



THE CITY OF WINNIPEG
ST JAMES CIVIC CENTRE FACILITY EXPANSION
2055 NESS AVENUE

RFP NO. 556-2024B

SPECIFICATIONS

ISSUED FOR CONSTRUCTION

SEPTEMBER 13, 2024

Introductory Information

00 01 10	Table of Contents	5
00 01 15	List of Drawing Sheets	3
00 31 00	Available Project Information	2

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

Division 01 - General Requirements

01 11 00	Summary of Work	4
01 21 00	Allowances	2
01 31 00	Project Management and Co-ordination	6
01 33 00	Submittal Procedures	4
01 33 29	General LEED Requirements	20
	Schedule S1 – Material Information Data Sheet	2
01 45 00	Quality Control	2
01 50 00	Temporary Facilities and Controls	7
01 57 13	Temporary Erosion and Sedimentation Control	7
	Schedule E1 – Erosion and Sedimentation Control Inspection Log	2
01 61 00	Common Product Requirements	6
01 64 00	City Furnished Products	6
01 74 00	Cleaning	2
01 74 19	Construction and Demolition Waste Management	4
01 78 00	Closeout Submittals	8
01 79 00	Demonstration and Training	2
01 81 19	Indoor Air Quality Requirements	11
01 91 13	General Commissioning Requirements	15

FACILITY CONSTRUCTION SUBGROUP

Division 02 - Existing Conditions

02 41 19	Selective Demolition	4
02 81 00	Hazardous Materials – General Provisions	16
02 82 00.01	Asbestos Abatement – Type 1 Precautions	4
02 83 11	Lead Abatement – Type 2 Moderate Risk Precautions	4
02 84 00	Non-Liquid Polychlorinated Biphenyl Abatement	6

Division 03 – Concrete

03 35 11	Concrete Floor Finishes	3
03 48 00	Precast Concrete Specialties	2

Division 04 – Masonry

04 20 00	Unit Masonry	6
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Division 05 – Metals

05 40 00	Cold-Formed Metal Framing	6
05 50 00	Metal Fabrications	6
05 51 00	Metal Stairs	6
05 75 00	Decorative Formed Metal	6

Division 06 - Wood, Plastics, And Composites

06 10 00	Rough Carpentry	5
06 40 00	Architectural Woodwork	16

Division 07 - Thermal And Moisture Protection

07 05 43	Cladding Support Systems	5
07 05 53	Fire and Smoke Assembly Identification	2
07 08 00	Commissioning of Thermal and Moisture Protection Systems	9
07 13 00	Sheet Waterproofing	4
07 16 16	Crystalline Waterproofing	2
07 21 00	Thermal Insulation	6
07 21 19	Foamed-In-Place Insulation	3
07 25 00	Weather Barriers	6
07 26 16	Below-Grade Vapour Retarders	3
07 42 13	Metal Wall Panels	6
07 42 33	Solid Phenolic Wall Panels	7
07 51 00	Built-Up Bituminous Roofing	7
07 52 00	Modified Bituminous Membrane Roofing	13
07 62 00	Sheet Metal Flashing and Trim	5
07 64 13	Standing Seam Sheet Metal Wall Cladding	6
07 84 00	Firestopping	8
07 92 00	Joint Sealants	7
07 95 13	Expansion Joint Cover Assemblies	4

Division 08 – Openings

08 06 10	Door Schedule	18
08 08 00	Commissioning of Openings	7
08 11 13	Hollow Metal Doors and Frames	8
08 11 74	Sliding Metal Grilles	3
08 14 16	Flush Wood Doors	4
08 31 00	Access Doors and Panels	5
08 33 13	Coiling Counter Doors	5
08 42 29	Automatic Entrances	9
08 43 13	Aluminum-Framed Storefronts	7
08 44 13	Glazed Aluminum Curtain Walls	9
08 44 35	Fire-Resistive Framed Glazing Assemblies	8
08 51 13	Aluminum Windows	6
08 71 00	Door Hardware	7
08 71 01	Door Hardware Sets	20
08 71 13	Automatic Door Operators	6
08 80 00	Glazing	14
08 83 00	Mