 - .4 Install isolation joints around structures and features that project through, into or against pavement.
- .2 For sawn joints.
 - .1 Ensure joints are sawn straight. Install end stakes to ensure straight joint alignment across paved area. Mark joint alignment with chalk line or other suitable guide to approval of the Contract Administrator.
 - .2 Saw joints using approved equipment and methods to produce joint dimensions indicated.

- .3 Restrict speed of saw cutting to ensure proper joint alignment and to avoid damage to concrete.
 - .4 Supply sufficient workers and equipment including standby equipment, to maintain satisfactory sawing schedule.
 - .5 Schedule sawing operations on 24 hours basis and consistent with concrete placing.
 - .6 Make initial saw cuts in progressive manner and as soon as concrete surface has hardened sufficiently to resist ravelling as cut is made and before shrinkage cracks occurs.
 - .7 If cracking occurs ahead of saw cut, stop sawing immediately. Move ahead several joints and cut one or more joints before returning to saw intermediate joints. Where cracking persists, make 1.0 m saw cut from one edge and complete sawing from opposite edge. Adjust sawing schedule accordingly.
 - .8 If uncontrolled cracking or other surface damage results from inadequate or improper sawing techniques suspend further concrete operations until situation is corrected and immediately remove and replace damaged slabs.
 - .9 Immediately on completion of sawing, flush joints with water to remove laitance.
- .3 Sealing:
- .1 Provide second cut prior to sealing.
 - .2 If ambient temperature is below -4°C , defer second cuts to the following season when temperature requirements can be met.
 - .3 Thoroughly clean the joints of all dirt, loose mortar particles and other foreign material.
 - .4 Clean joints and the pavement surface of all residue left by the sawing operation. Initially use water jet having sufficient volume and pressure to remove the residue. Blow out the joint with an air jet having sufficient volume and pressure to remove remaining residue. Allow joints sufficient time to thoroughly dry before applying the joint sealer.
 - .5 Install backer rods immediately after cleaning and before sealant installation. Insert backer rods uniformly to the required depth to achieve the required shape factor. Insert backer rods using a double wheel steel roller and do not puncture or stretch during the installation process.
 - .6 Ensure the joint is surface dry at the time of filling, with an ambient temperature of at least 4°C and rising.
 - .7 Fill the joint with low modulus joint sealer to the depth indicated using an approved mechanical pressure joint filling system. Overfilling of joints shall not be permitted. Remove overfilled joints of excess material.
 - .8 Seal joints before allowing vehicular traffic on new pavement.

3.16 WEATHER CONDITIONS

- .1 Protect freshly laid concrete from adverse weather conditions including heat, wind, rain, sleet, snow and cold.
- .2 Protect concrete from freezing for a minimum of 5 days after placement and until a minimum compressive strength of 20 MPa is met. Minimum requirements for protection include:
 - .1 0°C to -3°C : Cover concrete with polyethylene film
 - .2 -3°C to -5°C : Cover concrete with insulated tarps or two sheets of polyethylene film separated by 300mm of dry straw

- .3 Remove and replace at own cost all concrete damaged as a result of inadequate protection against weather conditions.
- .4 When air temperature is at or exceeds 27 degrees C during the basic curing period, follow the requirements of CSA A23.1.

3.17 REPAIR/RESTORATION

- .1 Where defective concrete is identified by the Contract Administrator, the Contract Administrator will determine the remediation, whether repair or removal & replacement.
- .2 For repairs:
 - .1 During plastic condition, repair using methods approved by the Contract Administrator.
 - .2 Grind off high surface variations to the satisfaction of the Contract Administrator.
- .3 For removal and replacements:
 - .1 Remove minimum 3.0 meters of pavement by sawing through concrete across full lane width.
 - .2 Replace with new concrete to this specification.
 - .3 Construct contraction joint at boundary between sawn face of existing concrete and new concrete.
 - .4 Install dowel bars, tie bars and/or new reinforcement between old and new concrete as indicated.
- .4 Pay adjustments are not considered in this specification.

3.18 SAMPING AND TESTING

- .1 Unless otherwise specified, test procedures shall be in accordance with City of Winnipeg's Standard Construction Specifications.
- .2 All costs related to the sampling and testing of materials and Works shall be borne solely by the Contractor.
 - .1 The Owner may hire an independent inspection agency at random to conduct quality assurance tests.
 - .2 Notify the Contract Administrator of any testing onsite 24 hours in advance of performing the tests.
- .3 All testing to be performed by an agency certified by the City of Winnipeg.
- .4 Minimum frequency of concrete tests for slip-form or hand-pour scenarios:
 - .1 Provide one concrete test on the first truck and then additional concrete tests for every 30 cubic meters or part thereof.
 - .2 If any air or slump test fails for any concrete load in the day's pour, continue to test slump and air on succeeding trucks until consistency is established.
- .5 Each concrete test shall consist of a slump test, air test, 7-day compressive strength break test for single lab-cured cylinder and 28-day compressive strength break test for two lab cured cylinders. For early-open concretes, provide additional cylinders with concrete break times matching the concrete mix.
- .6 Provide copies of all test results to the Contract Administrator.
- .7 Provide copies of all Plant Batch tickets to the Contract Administrator if requested.
- .8 Slump Tests

- .1 Follow CSA A23.2-5C, Slump of Concrete
- .2 If the measured slump falls outside the specified limits, complete a second test.
- .3 In the event of a repeated failure, the Contract Administrator may refuse the use of the batch of concrete represented.

- .9 Air Content Tests
 - .1 Follow CSA A23.2-4c, Air Content of Plastic Concrete by the Pressure Method.
 - .2 If the measured air content falls outside the specified limits complete a second test within the allowed discharge time for the mix.
 - .3 In the event of a repeated failure, the Contract Administrator may refuse the use of the batch of concrete represented.

- .10 Compressive Strength Test
 - .1 Prepare and cure specimens in accordance with CSA A23.2-3C, Making and Curing Concrete Compression and Flexure Test Specimens
 - .2 Follow CSA A23.2-9C, Compressive Strength of Cylindrical Concrete Specimens.
 - .3 Provide compressive strength tests on specimens cured under the same site conditions to determine if the pavement may be opened to traffic and also check the adequacy of curing and/or cold weather protection.
 - .4 If the compressive strength falls outside the specified limits, follow actions in accordance with CSA A23.1. Cover costs of additional testing including core removal, core testing and repair of core holes.
 - .5 Where scaling of the surface occurs during the warranty period, retexture the scaled areas by mechanical means approved by the Contract Administrator.

- .11 Concrete Roughness
 - .1 Prepare surface shall meet +/- 5mm tolerance checked with a 3 metre long metal straight edge.

- .12 Concrete Thickness
 - .1 Pavement thickness shall within 5 mm of the thickness indicated on the Drawings.

- .13 Addition of Water and/or Air Entraining Admixture
 - .1 No water and/or air entraining admixture may be added except if:
 - .1 at the start of discharge the measured slump or air content is less than specified; and
 - .2 no more than 60 minutes have elapsed from the time of batching to the start of discharge.
 - .2 Do not exceed 12 litres of water per cubic meter.
 - .3 When addition of air entraining admixture is permitted:
 - .1 Provide proper amount to meet specified air content ranges;
 - .2 Turn mixer drum a minimum of 30 revolutions at mixing speed; and
 - .3 Retest slump and air content.

3.19 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Provide all labour, materials, methods, equipment and accessories for the supply and installation of unit pavers and salvaged granite pavers as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 N/A

1.3 REFERENCES

- .1 City of Winnipeg Standard Construction Specifications:
 - .1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction
 - .2 CW 3330 – Installation of Interlocking Paving Stones
- .2 City of Winnipeg Standard Construction Details:
 - .1 SD-240A – Interlocking Paving Stone Detail for Medians and Private Approaches.

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Submit full sized sample of unit paver.

1.5 QUALITY CONTROL

- .1 All workmanship and all materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations, from the selection and production of materials, through to final acceptance of the Work.
- .2 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection of approval that may have been previously given.
- .3 The Contract Administrator reserves the right to reject any materials or Works that are not in accordance with the requirements of this specification.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 Materials

- .1 Pavers:
 - .1 210 x 105 x 80mm 8CM holand paver, colour: charcoal, running bond pattern, or approved equal.

- .2 Separate Price: 600 x 150 x 100mm Broadway plank 100 paver, colour charcoal, running bond pattern, or approved equal.
- .3 Available from Barkman Concrete, ph. 1-800-461-2278.
- .2 Salvaged Granite Pavers – Base Bid: +/- 75mm thick multi-shape, multi-colour granite from stockpile.
- .3 Granular base: crushed limestone to specification CW 3110.
- .4 Joint Sand: to the requirements of specification CW 3330.

Part 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION OF PAVERS

- .1 Preparation of Sand Base: install bedding sand to a minimum of 13mm as specified on the Drawings and to CW 3110. Do not compact sand base prior to installing pavers.
- .2 Install pavers in accordance with specification CW 3330. Install separate price unit pavers to City of Winnipeg SD-240A. Set pavers in locations and patterns as shown on the Drawings.
- .3 Commence installation of pavers against edge to obtain straightest possible course of installation.
- .4 Pavers shall be cut with saw only to obtain true even undamaged edges. Chipped pavers are unacceptable.
- .5 Crews shall work on installed pavers and not on sand layer.
- .6 Compact pavers into the bedding sand layer using approved vibratory compactors until they are at the proper grade, uniformly level and free of any movement.
- .7 Spread and fine grade joint sand over pavers and sweep into joints.
- .8 Sweep remaining sand over all pavers and remove excess from site.
- .9 Remove cracked, chipped, broken or otherwise damaged paving materials from Site immediately.
- .10 Ensure a perfect / flush match between pavers and the edge of the block outs on all edges.

3.3 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 17 – Aggregates: General
- .2 Section 32 11 16.01 – Granular Sub-Base
- .3 Section 32 11 23 – Aggregates Base Courses
- .4 Section 31 32 21 – Geotextiles

1.2 REFERENCES

- .1 City of Winnipeg
 - .1 The latest revisions of the City of Winnipeg Standard Construction Specifications shall apply to the work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.
 - .5 City of Winnipeg Standard Construction Specification CW3110-Sub-Grade, Sub-Base and Base Course Construction, CW 3326- Detectable Warning Surface Tiles, CW 3325 Portland Cement Sidewalk and CW3310 Portland Cement Concrete Pavement Works
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D260-86 (2001), Standard Specification for Boiled Linseed Oil.
 - .4 ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-3.3-99 (March 2004), Kerosene, Amend. No. 1, National Standard of Canada.
 - .2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

- .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 Products

2.1 MATERIALS

- .1 Portland Cement Concrete Materials as per clause 5.3 and 5.4 CW3310 “Portland Cement Concrete Pavement Works”
- .2 Granular base: material to Section 31 05 17 – Aggregate: General and Section 32 11 23 Aggregate Base Courses requirements.
- .3 Geotextile: install non-woven separation geotextile under sidewalks base as per Section 31 32 21 – Geotextiles.
- .4 Detectable Warning Surface Tiles: Product list and installation requirements to follow the City of Winnipeg Specification CW 3326 – Detectable Warning Surface Tiles
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .6 Fill material: refer to Section 31 05 17 – Aggregate: General and Section 32 11 23 Aggregate Base Courses.

2.2 MIX DESIGN STATEMENT

- .1 To obtain approval, concrete suppliers must submit the following information to the Contract Administrator:
 - .1 Names of suppliers and sources for aggregates, cement and fly ash;
 - .2 Names of manufacturers and products for admixtures with letter certifying that the admixtures comply with the relevant ASTM standards;
 - .3 Concrete mix designs with unique mix design codes signed and dated by person selecting the mix proportions;
 - .4 Copy of MRMCA certificate for concrete batch plant;
 - .5 Copies of most recent scale calibration reports for the concrete batch plant;
 - .6 Test data for aggregates (in accordance with clause 5.3.1 CW3310 “Portland Cement Concrete Pavement Works”);
 - .7 Test reports for the cement and fly ash that are representative of the materials to be used during concrete production;
 - .8 A minimum of five (5) sets of concrete compressive strength tests for the hand placement paving (Type 1) mix with and without fly ash and the sidewalk (Type 2) mix with and without fly ash to demonstrate the concrete mix will achieve the required strength level. The strength test data may be obtained from either Quality Control testing during production or trial batches;
 - .9 Air-void parameters for the Type 1 slipform paving mix. If fly ash is to be used in the concrete mix, air-void parameters shall be submitted for the Type 1 slipform paving mix with and without fly ash. The concrete will be considered to have a satisfactory air-void system if the spacing factor

does not exceed 260 µm. In no case shall the tests be more than twelve (12) months old.

- .10 Sieve analysis test reports for the individual aggregates and the combined aggregate gradations to be used in the Portland Cement Concrete. The sieve analysis test reports shall be representative of the material to be used during concrete production.
- .11 Quality control program for all constituent materials and concrete mix.
- .12 Once the design gradation has been approved, allowable deviations in gradation shall be as follows:

Allowable Deviation From The Job Mix Formula	
Sieve Size	Deviation in % By Mass Passing Sieve
20 000	± 3%
14 000	± 4%
10 000	± 5%
5 000	± 5%
2 500	± 4%
1 250	± 4%
630	± 3%
315	± 3%
160	± 2%
80	± 1%

- .2 Once approved, all concrete shall be supplied in accordance with this Mix Design Statement. No changes in the concrete mix designs will be permitted without following the above procedure.

2.3 CONCRETE STRENGTH AND WORKABILITY

- .1 In accordance with CSA A23.1, Alternative (1) for specifying concrete, the concrete mix shall be proportioned such as to yield concrete having the required strength and workability, as follows:
 - .1 Type 1 - Concrete for Pavements, Commercial Approaches, Curb and Gutter Sections, Curbs, Monolithic Curb and Sidewalks, Splash Strips and Bull-noses:
 - .1 Class of Exposure: C-2
 - .2 Minimum Specified Compressive Strength @ 28 days = 32 MPa
 - .3 Minimum Cementitious Content = 340 kg/m³

- .4 Maximum Water/Cementitious Ratio = 0.45
- .5 Slump = 50 ± 20 mm (for slip form paving) = 70 ± 20 mm (for hand placement)
- .6 Aggregate Size = 20 mm Nominal
- .7 Air Content = 5.0% to 8.0%
- .2 Type 2 - Concrete for Sidewalks, Residential Approaches, Median Slabs and Other Related Concrete Works:
 - .1 Minimum Specified Compressive Strength @ 28 days = 30 MPa
 - .2 Minimum Cementitious Content = 300 kg/m³
 - .3 Maximum Water/Cement Ratio = 0.49
 - .4 Slump = 80 ± 20 mm
 - .5 Aggregate Size = 20 mm Nominal
 - .6 Air Content = 5% to 8%

2.4 RESTRICTIONS ON THE USE OF FLY ASH IN CONCRETE

Class CI fly ash shall not replace Portland Cement by more than fifteen (15%) percent by mass of total cementitious content in the mix. The use of fly ash as a partial replacement for Portland cement shall not be permitted between October 1 and May 15.

3 Execution

3.1 GRADE PREPARATION

- .1 Construct embankments using excavated material free from organic matter or other objectionable materials.
 - .1 Dispose of surplus and unsuitable excavated material in approved location on site off site.
- .2 Place fill in maximum 150 mm layers and compact to at least 95% of maximum dry density to ASTM D698.

3.2 GRANULAR BASE

- .1 Obtain the Contract Administrator's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 95% of maximum density to ASTM D698.

3.3 CONCRETE

- .1 Obtain the Contract Administrator's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with CSA-A23.1/A23.2.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2mm deep, by drawing broom in direction normal to centre line.
- .4 Provide edging as indicated with 10mm radius edging tool.

- .5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable by the Contract Administrator can be demonstrated. Hand finish surfaces when directed by Contract Administrator.
- .6 For details of Concrete Sidewalk, Curb and Gutter, Mountable Curb and Curb Ramp see Drawing C04.

3.4 TOLERANCES

- .1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5m.
- .2 Install expansion joints at intervals of 6m.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.6 ISOLATION JOINTS

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Seal isolation joints with sealant approved by the Contract Administrator.

3.7 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by the Contract Administrator.
- .2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.8 QUALITY ASSURANCE

- .1 Testing Frequency
 - .1 The Contract Administrator shall ensure the number and frequency of quality assurance tests as follows:
 - .1 One concrete test shall consist of:
 - .2 Slump test
 - .3 Air test
 - .4 One lab cure cylinder – 7 day break
 - .5 Two lab cure cylinders – 28 day break
 - .2 Slip Form or Hand Pour:
 - .1 <100 cu.m. per day – The minimum testing frequency per day for each mix design shall be one test on the first truck, then one test every 30 cu.m. or part thereof.

- .2 > 100 cu.m. per day - The minimum testing frequency per day for each mix design, shall be one test on the first truck, then one test every 100 cu.m. or part thereof.
 - .3 If any air or slump test fails for any concrete load in the day's pour, continue to test slump and air on succeeding trucks until consistency is established.
 - .4 Additional testing shall be as directed by the Contract Administrator. To establish the field strength for early opening of pavement, take additional field cure cylinders with a break time to match the concrete mix.
 - .5 Copies of all test results shall be sent to the Contract Administrator.
- .2 Concrete Quality
- .1 Slump tests shall be made in accordance with CSA A23.2-5C, Slump of Concrete. If the measured slump falls outside the limits specified in Clause 6 of CW3310 Portland Cement Concrete Pavement Works, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
 - .2 Air content determinations shall be made in accordance with CSA A23.2-4C, Air Content of Plastic Concrete by the Pressure Method. If the measured air content falls outside the specified limits, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.
 - .3 Samples of concrete for all slump, air, and strength tests shall be taken in accordance with CSA A23.2-1C, Sampling Plastic Concrete.
 - .4 Test specimens shall be made and cured in accordance with CSA A23.2-3C, Making and Curing Concrete Compression and Flexure Test Specimens.
 - .5 Compressive strength tests of concrete cylinders shall be conducted in accordance with CSA A23.2-9C. Compressive Strength of Cylindrical Concrete Specimens.
 - .6 Where compressive strengths do not meet the specifications, the Contract Administrator shall require actions be taken in accordance with CSA A23.1. Cost of additional testing including core removal, core testing and repair of core holes shall be paid for by the contractor.
 - .7 Where scaling of the concrete surface occurs during the Warranty Period, as determined by the Contract Administrator, the Contractor shall solely, at his expense, retexture the scaled areas by mechanical means acceptable to the Contract Administrator or replace the full thickness of pavement for those areas.
- .3 Concrete Pavement Roughness
- .1 As a basis for acceptance, the surface of the finished concrete pavement shall be checked with a 3 metre long metal straight edge and be within plus or minus 5

mm. Areas of pavement that do not meet these tolerances shall be corrected to the satisfaction of the Contract Administrator.

- .4 Addition of Water and/or Air Entraining Admixture
 - .1 After initial mixing no water and/or air entraining admixture may be added except if, at the start of discharge the measured slump of the concrete or the measured air content of the concrete is less than that specified and no more than 60 minutes have elapsed from the time of batching to the start of discharge. Water added shall not exceed 12 litres per cubic metre as measured by an approved measuring device.
 - .2 Air entraining admixture shall be added as required to meet specified allowable air content ranges. The mixer drum shall be turned a minimum of 30 revolutions at mixing speed and the slump and air content shall be retested
- .5 Acceptance Criteria
 - .1 Acceptance criteria for compressive strengths of laboratory cured cylinders shall conform to CSA A23.1.

3.9 BACKFILL

- .1 Allow concrete to cure for 7 (seven) days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by the Contract Administrator.
 - .1 Compact and shape to required contours as indicated.

3.10 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of all sidewalk paving, thickened edge concrete pad, thickened edge sidewalk, curb, concrete header, flagpole pile, concrete and timber bench and miscellaneous accessories as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 32 31 12 - Exterior Metal Fabrication
- .2 32 32 14 – Exterior Site Carpentry
- .3 10 75 00 - Flagpoles

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D698-(1998), Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.2-98, Boiled Linseed Oil.
 - .2 CAN/CGSB-3.3-99, Kerosene.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1/A23.2-94, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .4 City of Winnipeg Standard Construction Specifications, current edition.
 - .1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.
 - .2 CW 3310 – Portland Cement Concrete Pavement Works.
 - .3 CW 3325 – Portland Cement Concrete Sidewalk.

1.4 SAFETY PRECAUTIONS

- .1 The Contractor shall provide guards, barricades, dust screens, and/or other construction necessary to secure the safety of workers, the public, and personnel alike and shall comply with all Provincial statues applicable to the Work of their nature. Protective clothing and equipment shall be worn at all times during sandblasting operations. The Contractor shall provide all other protective measures as may be required by any law in force in Manitoba.

1.5 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an Engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.6 QUALITY ASSURANCE

- .1 Minimum two (2) weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on the following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.

1.7 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 The Contractor shall furnish a 1m x 1m concrete sample – 1/2 broom finish and 1/2 troweled finish for approval by the Contract Administrator prior to construction. If the sample is rejected, additional sample panels shall be made until approval is obtained. The approved sample panel will be kept at the jobsite and will become the quality standard for site concrete finishes.
- .3 Submit concrete test results indicating compliance with the specifications.
- .4 Submit product data sheets for concrete accessories.

1.8 QUALITY CONTROL

- .1 Only qualified concrete installers with more than 10 years of experience installing site concrete works will be accepted.
- .2 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials, through to final acceptance of the Work.
- .3 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.
- .4 The Contract Administrator reserves the right to reject any materials or Works that are not in accordance with the requirements of this Specification.

1.9 SITE CONDITIONS

- .1 Concrete installation to be completed under ideal conditions when temperatures will not be falling below 5°C overnight and only once all other preparatory work including base preparation, layout, forming and reinforcing has been inspected and approved.

1.10 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 120 minutes after batching.
- .2 Modifications to maximum time limit must be agreed to by Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
- .3 Deviations to be submitted for review by Contract Administrator.

- .4 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.11 TESTING

- .1 The inspection and testing of site concrete will be carried out by a testing laboratory appointed by the Contractor and approved by the Contract Administrator. Testing laboratory to be certified in accordance with CSA A283. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 Test concrete for every batch delivered to site. Field annotate with sequential pour numbers the areas covered by each batch of concrete delivered to the site should a batch be deemed unacceptable after twenty-eight (28) days.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Sub-grade, sub-base and granular base construction to CW 3110.
- .2 Portland cement concrete constituent materials, reinforcing, expansion / isolation joint filler, and forms to CW 3310.

Part 3 Execution

3.1 RELATED WORK

- .1 Ensure all mechanical and electrical rough-ins are fully coordinated and in place. Coordinate with mechanical and electrical Contractors prior to concrete installation.
- .2 Prior to concrete installation, ensure rough grading is complete and sub-grade / sub-base fill is compacted and approved by the Contract Administrator prior to installing base course material.
- .3 Do not complete any soft landscape finishes prior to completing site concrete works and all other hard landscape elements.

3.2 LAYOUT

- .1 Accurately lay out paving work to patterns and conditions shown on the Drawings and verify with Contract Administrator prior to construction.
- .2 Provide additional control points and stakeouts as required to effect correct alignments and grade elevations.
- .3 Adjust stakes as necessary to allow for installation of concrete.
- .4 Advise Contract Administrator of discrepancies and on-site conditions detrimental to critical layouts and obtain approved corrections.

3.3 GRANULAR BASE

- .1 Place granular base course base material to lines, widths, and depths as indicated on the Drawings and to CW 3310.
- .2 Obtain Contract Administrators approval of base course and compaction tests before forming and pouring concrete.

3.4 FORMING

- .1 Obtain approval of layout and compaction testing from Contract Administrator prior to forming.
- .2 Form concrete and place reinforcement to CW 3310.

3.5 CONCRETE INSTALLATION

- .1 Obtain approval from Contract Administrator of all forming and reinforcing steel prior to placing concrete.
- .2 Install concrete to CW 3310 & CW 3325.

3.6 CONCRETE FINISHING AT TIME OF POURING

- .1 Immediately after floating, give concrete surfaces a uniform broom finish producing regular corrugations not exceeding 2mm deep, by drawing broom in one direction perpendicular to a centre line established with the Contract Administrator. Run all broom finishes at the same angle.

3.7 TOLERANCES

- .1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.8 SAW CUT CONTROL JOINTS

- .1 Install saw cut transverse joint at 1500mm on centre and to the depths indicated on the Drawings.

3.9 ISOLATION JOINTS

- .1 Install isolation joints along lengths adjacent to buildings and permanent structures.
- .2 Install joint filler in isolation joints to CW 3310.

3.10 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least one (1) day after placing or sealing moisture in by curing compound as approved by Contract Administrator.
- .2 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements. Cover newly poured concrete during curing period if inclement weather or cold weather conditions are imminent.

3.11 BACKFILL

- .1 Allow concrete to cure for seven (7) days prior to backfilling.

- .2 Backfill to designated elevations with material as indicated on the Drawings. Compact and shape to required contours as indicated.

3.12 DEFECTIVE CONCRETE WORK

- .1 Remove and re-pour areas showing checking, slumping, cracking, spalling or honeycombing.

3.13 ACCEPTANCE

- .1 Obtain final approval of concrete installation via a site inspection with the Contract Administrator.

3.14 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of painted parking stall lines, guide lines, universal access symbol, and pedestrian crossings.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thin.
 - .2 CGSB1-GP-12c-68, Standard Paint Colours.
 - .3 CGSB1-GP-71-83, Method, of Testing Paints and Pigments.
 - .4 CGSB1-GP-74M-79, Paint, Traffic, Alkyd.

1.3 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Product data confirming chemical composition for traffic paint conforms to the latest health and environmental standards.

1.4 SAMPLES

- .1 Submit to Contract Administrator the following material sample quantities at least two (2) weeks prior to commencing the Work:
 - .1 Painted sample of each type of paint.
 - .2 Sampling to CGSB1-GP-71.
- .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.
- .3 Submit shop drawing for universal access parking symbol.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Paint: to CGSBI-GP-74M-79.
- .2 Colour: White CGSBI-GP-12C-68.
- .3 Thinner: to CAN/CGSB-1.5-M19.

Part 3 Execution

3.1 EQUIPMENT REQUIREMENTS

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONDITIONS OF SURFACES

- .1 Pavement surface to be dry, free from ponding water, frost, ice, dust, oil, grease and other foreign materials. Clean paved areas as necessary to achieve acceptable surface preparation.

3.3 TRAFFIC CONTROL

- .1 Barricade areas to be painted to all vehicular traffic during installation and for a minimum of 4 hours after installation.

3.4 APPLICATION

- .1 Lay out parking stall lines, universal access parking symbols and pedestrian crossings as indicated on the Drawings. Obtain Contract Administrator's approval prior to painting.
- .2 Unless otherwise approved by Contract Administrator, apply paint only when air temperature is above 10°C, wind speed is less than 60km/h and no rain is forecast within the next eight (8) hours.
- .3 Apply traffic paint evenly at rate of 3m² per litre. Do not thin paint unless approved by Contract Administrator.
- .4 Paint lines to be 100mm wide, of uniform colour and density with sharply defined edges.
- .5 Paint parking stall lines yellow.
- .6 Paint universal access parking symbols and pedestrian crossing lines white.
- .7 Thoroughly clean distributor tank before refilling with paint of a different colour.

3.5 TOLERANCE

- .1 Paint markings to be within plus or minus 6mm of dimensions indicated, straight and true and aligned with fixed features such as curbs, sidewalks and walls.
- .2 Remove incorrect markings and re-apply at no extra cost to the City.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.

3.7 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 The fabrication and installation of the garbage bin enclosure and concrete and timber bench.

1.2 RELATED SECTIONS

- .1 32 16 15 – Site Concrete
- .2 32 32 14 – Exterior Site Carpentry

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA -G164-M93(R1998), Hot Dip Galvanized or Irregularly Shaped Articles, or latest.
 - .2 CAN/CSA -S16.1-01, Limit States Design of Steel Structures.
 - .3 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .4 CSA W59-1989, R2001, Welded Steel Construction, Metal Arc Welding, Imperial Version.

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Submit samples for:
 - .1 Steel bar
 - .2 Steel round tubing
 - .3 Steel L-Angles
 - .4 Steel rectangular tubing
- .3 Submit shop drawings for:
 - .1 Garbage bin enclosure
 - .2 Concrete and timber bench
- .4 Use construction drawings as reference only. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from the Drawings.
- .5 Drawings to clearly indicate size, assembly, welds, hardware, materials, core thicknesses, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, installation details and accessories for all aspects of Work.

1.5 QUALITY ASSURANCE

- .1 All workmanship and all materials furnished and supplied under this specification shall be of the highest standards and are subject to close and systematic inspection and testing by the Contract Administrator including all operations, from the selection of materials, through to final acceptance of the Work.
- .2 Strict conformance to this specification will be enforced. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works that are not in accordance the requirements of this specification.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Steel Flat Bar, Round Tubing, L-Angles and Rectangular Tubing: to CAN/CSA G40.20/G40.21, Grade 300W.
- .2 Welding Materials: to CSA W59.
- .3 Welding Electrodes: to CSA W48 Series.
- .4 Anchor Bolts: stainless steel conc. wedge anchor to ASTM F593-17.

2.2 FINISHES

- .1 All steel components to be hot dip galvanized to ASTM F93-17.

Part 3 Execution

3.1 CONSTRUCTION METHOD

- .1 Obtain approval of samples and shop drawings prior to ordering materials and commencing fabrication.
- .2 Do welding in accordance with CSA W59. Ensure exposed welds are continuous for length of each joint unless otherwise indicated.
- .3 File or grind exposed welds smooth and flush. De-grease and de-bur all sharp edges in the shop left behind after fabrication is complete.
- .4 Galvanizing: prepare surface to ensure surface is free of grease, rust and scale.

3.2 DELIVER TO SITE

- .1 Allow all shop galvanized members to fully cure before preparing for shipment.
- .2 Wrap members in cellophane plastic or bubble wrap designed to protect finished surfaces without scratching or marring them during transport. Secure wrappings with appropriate tape or adhesives that are sturdy but can easily be removed at the site.
- .3 Deliver to site with equipment suitable for carrying loads and capable of hoisting metal into final locations without damaging finish.

3.3 SITE CONDITIONS

- .1 Make a careful examination of the site and structures and investigate all matters relating to the Work to be undertaken, the means of access and egress and the rights and interests which may be interfered with during construction.
- .2 Report any discrepancies or omissions to the Contract Administrator, who will issue a written clarification. Oral interpretations or instructions are not acceptable.

3.4 INSTALLATION

- .1 Erect metal square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .2 Provide suitable and acceptable means of anchorage, such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .3 Exposed fastening devices to match finish and be compatible with material through which they pass, as per the Drawings.
- .4 Do touch-up welding in accordance with CSA W59, unless specified otherwise. Make field connections with high tensile bolts, or weld to CSA S16.1-M (latest). Touch up rivets, field welds, bolts and burnt or scratched surfaces after erection and galvanized surfaces damaged by construction activities.

3.5 ACCEPTANCE

- .1 Work will be accepted only if it is erected true to the design intent in conformation with shop drawings.

3.6 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from site.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the fabrication and installation of garbage bin enclosure and concrete and timber bench.

1.2 RELATED SECTIONS

- .1 32 31 12 - Exterior Metal Fabrication

1.3 REFERENCES

- .1 American Wood-Preservers Association (AWPA)
 - .1 AWPA M2, Standard for Inspection of Treated Wood Products.
 - .2 AWPA M4, Standard for the Care of Preservative-Treated Wood Products.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 Canadian Standards Association (CSA)
 - .1 CSA B111, Wire Nails, Spikes and Staples.
 - .2 CSA O141 Softwood Lumber.
 - .3 CSA O80, Wood Preservation.
 - .4 CSA O80.20, fire-retardant treatment of lumber by pressure processes.
 - .5 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel.
 - .6 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .7 CAN/CSA-S16.1, Limit States Design of Steel Structures.

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Submit product data and samples of the following to Contract Administrator:
 - .1 Cedar lumber
 - .2 Pressure treated lumber
 - .3 Stainless steel lag screws
 - .4 Locking pins,
 - .5 Heavy duty gate latch
 - .6 Wheels
- .3 Submit shop drawings for:
 - .1 Garbage bin enclosure
 - .2 Concrete and timber bench

- .3 Use construction drawings as reference only in preparing submissions. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from the Drawings.
- .4 Shop drawings to clearly indicate size, assembly, welds, hardware, materials, core thicknesses, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, installation details and accessories for all aspects of work.

1.5 QUALITY ASSURANCE

- .1 Carpentry shall be performed by trained and qualified craftspeople with demonstrable experience sourcing and work.
- .2 Conduct a pre-installation meeting with Contract Administrator to verify project requirements.
- .3 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .4 For products treated with preservative by pressure impregnation, submit following information certified by authorized signing officer of treatment plant:
 - .1 Information listed in AWWPA.M2 and revisions specified in CAN/CSA-080 Series, Supplementary Requirement to AWWPA Standard M2 applicable to specified treatment.
 - .2 Moisture content after drying following treatment with water-borne preservative.
- .5 All wood to be free of defects. Any warped, checked or bent materials will be rejected.

1.6 SOURCE AND DELIVERY

- .1 Wood shall be from one supplier and shipped by rail.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 CEDAR LUMBER

- .1 Material: No. 2 western red cedar, mill run grade, rot resistant and colour consistent, FSC certified with a planed texture for decking and bench plank. Average moisture content 19% maximum.

2.2 PRESSURE TREATED WOOD

- .1 Material to be pressure treated lumber, no. 1 grade, colour: brown, moisture content 19% or less in accordance with following standards: CAN/CSA-O141; NLGA Standard Grading Rules for Canadian Lumber; Forest Stewardship Council (FSC) certified.
- .2 Above Ground Preservative: to CSA-O80 Series, ACQ-C treatment, clear finish. Minimum net retention: 4.0 kg/m³.
- .3 Ground Contact Preservative: to CSA-O80 Series, ACQ-C treatment, clear finish. Minimum net retention: 6.4 kg/m³.

2.3 **HARDWARE**

- .1 Nails and spikes: to CAS B111, galvanized, for exterior works. Use spiral thread nails.
- .2 Bolts nuts, washers, lag screws to be hot dipped galvanized, sizes to suit application.
- .3 Lag screws: hot dipped, galvanized, sizes to suit application.
- .4 Gate Wheels: 150mm dia. minimum, exterior grade metal.

Part 3 **Execution**

3.1 **PREPARATION**

- .1 Handle and use material in a manner that will avoid damage or field fabrication causing alteration in original treatment. Verify and confirm all underground services have been installed and accepted prior to commencing site carpentry Work.

3.2 **INSTALLATION**

- .1 Construct all Work as indicated on the Drawings using adequate fastening methods to ensure solid durable finished work suitable for the purpose intended.
- .2 Do all nailing and fastening neatly, evenly and thoroughly. Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity. Install all members true to line, levels and elevations.
- .3 Set plumb and space uniformly. Countersink bolts where necessary to provide clearance for other Works.
- .4 Treat surfaces of ACQ treated lumber exposed by field cutting, trimming or boring with liberal application of wood preservative before installation. Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum three (3) minute soak on lumber.

3.3 **CLEANING**

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of bike racks, waste receptacles and steel bollards.

1.2 RELATED SECTIONS

- .1 32 16 15 – Site Concrete

1.3 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Submit product data for: bike rack and waste receptacle. Include dimensions, materials and finishes.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site, suitably packaged, clearly marked indicating manufacturer name and any other identifying symbols or information. Do not deliver materials long before they are required on site. Cause no delays to scheduling.
- .2 Store materials in a dry location off the ground and prevent damage.
- .3 Replace immediately all materials damaged, or unfit for use during delivery or storage.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 SITE FURNITURE

- .1 Bike Rack
 - .1 Ring bike rack, stainless steel finish, embedded in concrete sidewalk, or approved equal. Available from Landscape Forms ph. 1-800-430-6206.
- .2 Waste Receptacle
 - .1 Select Recycling System, triple unit, powdercoated silver, surface mounted. Signage placement: 8" x 8" Multi-Use Opening. Signage choices: 01 "Paper", 06 "Aluminum Glass Plastic" and 13 "Waste Only" or approved equal. Available from Landscape Forms ph. 1-800-430-6206.
- .3 Steel Bollard: 150mm Dia. dia. schedule 40 galvanized steel.
- .4 Hardware
 - .1 Lag Bolts: hot dipped, galvanized, sizes to suit application.

Part 3 Execution

3.1 INSTALLATION

.1 General

- .1 Ensure that all related Work has been approved by the Contract Administrator commencing site furniture installation.
- .2 Assemble furnishings in accordance with manufacturer's instructions. Obtain Contract Administrator approval of assembled furnishings prior to mounting.
- .3 Stake out or mark site furniture locations on site for Contract Administrator approval prior to installation
- .4 Install all furnishings true, plumb, anchored and firmly supported to the manufacturers express written specifications, and as shown on the Drawings.
- .5 Bike Racks are to be embedded in concrete. Coordinate with concrete installation.
- .6 Steel Bollard are to be embedded in concrete. Coordinate with concrete installation.

3.2 TOUCH-UPS

- .1 Touch-up minor damage to finishes with matching paint available from the supplier, to approval of Contract Administrator.
- .2 Site furnishings with major damage to finishes will be rejected.

3.3 ACCEPTANCE

- .1 Site furnishings will be subject to a thorough field inspection and will not be accepted until all workmanship and deficiencies have been addressed.

3.4 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This specification shall cover the supply and installation of reflective metal signs.

1.2 RELATED SECTIONS

- .1 31 37 01 – Rock Mulch
- .2 32 16 15 – Site Concrete
- .3 32 91 19 – Planting Medium Placement & Finished Grading

1.3 REFERENCES

- .1 American Society for testing and Materials International (ASTM)
 - .1 ASTM A276-91a, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - .2 ASTM B209M-92a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .3 ASTM B210M-92a, Specification for Aluminum-Alloy Drawn Seamless Tubes.
 - .4 ASTM B211M-92a, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.
- .2 Canadian Standards Association (CSA)
 - .1 CAN / CSA-G40.21-M92, Structural Quality Steels.
 - .2 CAN / CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA W47.2-M1987, Certification of Companies for Fusion Welding of Aluminum.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN / CGSB-1.94-M89, Xylene Thinner (Xylol).
 - .2 CAN / CGSB-1.99-92, Exterior and Marine Phenolic Resin Varnish.
 - .3 CAN / CGSB-1.104-M91, Semi gloss Alkyd Air Drying and Baking Enamel.
 - .4 CAN / CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
 - .5 CGSB 1-GP-12c-65, Standard Paint Colours.
 - .6 CGSB 31-GP-3M-88, Corrosion Preventive Compound, Cold Application, Soft Film.
 - .7 CGSB 31-GP-101Ma-89, Chemical Conversion Films for Aluminum and Aluminum Alloys.

1.4 SUBMITTALS

- .1 Submit in accordance with Submittal Procedures specification.
- .2 Shop Drawings:
 - .1 Submit shop drawings for graphic layout proofs.
 - .2 Submit shop drawings indicating method of attachment of reflective metal signs to fence.
 - .3 Use construction drawings as reference only in preparing submittals. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from the Drawings.

- .4 Drawings to clearly indicate size, assembly, welds, hardware, materials, core thicknesses, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, installation details and accessories for all aspects of the Work.
- .3 Samples: Submit a 300 x 300mm sample of reflective metal sign.
- .4 Contract Administrator shall provide original artwork for entry sign and reflective metal signs in vector based digital format.

1.5 QUALITY ASSURANCE

- .1 Fabricate and Installer: trained and qualified fabricators and installers, fully certified to produce high quality, custom signage with a minimum of ten (10) years experience, fabricating and installing large pylon signs and custom designed elements. General contractor to provide signage company curriculum vitae and 3 references for Contract Administrators approval prior to proceeding with the Work in this specification.
- .2 All workmanship and all materials furnished and supplied under this specification shall be of the highest standards and are subject to close and systematic inspection and testing by the Contract Administrator including all operations, from the selection of materials, through to final acceptance of the Work.
- .3 Strict conformance to the specifications will be enforced. The Contract Administrator shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.
- .4 The Contract Administrator reserves the right to reject any materials or works that are not in accordance the requirements of this specification.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 REFLECTIVE METAL SIGNS

- .1 Aluminum Metal Panel: 0.90 gauge metal plate, sign grade, aluminum panel 5052 H36 or H38, size and shape as indicated on the Drawings.
- .2 Sheeting: 3M Brand Scotchlite Series 3200 Engineering Grade Reflective Sheeting, or approved equal, complete with permanent pressure sensitive adhesive backing. Sheeting colours as noted on the Drawings. Sheeting to comply with ASTM D4956-90.
- .3 Inks: Matched, UV stable, waterproof transparent inks as required. 3M Scotchlite 700 series, enamel baked ink system, or approved equal.
- .4 Artwork shall be provided in vector based digital format as required by the manufacturer. Artwork is the property of the City and shall not be reproduced in any quantity or for any purpose outside the parameters of this Contract without the express written permission of the City.
- .5 Final design of artwork for reflective metal signs to be coordinated with the City.
- .6 Mounting Hardware:
 - .1 Schedule 63mm diameter, hot dipped galvanized sign posts.
 - .2 Hot-dipped galvanized screws capable of securely fixing signage in place. Sizes as noted on the Drawings.

Part 3 Execution

3.1 REFLECTIVE METAL SIGNS FABRICATION AND INSTALLATION

- .1 Provide proposed colour sample to Contract Administrator for approval prior to fabrication.
- .2 Send proofs of sign graphics and letters at 1:1 for Contract Administrators approval prior to fabrication.
- .3 Debur degrease and etch edges of sign plates to accept reflective sheeting decals in accordance with decal manufacturer's recommendations.
- .4 Apply sheeting in accordance with manufacturer's written specifications. Decals shall be centred precisely on base plate. Trim sheeting to form clean, smooth edge along perimeter of base plates.
- .5 Sign Base Installation: friction drive posts into compacted fill or surface mount to concrete sidewalk as indicated on the Drawings.
- .6 Fasten signage as indicated on the Drawings. Confirm sign orientation on site with the Contract Administrator.

3.2 TESTING AND TOUCH-UP'S

- .1 Clean and repair any damaged surfaces as recommended by product manufacturer leaving finished product clean and unblemished.
- .2 Obtain final approval from the Contract Administrator making any and all necessary adjustments prior to leaving the site.

3.3 ACCEPTANCE

- .1 Work will be accepted only if it is erected true to the design intent in conformation with shop drawings.

3.4 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from site.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply, installation, and final contouring of planting medium for planting beds as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 N/A

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the environment (CCME) Guidelines.
- .3 The City of Winnipeg Standard Construction Specifications
 - .1 CW 1130 – Site Requirements
 - .2 CW 3540 – Topsoil and Finished Grading for Establishment of Turf Areas.

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Soil Testing: submit certified test reports showing compliance with or recommended amendments in accordance with the performance characteristics and physical properties as described in Item 1.5 - Quality Assurance.
- .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

- .1 This project shall use locally produced planting medium amended as required.
- .2 Obtain approval of proposed planting medium source from Contract Administrator prior to placing order.
- .3 Test in accordance with General Requirements. Prepare and ship planting medium samples to approved laboratory in accordance with Provincial regulations and laboratory requirements, indicating intended use on each sample.
- .4 Inspection and testing of planting medium will be carried out by a Testing Laboratory appointed by the Contractor. Testing laboratory to be certified in accordance with CSA A283.
- .5 A minimum of (3) three tests are required for planting medium preparation:
 - .1 Test 1 - Planting medium.
 - .2 Test 2 - Amended planting medium based on test 1 results.
 - .3 Test 3 - Re-test planting medium if required, to meet specifications.

- .6 Additional testing of planting medium to meet specifications shall be the responsibility of the Contractor at no additional cost to the City.
- .7 Test planting medium for nutrients N, P, K, micronutrients, soluble salt content, pH value and OM (organic matter).
- .8 Submit copy of planting medium analysis and recommendations for corrections to Contract Administrator.
- .9 Acceptance of planting medium is subject to inspection of material and confirmation of test results. Do not commence the Work until Contract Administrator has accepted planting medium.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Store materials in a dry area, protected from freezing, sedimentation, and contamination.
- .2 Deliver and store fertilizer in waterproof bags labelled with weight, analysis, and name of manufacturer.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Topsoil
 - .1 In accordance with CW 3540 for topsoil, except organic matter to be in the range of 5-10%.
- .2 Peatmoss:
 - .1 Deliver from partially decomposed fibrous or cellular stems and leaves of species of sphagnum mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material that could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .3 Coarse Sand: Clean, hard fine silica sand, well washed and free of impurities, chemical or organic matter. Coarse texture, and to the following gradation:

<u>Particle Size (mm)</u>	<u>% Passing Through Screen</u>
2.0	100%
1.0	95 to 100%
0.5	80 to 100%
0.25	0 to 30%
0.15	0 to 8%

- .6 Protect bottom of all excavations against freezing. Remove water that enters excavations prior to planting. Ensure source of water is not groundwater.
- .7 Scarify bottom of planting bed excavations to a depth of 150mm.
- .8 Cover bottom of each planting bed excavation with bone meal fertilizer per manufacturers written specifications and application rate for each type of application.
- .9 Do not backfill planting bed with planting medium until the Contract Administrator has approved planting bed preparations.

3.2 PLACING AND SPREADING OF PLANTING MEDIUM

- .1 Place planting medium after Contract Administrator has accepted sub-grade.
- .2 Spread planting medium in uniform layers not exceeding 150mm.
- .3 Spread planting medium as indicated on the Drawings to follow minimum depths after settlement: 300mm for planting beds to 75mm below finished grade to allow for wood mulch to specification 32 93 10.
- .4 Tamp down or roll soil with manual or mechanized equipment until it forms a firm solid surface that lightly takes a foot imprint.

3.3 SOIL AMENDMENTS

- .1 Spread fertilizer over entire area at rate and ratio determined by soil test, or as specified above.
- .2 Mix fertilizer thoroughly into upper 50mm of planting medium.

3.4 FINISHED GRADING

- .1 To CW 3540.
- .2 Fine grade entire planting medium area to elevations as indicated on the Drawings. Eliminate rough spots and low areas. Leave surfaces smooth, uniform and firm against foot printing with a fine loose texture.
- .3 Protect beds from erosion at drainage outlets until planting and mulching is completed.

3.5 ACCEPTANCE

- .1 Leave surfaces smooth, uniform and firm against foot printing with a fine loose texture.
- .2 Leave surfaces to within 10mm of design grades uniformly sloping and maintaining positive drainage as indicated on the Drawings.
- .3 Amend all low spots and creases prior to proceeding with planting and seeding operations.
- .4 The Contract Administrator reserves the right to spot test the planting medium installed throughout the site should the finished product look, smell, feel or appear in any way different from the approved tested samples provided in any location.

- .5 Surfaces will be accepted when finished grading and soil quality meet all the standards and quality of workmanship noted within this section and when all adjacent hard surfaces have been cleaned to the Contract Administrators satisfaction.

3.6 SURPLUS MATERIAL

- .1 Dispose of excess planting medium to a topsoil supply facility within 25 km of the site.

3.7 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of trees, shrubs, perennials, groundcovers, mulch, geotextile fabric and accessories as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 32 91 19 - Planting Medium & Finish Grading

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada (AAFC)
 - .1 Plant Hardiness Zones in Canada-2000.
- .2 Canadian Nursery Landscape Association (CNLA)
 - .1 Canadian Standards for Nursery Stock-2001.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Submit product data for: Fertilizer.
- .3 Submit samples for:
 - .1 Geotextile fabric.
 - .2 Wood chip mulch.

1.5 SOURCE QUALITY CONTROL

- .1 Obtain approval of approval of plant material at source.
- .2 Notify Contract Administrator of source of material at least seven (7) days in advance of shipment. No Work under this Section is to proceed without approval.
- .3 Acceptance of plant material at source does not prevent rejection on site prior to or after planting operations.
- .4 Plant material imported from other nations will not be accepted for this project.
- .5 Bare root plant material will not be accepted for this project.

1.6 STORAGE AND PROTECTION

- .1 Protect plant material from frost, excessive heat, wind, and sun during delivery.

- .2 Immediately store and protect plant material which will not be installed within four (4) hours after arrival at site in storage location approved by Contract Administrator:
- .3 Protect plant material from damage during transportation:
 - .1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
 - .2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
 - .3 Protect foliage and rootball using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .4 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in topsoil and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers.
 - .3 For balled and burlaped and wire basket rootball, place to protect branches from damage. Maintain moisture level in root zones.

1.7 SCHEDULING

- .1 Obtain approval of species alternatives from Contract Administrator prior to ordering plant material. All species must native or adaptive species suited to the region.
- .2 Order plant material as soon as possible after award of contract to ensure plant availability. Plants should be ordered at least one full growing season prior to anticipated planting date.
- .3 Obtain approval from Contract Administrator of schedule fourteen (14) days in advance of shipment of plant material.
- .4 Schedule to include:
 - .1 Quantity and type of plant material.
 - .2 Shipping dates.
 - .3 Arrival dates on site.
 - .4 Planting dates.

1.8 WARRANTY OF NURSERY STOCK

- .1 The Contractor hereby warrants that plant material as itemized on plant list on the Drawings will remain free of defects for one (1) years, after the date of Substantial Performance.
- .2 The end-of-warranty inspection will be conducted by the Contract Administrator.
- .3 Contract Administrator reserves the right to extend Contractor's warranty responsibilities for an additional one (1) year if, at end of the initial warranty period, leaf development and growth is not sufficient to ensure future survival of plant material.

1.9 REPLACEMENTS

- .1 During warranty period, remove from Site any plant material that has died or failed to grow satisfactorily as determined by the Contract Administrator.
- .2 All replacement plant material subject to an additional one (1) year of warranty.

- .3 All required replacements shall be by plants of at least the same size and species as specified and shall be supplied and planted in accordance with the Drawings and Specifications.
- .4 Should the replaced plant material not survive, the Contractor will be responsible to replace it a third time and guarantee it for a period equal to the original warranty period unless it is determined that unique Site conditions or inadequate maintenance causes the death of plants.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIAL

- .1 Plant Material
 - .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
 - .2 Source of plant material: grown in Zone 3 in accordance with Plant Hardiness Zones in Canada.
 - .3 Plant material must be planted in zone indicated as appropriate for its species.
 - .4 Plant material free of disease, insects, defects, or injuries and structurally sound with strong fibrous root system.
 - .5 Plant species, cultivars and sizes as indicated on the Drawings.
 - .6 Trees with straight trunks, well and characteristically branched for species except where specified otherwise.
 - .7 Substitutions to plant material are not permitted unless written approval has been obtained by the Contract Administrator as to type, variety, and size. Plant substitutions must be of similar species and of equal size as those originally specified.
- .2 Planting Medium: as specified in Section 32 91 19 - Planting Medium & Finish Grading.
- .3 Water: free of impurities that would inhibit plant growth.
- .4 Heavy Duty Baler Twine: polypropylene baler twine, UV protected.
- .5 Stakes: wooden, 76mm dia. x 2440mm treated softwood lumber, pointed bottom end.
- .6 Tree Tie: biodegradable or polyethylene fabric strapping min. 38mm wide.
- .7 Guy Wire: 9-gauge, flexible, non-corrosive strand wire.
- .8 Wire Tightener: PG wire tightener.
- .9 Clamps: U-bolt galvanized, 12mm (1/2") \varnothing , c/w curved retaining bar and hex nuts.
- .10 Anchors: Drive-in Type, 12mm (1/2") \varnothing x 102 mm (4") long, aluminum.
- .11 Tree Protection: Plastic, 13mm dia., nylon reinforced garden hose over guy wire.

- .12 Trunk Protection Collar: White perforated helix plastic wrap.
- .13 Flagging Tape: Fluorescent, orange, or red colour.
- .14 Anti-Desiccant: wax-like emulsion.
- .15 Geotextile Fabric: Non-woven fabric to CW 3130.
- .16 Wood Mulch: Enviro-mulch, colour chocolate brown, available from Reimer Soils 204-237-6668, or approved equal.
- .17 Fertilizer: Synthetic start-up slow-release fertilizer with a N-P-K analysis of 12-36-15 ratio at a rate of 4 kg per 100 m² which is 8 pounds per 100 sq ft.

Part 3 Execution

3.1 PRE-PLANTING PREPARATION

- .1 Obtain approval from Contract Administrator of finish grading and planting medium installation prior to commencing Work in this Section.
- .2 Ensure plant material is acceptable to Contract Administrator.
- .3 Remove damaged roots and branches from plant material with sharp clean equipment treating wounds as necessary to maintain plant health.
- .4 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.2 LAYOUT AND PREPARATION OF PLANTING BEDS

- .1 Prepare planting beds and obtain approval per section 32 91 19.
- .2 Layout plants in pots on beds for Contract Administration approval prior to installation.
- .3 For individual trees:
 - .1 Stake out locations of all trees and obtain approval from Contract Administration prior to excavating tree pits.
 - .2 Cut clean slit in geotextile fabric to accommodate tree if located in a shrub bed.
 - .3 Excavate tree pits to depths and widths indicated on the Drawings.
 - .4 Remove rocks, roots, debris, and toxic material from the tree pit.
 - .5 Scarify sides of planting hole.
- .4 For shrubs, perennials, and grasses:
 - .1 Layout plants per the Drawings carefully ensuring spacing as specified on the Drawings.
 - .2 Obtain Contract Administrator approval of plant layouts and make any necessary adjustments on site.
 - .3 Cut clean slit in geotextile fabric to accommodate each plant.
- .5 Remove water which enters excavations or shrub beds prior to planting. Notify Contract Administrator if water source is groundwater.

3.3 PLANTING

- .1 For jute burlap rootball, cut away top one third of wrapping and wire basket without damaging rootball. Do not pull burlap or rope from under rootball.
- .2 For container stock or rootball in non-degradable wrapping, remove entire container or wrapping without damaging rootball. Loosen rootball to encourage bonding with planting medium and subgrade.
- .3 For trees remove excess soil build up over root flair until the first fibrous roots at trunk are present & position at top of mulch / finished grade.
- .4 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to public areas of the garden.
- .5 For trees and shrubs:
 - .1 Backfill soil in 150mm (6") lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated soil, backfill to finish grade.
 - .2 Form watering saucer as indicated on the Drawings.
- .6 For perennials, annuals, and grasses, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .7 Water plant material thoroughly. Use deep root feeders for trees.
- .8 After soil settlement has occurred, fill with soil to finish grade.
- .9 Dispose of burlap, wire, and container material off site.

3.4 TRUNK PROTECTION

- .1 Install trunk protection collar on single-stem deciduous trees as indicated on the Drawings.

3.5 TREE SUPPORTS

- .1 Install tree supports as indicated on the Drawings taking care not to damage or puncture underground utilities.
- .2 Use double stake tree support for deciduous trees:
 - .1 Place first stake on prevailing wind side of tree trunk.
 - .2 Drive stakes minimum 150mm into undisturbed soil beneath roots. Ensure stakes are secure, vertical and unsplit.
 - .3 Install tree-tie 1500mm above grade.
- .3 Use three (3) guy wires and anchors for coniferous trees:
 - .1 Install guying collars above branch to prevent slipping at approximately two thirds of plant height for evergreens. Collar mounting height is not to exceed 2.44m (8') above grade.
 - .2 Guying collars to be of sufficient length to encircle tree plus 50mm (2") space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120°.

- .3 Install anchors at equal intervals about tree and away from trunk so that guy wire will form 30° angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.
 - .4 Attach guy wire to anchors. Tension wire and secure by multi-wraps installing clamps.
 - .5 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.
 - .6 Install fluorescent flagging tape to guys as indicated.
- .4 After tree supports have been installed prune as directed by Contract Administrator. Pruning to be completed by a Certified Arborist, as necessary.

3.6 MULCHING

- .1 Obtain approval of planting and irrigation from Contract Administrator before mulching material is applied.
- .2 Ensure soil settlement has been corrected prior to mulching with wood chip mulch.
- .3 Spread wood chip mulch as indicated on all shrub beds and in all tree saucers.
- .4 Spread mulch to minimum thickness of 75mm. Mulch material susceptible to blowing must be moistened and mixed with topsoil before applying. When mulching is placed in fall, place immediately after planting. When mulch is placed in spring, wait until soil has warmed up.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform the following operations from time of installation until thirty (30) days following the issuance of Certificate of Substantial Completion.
- .2 Water planting beds in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100mm.
- .3 Prune low hanging or ill formed branches that mar optimal plant form.
- .4 Weed and fertilize as necessary.
- .5 Top-up up mulch as necessary.

3.8 WARRANTY PERIOD

- .1 All plantings will be inspected by the Contract Administrator immediately after thirty (30) day establishment period.
- .2 A certificate of total performance will be issued at the end of the inspection and the completion of associated replacements / adjustments.
- .3 The date of the certificate of total performance will mark the beginning of the one (1) year warranty period.
- .4 A plant warranty inspection scheduled and led by the Contract Administrator will be conducted as close to one year after the issuance of the certificate of total performance as possible.

3.9 ACCEPTANCE

- .1 Trees shrubs, perennials, grasses, and groundcovers will be inspected at substantial performance and at the end of the one (1) year warranty period. Trees, shrubs, perennials, grasses, and groundcovers will be accepted by the Contract Administrator, provided that:
 - .1 Plants are showing vigorous well rounded new growth.
 - .2 Plants are free of disease or pests.
 - .3 Plants show no signs of malnutrition or stress
- .2 After the warranty inspection the Contract Administrator shall replace trees, shrubs, perennials, and grasses that do not meet the standards in 3.8 with new plant material as originally specified at no additional cost to the City. All replacement plants shall be subject to a thirty (30) day establishment maintenance period.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the maintenance of trees, shrubs, groundcovers, vines, perennials, planting beds following acceptance of the plant material to start warranty.
- .2 In general, the work shall include:
 - .1 Spring Cleaning
 - .2 Watering
 - .3 Mowing
 - .4 Weed Control
 - .5 Pest and Disease Control
 - .6 Pruning
 - .7 Mulching
 - .8 Winter Preparation

1.2 MAINTENANCE PERIOD

- .1 Maintenance shall occur between the date of installation and up to a period of one (1) years from date landscaped areas are accepted to start warranty. The warranty period for plant materials will be coincidental to the maintenance period.
- .2 Thirty (30) days after the planting installation has been completed, the Contract Administrator shall perform an inspection of the plant material to determine if the plant material is acceptable to start warranty.
- .3 Eligible maintenance months are May to October.
- .4 Maintenance shall be performed on an as required basis.

1.3 SCHEDULING AND MONITORING

- .1 Provide watering service within 24 hours, weeding services within 48 hours of the request by the Contract Administrator. Monitor the Site and advise the Contract Administrator of conditions that might void the Contractor's warranty responsibilities.
- .2 The Contractor shall maintain a log noting times, dates, equipment used, and quantity of materials used, and areas treated for each maintenance application. Forms shall be provided by Contract Administrator. Submit log to Contract Administrator upon request. Contractor shall notify Contract Administrator of the exact time Contractor proposes to commence each application.
- .3 Schedule operations in accordance with growth, health, weather conditions, and use of Site.
- .4 Perform each operation continuously and completely within a reasonable time.
- .5 Store equipment and materials off Site.
- .6 Collect and dispose of debris or excess material on the day the maintenance is undertaken.

1.4 WATER SUPPLY

- .1 Arrange for, pay for, and maintain potable water supply at the site during the maintenance period.

1.5 PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, benchmarks, buildings, furniture, pavement, curbs, surface, and underground utility lines. Repair damaged items to approval of Contract Administrator at no cost to The City.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Materials shall conform to the requirements of related Specification sections.
- .2 Provide all equipment to properly execute Work. Maintain such equipment in a workable, safe condition while in use.
- .3 Contract Administrator shall review equipment to be used to execute Work prior to execution.

Part 3 Execution

3.1 SPRING CLEANING

- .1 Sodded Areas: rake areas and remove dead vegetation, leaves, and debris. Do heavy raking with flexible grass rake on areas with "snow mould". Roll lightly areas where grass plants have lifted due to frost action.
- .2 Planting Beds: clean beds and planters of debris, refuse and dead plant material. Weed as necessary and top up mulch where degraded to below the original specified depths.

3.2 FERTILIZING

- .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
- .2 Rate, ratio and frequency as recommended by soil test results and plant health.

3.3 WATERING

- .1 Apply water as required to supplement rainfall and to maintain optimum growing conditions. In general, water once a week to achieve rates as indicated. Allow soil to adequately dry between watering to prevent over saturation without creating water stress.
- .2 The Contractor must water at least once a week between May 1st and October 15th inclusive. A complete record is to be kept of each series of waterings for all planted trees noting location and date of watering. This record is to be given to the Contract Administrator when requested.
- .3 Apply forty (40) litres of water per 25mm calliper per application using a deep root feeder or low-pressure open flow nozzle and hose. The water stream must not gouge the soil and mulch.

3.4 WEED CONTROL

- .1 Inspect and undertake weed control weekly during the first year of maintenance and monthly during the second year.

- .2 By hand, remove all weeds with their roots from tree pits and tree beds and dispose of off Site.
- .3 When weeding operation is complete, replace and rake displaced mulch to its original condition.

3.5 PEST AND DISEASE CONTROL

- .1 Obtain written approval of Contract Administrator prior to using any pesticide.
- .2 Control pests and disease through pruning or application of pesticides. Use species specific pesticides where possible. Use only pesticides of low mammalian toxicity. Strictly follow manufacturer's written instructions.

3.6 PRUNING

- .1 The Contractor shall provide a person with a Manitoba Arborists Certificate for each work crew or Work Site.
- .2 Prune as required to remove dead, broken or damaged limbs. Prune back to healthy growth while maintaining balanced crown shape. Employ clean sharp tools. Make cuts smooth and flush with outer edge of branch collar near the main stem or branch. Cuts must be smooth and sloping to prevent accumulation of water on cut. Do not leave little stumps ("horns") on trunks or main branches. Prune according to accepted horticultural practices as outline in "The Pruning Manual", Publication No. 1505-1977 by Agriculture Canada.

3.7 MULCHING

- .1 Add mulch as required to maintain original 75mm thickness.

3.8 WINTER PREPARATION

- .1 Rake and assemble leaves after they have been shed by trees. Remove from site.
- .2 Clean out planting beds and remove debris from site.
- .3 Protect trees from rodent damage using approved plastic protector beyond snow line or by applying rodent repellent sprays. Use spray to protect shrubs as required.
- .4 Water planting beds and trees thoroughly during the fall season. Ensure adequate moisture in root zones of plant material prior to freeze-up.
- .5 Apply anti-desiccant to evergreen trees and shrubs susceptible to winter desiccation.

3.9 FINAL ACCEPTANCE

- .1 The Contract Administrator, The City and Contractor will conduct a plant warranty and landscape maintenance review at the end of the one (1) year maintenance period.
- .2 Areas will be accepted by the Contract Administrator provided that:
 - .1 Trees shrubs, perennials, and groundcovers are showing growth and vigor satisfactory to the Contract Administrator and to the standards specified in Section 32 93 10.
 - .2 Planting beds are free of weeds & invasive plant species and mulch provides cover between plantings to the full 75mm depth originally specified.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 33 – Excavating, Trenching and Backfilling
- .2 Section 33 41 00.01 – Storm Utility Drainage Piping

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM) – Latest Edition
 - .1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.
 - .2 ASTM C117, Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .5 ASTM C478M, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .6 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB) – Latest Edition
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International) – Latest Edition
 - .1 CAN/CSA-A23.1-04/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A3002, Masonry and Mortar Cement.
- .4 These Specifications shall also apply to the Work.
 - .1 The latest revision of the City of Winnipeg Standard Construction Specifications shall apply to the Work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.

2 Products

2.1 MATERIALS

- .1 Precast concrete sump pit, manhole, and catch basin sections: to ASTM C139 and C478M, circular; 914 (36") inside diameter (CBs) and 1200 (48") Manholes unless otherwise noted on the drawings, minimum depths noted on drawings, unless otherwise noted. Top sections to be flat slab top type with opening offset for vertical ladder installation.
- .2 Internal joints shall be made watertight using pre-formed bituminous gaskets or flexible buytl rubber joint sealant. Exterior joints shall be wrapped with "Cretex Wrap" external joint sealer or approved equivalent.
- .3 Mortar: Masonry Cement: to CAN/CSA-A3002, latest edition.
- .4 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164, latest edition. Rungs to be safety pattern (drop step type).
- .5 Adjusting rings: to ASTM C478M, latest edition.
- .6 Concrete Brick: to CAN3-A165 Series, latest edition.
- .7 Galvanized iron sheet: approximately 2 mm thick.
- .8 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames.
 - .1 Frame with grating or cover to constitute one unit.
 - .2 Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
 - .3 Castings: sandblasted or cleaned and ground to eliminate surface imperfections.
 - .4 Catch basin frames and covers to OPSS 407, size to suit and as shown on drawings.
 - .5 Manhole frames and covers: heavy duty municipal type for road service to CCDG, cast iron without perforations, except for two 25 mm square lifting holes.
 - .6 Sump pit frames and covers: heavy duty municipal type to CCDG. Cover to be 10mm (3/8") thick, checkered aluminium plate, 610 x 610 (24" x 24") minimum, or to suit sizes indicated on drawings.
- .9 Granular bedding and backfill: in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling.

3 Execution

3.1 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling and as indicated on drawings.
- .2 Obtain approval of the Contract Administrator before installing outfall structures, manholes or catch basins.

3.2 CONCRETE WORK

- .1 Position metal inserts in accordance with dimensions and details as indicated.

3.3 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses. A maximum of three units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of the Contract Administrator and remove soft and foreign material before placing concrete base.
- .4 Set precast concrete base on 150 mm minimum of select granular bedding compacted to 98% maximum density to ASTM D698.
- .5 Precast units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with the Contract Administrator approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.
 - .2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 - .3 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.
 - .4 Seal all external joints with external joint wrap.
- .6 For sewers:
 - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
 - .2 Bench to provide smooth U-shaped channel.
 - .1 Side height of channel to be 0.75 times full diameter of sewer.
 - .2 Slope adjacent floor at 1 in 20.
 - .3 Curve channels smoothly.
 - .4 Slope invert to establish sewer grade.
- .7 Compact granular backfill to 98% maximum density to ASTM D698.
- .8 Place unshrinkable backfill in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling.
- .9 Installing units in existing systems:
 - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, [and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
- .10 Set frame and cover to required elevation on no more than 2 courses of brick.
 - .1 Make brick joints and join brick to frame with cement mortar.
 - .2 Parge and make smooth and watertight.
- .11 Place frame and cover on top section to elevation as indicated.
 - .1 If adjustment required use concrete ring.
- .12 Clean units of debris and foreign materials.

- .1 Remove fins and sharp projections.
- .2 Prevent debris from entering system.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 33 – Excavating, Trenching and Backfilling

1.2 REFERENCES

- .1 These Specifications shall apply to the Work.
 - .1 The latest revisions of the City of Winnipeg Standard Construction Specifications shall apply to the work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.

1.3 DESCRIPTION OF WORK

- .1 The work described herein shall consist of the construction of water services, including the supply and installation of pipe, appurtenances (elbows, reducers, caps), as well as accessories such as couplings, services saddles, cathodic protection, thrust blocks, lubricant and including gate valves, the connection of the pipe to the source of water supply, the hydrostatic and bacterial testing of the pipe and the disinfection of those pipes to be used to convey potable water.
- .2 Prior to work of this Section, it is the Contractor's responsibility to confirm locations of all existing underground services and natural features.

1.4 QUALITY ASSURANCE

- .1 CONCRETE- At the Contract Administrator's request, testing may be performed on concrete used in thrust blocks, in accordance with CSA A23.2, Methods of Test for Concrete. Water used for mixing concrete shall be clean and free of oil and alkali, organic matter or other deleterious substances. Water shall be equal to potable water (drinking water) in physical and chemical properties.
- .2 PRESSURE TEST - The Contractor shall pressure test all work of this Section and provide prompt test report results to the Contract Administrator, showing dates, pressure, and a witness signature from the Site Superintendent.
- .3 BACTERIOLOGICAL TESTS - Upon completion of the watermains intended to convey potable water, the Contract Administrator may request water samples and bacteriological tests as necessary.

1.5 STORAGE AND HANDLING

- .1 Pipe and other materials associated with the construction of watermains shall be stored and handled in accordance with the recommendations of the manufacturer and to the satisfaction of the Contract Administrator.

2 Products

2.1 PIPE

- .1 The following pipe material shall be considered approved for watermains 150 mm in diameter and larger:
 - .1 Polyvinyl Chloride Pipe (PVC) Series 160, SDR 26 conforming to ASTM Specification D-2241 manufactured and certified to CSA B137.3.

2.2 GASKET AND LUBRICANTS

- .1 Gaskets and lubricant used to join pipes and to join pipes and appurtenances shall be of a type compatible with the particular pipe or appurtenance being used. Oil and gasoline resistant gaskets are generally not required but if, during construction, the Contract Administrator determines that the soil has been contaminated by petroleum and petroleum by-products, oil and gasoline resistant gaskets shall be used on all pipe installed within, and extending 100 metres beyond the outermost limit of, the contamination zone.

2.3 GATE VALVES

- .1 All gate valves shall conform to American Waterworks Association Standard C509 and shall be direct bury, non-rising stem, resilient seated wedge gate valve with push on joints rated at 1.0 Mpa. Gate Valves shall be left hand opening.

2.4 COUPLINGS

- .1 All couplings shall be of a type approved for use by all applicable standards

2.5 WATERMAIN RESTRAINTS

- .1 Restraint devices for PVC watermain pipe shall be as follows:
 - .1 PVC pipe to PVC pressure fittings shall be Uni-flange 1360, EBAA Iron Series 2500, or approved equivalent.
 - .2 PVC pipe to PVC pipe shall be Uni-flange 1350, EBAA Iron Series 1600, or approved equivalent

3 Execution

3.1 DEPTH OF WATERMAIN

- .1 The Contractor shall in all cases install the proposed watermain to the design grade shown on the drawings or to a depth of 3.0 m from the finished grade to the top of the watermain pipe, whichever is greater.

3.2 METHOD OF PIPE INSTALLATION

- .1 Watermains shall be installed either by open trench excavation with the appropriate class of backfill or by trenchless methods. Watermains to be installed under existing or proposed pavements within the road right-of-ways shall be installed using trenchless methods.
- .2 Shafts for coring shall be adequately sized to safely accommodate all coring equipment and personnel required for pipe extraction, coring and pipe installation.

- .3 Where field conditions are such that a cored hole cannot be made, the Contractor shall install the pipe in an open trench with the appropriate class of backfill in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling.

3.3 CLEANING

- .1 Prior to installation, the interior and joining surfaces of all pipes, accessories, and appurtenances shall be cleaned of dirt and foreign material and wiped dry.

3.4 PUSH-ON JOINTS

- .1 Pipe with push-on type bell and spigot joints (PVC) shall be laid with the bell end toward the direction of laying unless otherwise directed by the Contract Administrator. The lubricant recommended by the pipe manufacturer shall be applied to the spigot end only. The spigot end shall be inserted into the bell end of the previously laid pipe to the stop mark on the pipe, such that a secure joint is obtained.

3.5 THRUST BLOCKS

- .1 Concrete thrust blocks shall be installed at crosses, tees, elbows, plugs, reducers, and caps. The minimum bearing areas (upon undisturbed trench soil) for thrust blocks shall be as outlined in Table 3.1.

**Table 3.1
MINIMUM BEARING AREAS (on undisturbed trench soil)
FOR THRUST BLOCKS**

PIPE DIAMETER (mm)	TEES & PLUG & THRUST (m²)	90° BEND (m²)	45° BEND (m²)	22.5° BEND (m²)
100	0.2	0.3	0.2	0.1
150	0.4	0.5	0.3	0.2
200	0.6	0.9	0.5	0.3
250	1.0	1.5	0.8	0.4
300	1.5	2.0	1.2	0.6

3.6 GATE VALVES AND FITTINGS

- .1 Gate valves shall be installed at the locations shown on the Construction drawings. Where shorts are used at valves and fittings (including couplers), the shorts shall be of sufficient length to ensure that there is a minimum 600 mm (face to face) between fittings.

3.7 ACCESSORIES

- .1 Accessories i.e., adaptors, couplings, etc., shall be installed by a method compatible with the pipe used and as approved by the Contract Administrator.

3.8 TEMPORARY PLUGS

- .1 During prolonged pauses in pipe laying, and always overnight, any open ends of the pipe shall be properly plugged with a cap compatible with the type of pipe being installed so as to prevent entry of foreign material into the pipe.

3.9 PROHIBITION OF USE AS A DRAIN

- .1 Under no circumstances shall the trench or the pipeline be used as a drain.

3.10 CONNECTIONS

- .1 The Contractor shall make connections at prearranged times and prearranged duration's subject to approval by the Contract Administrator. Such time and duration shall be kept to minimize disruption of existing services.
- .2 The Contractor shall note the following additional requirements regarding interruptions to existing water service:
 - .1 Where a shutdown of services involves the interruption of an adequate pressurized water supply to an industrial, commercial or institutional consumer for which water is a requirement for the facility to be open or operate, the Contractor shall make the necessary arrangements to meet these requirements. Such arrangements shall include but not be limited to evening or weekend work or the provision of a temporary pressurized water supply during the period of the shutdown.
- .3 The Contractor shall note the provision of temporary pressurized water supplies, where required.
- .4 The Contractor shall expose existing watermains at proposed connection points to determine existing watermain inverts.
- .5 After the existing watermain has been exposed and existing elevations and dimensions determined or confirmed, the Contractor shall notify the Contract Administrator of any discrepancy prior to construction. The Contract Administrator will modify design grades as required.
- .6 No additional payment will be made for exposing existing watermains to verify inverts.
- .7 Where connecting to existing cast iron watermains the Contractor shall install 10.9 kg sacrificial zinc anodes.

3.11 DEFLECTIONS

- .1 Where minor deflections in line or grade are required the pipe shall be deflected as required but not in excess of that recommended by the pipe manufacturer.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 31 23 33 – Excavating, Trenching and Backfilling

1.2 REFERENCES

- .1 These Specifications shall also apply to the Work.
 - .1 The latest revision of the City of Winnipeg Standard Construction Specifications shall apply to the Work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.

1.3 DESCRIPTION OF WORK

- .1 The Work described herein shall consist of the supply and construction of wastewater sewers, manholes, and all related accessories, as specified and as shown on the Drawings.
- .2 Prior to work of this Section, it is the Contractor's responsibility to site confirm locations of all existing underground services and natural features.

2 Products

2.1 PIPE

- .1 Polyvinyl Chloride Pipe shall be gasketed bell and spigot PVC SDR 35 in accordance with CAN/CSA B182.2 and ASTM D3034, latest editions.

2.2 FITTINGS

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35, latest edition.

2.3 BEDDING AND BACKFILL

- .1 Bedding and backfill material for gravity sewers installed in an open trench shall be as Specified in Section 31 23 33 – Excavating, Trenching and Backfilling.

2.4 MANHOLES

- .1 Manholes shall be standard pre-cast concrete 1200 mm diameter base and riser sections with flexible plastic gaskets between sections followed by a 1200 mm x 750 mm flat reducer on top, with solid frame and cover unit. Frame and cover units shall be Titan TF-101 or approved equivalent.

3 Execution

3.1 PREPARATION

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain the Contract Administrator's approval of pipes and fittings prior to installation.

3.2 METHOD OF PIPE INSTALLATION

- .1 Sewer mains to be installed within the site development shall be installed either by open trench excavation, with the appropriate class of backfill, or by trenchless methods.
- .2 The trenchless method proposed by the Contractor must maintain full roof and face support at all times to prevent sloughing of surrounding soils.

3.3 BEDDING AND BACKFILL

- .1 Bedding and backfill for gravity sewers installed in an open trench shall be as Specified in Section 31 23 33 – Excavating, Trenching and Backfilling.

3.4 INSTALLATION

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of the Contract Administrator.
- .2 Handle pipe using methods approved by the Contract Administrator.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

- .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipe during construction, except as may be permitted by the Contract Administrator.
- .7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CSA B182.11.
- .9 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 When stoppage of work occurs, block pipes as directed by the Contract Administrator to prevent creep during down time.
- .11 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .12 Make watertight connections to manholes.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .13 Use field connections approved by the Contract Administrator, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.5 DEPTH OF BURY

- .1 Sewers shall be installed to elevations shown on the drawing. If sewer inverts are not provided, the minimum depth of bury for gravity sewers shall be 2.50 metres, measured from finished ground level to top of pipe.

3.6 CONNECTIONS

- .1 Prior to installation, the Contractor shall expose the existing wastewater sewer at connection points to verify existing inverts. Where the Contractor is required to connect

to existing manholes, the Contractor shall confirm the invert(s) of pipe(s) in the manhole and notify the Contract Administrator of any error or omission prior to construction.

3.7 SEWER SERVICE INSPECTION

- .1 All new sewer service installations shall be inspected in accordance with the City of Winnipeg Construction Specifications.
- .2 All new sewer service pipe to have CCTV inspections completed and provided to the Contract Administrator for review prior to acceptance of the new sewer service.

END OF SECTION

1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 33 – Excavating, Trenching and Backfilling
- .2 Section 33 05 13 – Manholes and Catchbasin Structures
- .3 Section 33 31 13 – Public Sanitary Sewerage Gravity Piping

1.2 REFERENCES

- .1 These Specifications shall apply to the Work:
 - .1 The latest revisions of the City of Winnipeg Standard Construction Specifications shall apply to the work.
 - .2 The City of Winnipeg Standard Construction Specifications are available on the City of Winnipeg internet site at:
<http://www.winnipeg.ca/matmgt/spec/default.stm>
 - .3 Specifications, Drawings and Details included in this document shall govern over The City of Winnipeg Standard Construction Specifications.
 - .4 The sub-sections within The City of Winnipeg Standard Construction Specifications are to be used solely for their technical content regarding approved materials, products and construction methods.
- .2 ASTM International
 - .1 ASTM C117-13, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136 / C136M - 14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-12e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³)).
 - .4 ASTM D2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
 - .5 ASTM D3034-16, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .6 ASTM D3350-10, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .3 CSA International
 - .1 CSA A3000-13, Cementitious Materials Compendium.
 - .2 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.
 - .3 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings, and Means of Joining.
 - .4 CSA B1800-[11], Thermoplastic Non-pressure Pipe Compendium.
 - .1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.
 - .3 CSA B182.6-11, Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
 - .4 CSA B182.11-11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

2 Products

2.1 PIPE

- .1 Polyvinyl Chloride Pipe shall be gasketed bell and spigot PVC SDR 35 in accordance with CAN/CSA B182.2 and ASTM D3034, latest editions.
- .2 Storm service pipe shall be SDR35 PVC with diameters as shown on the drawings.

2.2 FITTINGS

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35, latest edition.

2.3 PIPE BEDDING AND BACKFILL

- .1 Bedding and backfill material for gravity sewers installed in an open trench shall be as Specified in Section 31 23 33 – Excavating, Trenching and Backfilling.

3 Execution

3.1 PREPARATION

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain the Contract Administrator's approval of pipes and fittings prior to installation.

3.2 METHOD OF PIPE INSTALLATION

- .1 Sewer mains to be installed within the site development shall be installed either by open trench excavation, with the appropriate class of backfill, or by trenchless methods.
- .2 The trenchless method proposed by the Contractor must maintain full roof and face support at all times to prevent sloughing of surrounding soils.

3.3 BEDDING AND BACKFILL

- .1 Bedding and backfill for gravity sewers installed in an open trench shall be as Specified in Section 31 23 33 – Excavating, Trenching and Backfilling.

3.4 INSTALLATION

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of the Contract Administrator.

- .2 Handle pipe using methods approved by the Contract Administrator
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipe during construction, except as may be permitted by the Contract Administrator.
- .7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CSA B182.11.
- .9 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .10 When stoppage of work occurs, block pipes as directed by the Contract Administrator to prevent creep during down time.
- .11 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .12 Make watertight connections to manholes.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .13 Use field connections approved by the Contract Administrator, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.5 DEPTH OF BURY

- .1 Sewers shall be installed to elevations shown on the drawing. If sewer inverts are not provided, the minimum depth of bury for gravity sewers shall be 2.50 metres, measured from finished ground level to top of pipe.

3.6 SEWER SERVICE INSPECTION

- .1 All new sewer service installations shall be inspected in accordance with the City of Winnipeg Construction Specifications.
- .2 All new sewer service pipe to have CCTV inspections completed and provided to the Contract Administrator for review prior to acceptance of the new sewer service.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Building perimeter and under-slab drainage systems.
- .2 Filter aggregate and fabric and bedding.

1.2 RELATED REQUIREMENTS

- .1 Section 31 23 33 - Excavating, Trenching and Backfilling: Backfilling over filter aggregate

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on pipe drainage products, and pipe accessories.
- .3 Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections.
- .4 Project record documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

Part 2 Products

2.1 REGULATORY REQUIREMENTS

- .1 Comply with applicable code for materials and installation of the work of this section.

2.2 PIPE MATERIALS

- .1 Corrugated plastic tubing: Flexible type; 150 mm diameter, with required fittings, and integral geotextile filter sock.
- .2 Use perforated pipe at subdrainage system; unperforated through sleeved walls, and under-slab where indicated.

2.3 ACCESSORIES

- .1 Pipe couplings: Solid plastic.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

3.2 PREPARATION

- .1 Hand trim excavations to required elevations 100 to 150 mm below intended elevation of bottom of tubing. Correct over-excavation as directed by Contract Administrator.
- .2 Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

- .3 Prepare bed using 100 to 150-mm layer of compacted filter gravel. Provide continuous, uniform bearing surface for tubing. Shape transverse depressions, as required, to suit joints.
- .4 Ensure tubing interior and coupling surfaces are clean before installing. Verify geotextile filter sock has no gaps or tears. Repair damaged filter sock material.

3.3 INSTALLATION

- .1 Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- .2 Place drainage pipe on prepared bedding material.
- .3 Lay pipe to slope gradients noted on drawings.
- .4 Place pipe with perforations facing down. Mechanically join pipe ends. Make joints in non-perforated tubing watertight.
- .5 Provide friction fit end plugs at open ends of pipe runs.
- .6 Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 300 mm.
- .7 Place aggregate in maximum 100 mm lifts, consolidating each lift.
- .8 Refer to Section 31 23 33 for compaction requirements. Do not displace or damage pipe when compacting.

3.4 PROTECTION

- .1 Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This specification shall include the supply and installation of landscape drain.

1.2 RELATED SECTIONS

- .1 N/A

1.3 REFERENCES

- .1 ASTM D1248-05, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
- .2 City of Winnipeg Standard Construction Specifications:
 - .1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction

1.4 SUBMITTALS

- .1 Submittals in accordance with submittal procedures specification.
- .2 Provide product data for all landscape drain components.

1.5 DELIVERY AND STORAGE

- .1 Deliver and store materials on site no earlier than one week prior to installation. Store stones in neat piles not exceeding 3m in height, within the staging area designated by the Contract Administrator.

1.6 CLEANING AND WASTE MANAGEMENT

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 NDS 305mm square catch basin model #1200, or approved equal.
- .2 NDS 305mm square catch basin atrium grate, colour green, model #1280 or approved equal.
- .3 NDS 305mm catch basin filter model # 1200F, or approved equal.
- .4 150mm Dia. PVC pipe and T-Connection.
- .5 Granular base to CW 3110.
- .6 NDS products available from NDS Inc. ph. 1.800.726.1994.

Part 3 Execution

3.1 GENERAL

- .1 Obtain approval of rough grading and sub-grade conditions from Contract Administrator prior to installation.

- .2 Fine grade area to be finished excavating or filling to depths indicated on the drawings and ensure positive drainage to outlet.
- .3 Verify that excavated base is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.2 INSTALLATION

- .1 Hand trim excavations to required elevations 100 to 150mm below intended elevation of bottom of tubing. Correct over-excavation as directed by Contract Administrator.
- .2 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .3 Install drainage products as shown on Drawings and per Manufacturer's recommendations. Review installation with Contract Administrator.
- .4 Place granular base in maximum 150mm lifts. Compact to required density prior to placing additional lifts.
- .5 Ensure pipe interior and coupling surfaces are clean before laying.
- .6 Lay pipe to minimum slope, as indicated on drawings, to discharge site. Make good any settlement that may occur in pipe trenches. Do not use shims to establish pipe slope.
- .7 Use manufacturer's recommended fittings. Connect pipes to landscape drains, sump pits to daylight outlets by appropriate adapters manufactured for these purposes.
- .8 Protect pipe ends and risers from damage and ingress of foreign material. Secure all joints and fittings with pipe glue and woven, commercial grade duct tape prior to backfilling.
- .9 Protect landscape drains and other inlet structures from contamination of backfill and other material by placing a piece of filter fabric inside the rim then securing the lid on top to hold the fabric. Remove fabric after surrounding construction is complete.
- .10 Place backfill material after pipe installation is approved by the Consultant by hand or using small landscape equipment in maximum 150mm lifts spreading material to form a stable mass between lifts.
- .11 Do not proceed with landscape finishes until backfilling has been approved.

3.3 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from site.

3.4 ACCEPTANCE

- .1 Drainage works will be accepted by Contract Administrator provided all drainage infrastructure is sloped and draining freely as designed.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Bridge crane system, with manual-driven underhung bridge beam, complete with runway and bridge beams, and electric chain hoist.

1.2 REFERENCE STANDARDS

- .1 ASME B30.16 - Overhead Underhung and Stationary Hoists 2022.
- .2 ASME B30.17 - Cranes and Monorails (With Underhung Trolley or Bridge) 2020.
- .3 CWB 112E - Welding Symbols Study Guide 2004.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Submit manufacturer's data and installation instructions for each type of hoist, trolley and accessory.
- .3 Shop Drawings: Indicate general arrangement of track beam system including clearances, principal dimensions, details of structural connections, anchors and methods of anchorage, component details, and electrical service requirements and connections. indicate welded connections with CWB 112E welding symbols; indicate net weld lengths.
 - .1 Shop Drawings to be signed and sealed by professional engineer licensed in the Province in which the Project is located.
- .4 Erection drawings: Indicate members by label, assembly sequence, and temporary erection bracing.
- .5 Certificate: Certify that products of this section meet or exceed specified requirements.
- .6 Delegated design documents: Drawings and calculations sealed by Designer.
- .7 Test reports.
- .8 Designer's qualification statement.
- .9 Manufacturer's qualification statement.
- .10 Installer's qualification statement.
- .11 Operation and maintenance data: Include complete description and sequence of operation together with wiring diagrams showing electrical connections, manufacturer s' instructions covering maintenance requirements, and parts catalogue giving complete list of repair and replacement parts with cuts and identifying numbers.

1.4 QUALITY ASSURANCE

- .1 Designer qualifications: Perform design under direct supervision of Professional Engineer experienced in design of this type of work and licensed in the Province in which the Project is located.
 - .1 Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.
- .2 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- .3 Installer qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Design and construct underhung crane system to ensure no impairment of strength of track or structural support.
- .2 Maximum allowable deflection: Not exceed $L/450$ of unsupported span, with hoist at rated load and at any location.

2.2 SYSTEMS

- .1 Single-girder underhung crane: Comprised of runway beams hung from OWSJ, manual-driven underhung bridge beam, end stops, sway bracing, trolley-mounted electric hoist and other components as required for a complete system, complying with ASME B30.17.
 - .1 Capacity: Minimum 250 kg including live load, impact and handling equipment weights.
 - .2 Length of bridge: indicated.
 - .3 Length of runway beams: indicated.
 - .4 Power supply: 220 V, 3 phase, 60 Hz.
 - .5 Trolley end stops at open end locations of bridge beam.
- .2 Hoist:
 - .1 Hoist: ASME B30.16, single speed motor, chain-type, for hook mounting from plain trolley, with upper and lower limit switches to prevent over travel, (automatic reset type), complete with steel chain container, load chain, upper hook, lower hook and block assembly; H4 (heavy) duty.
 - .2 Hoist capacity: Minimum rated 250 kg.
 - .3 Hoist lift: 5.8 m.
 - .4 Hoist lifting speed: 4.27 m/minute.
 - .5 Hoist motor: 0.34 hp.
 - .6 Load hook: Self-closing latch type safety hook.
 - .7 Suspension: Self-closing swivel latchlock hook.
 - .8 Products:
 - .1 Acculift, SER Heavy Duty Electric Chain Hoist, Model SER003S
 - .2 Substitutions: See Part B - Bidding Procedures.
- .3 Trolley:
 - .1 Designed to operate from runway section, plain type, low-headroom with steel plate side frames; universal tread flanged track-wheels equipped with shielded ball bearings for rolling on standard S-beam structural shapes, or flat flanged beams; hardened wheels and axles; suspension plate for use with hook suspended hoist.
- .4 Identification plates: Provide identification plates of non-corrosive metal with permanent lettering. Include following information:
 - .1 Hoist and trolley: Manufacturer's name, model number, capacity rating, and other essential information.

2.3 CONTROLS

- .1 Control equipment: mounted in enclosed compartment, which forms part of hoist including transformer for 110-volt control circuit.
- .2 Pendant push-button station: Suspended from control compartment, complete with supporting chain or cable, to locate station 1.2 metres above operating floor level (confirm operating floor level with Consultant). IP65 dust- and watertight.
 - .1 Clearly mark each push-button to indicate function, with sufficient buttons to control operations of hoist.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: Verify that building dimensions relate to reviewed Shop Drawings.

3.2 INSTALLATION

- .1 Install crane system in accordance with manufacturer's written instructions, and reviewed Shop Drawings.

3.3 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control for additional requirements.
- .2 Upon completion, and before final acceptance, complete initial inspection, and operational tests and load test of crane and hoist systems in accordance with ASME B30.17. Notify Contract Administrator minimum 48 hours before inspection and testing.
- .3 Provide test loads, operating personnel, instruments, and all other necessary apparatus required for testing at no additional cost to the City. Test and final adjustments of the equipment will be under the supervision of the Contract Administrator.
- .4 Non-conforming work: Rectify deficiencies found and completely retest work affected by such deficiencies at no additional cost.

3.4 ADJUSTING

- .1 Adjust system for smooth operation.

3.5 CLOSEOUT ACTIVITIES

- .1 See Section 01 79 00 - Demonstration and Training for additional requirements.
- .2 Demonstrate proper operation of equipment to City's designated representative.
- .3 Training: Train City's personnel on operation and maintenance of system.
 - .1 Training Reference: Operation and maintenance manual and additional training materials as required.
 - .2 Provide minimum of two hours of training.
 - .3 Instructor: Manufacturer's training personnel.
 - .4 Location: Project site.

END OF SECTION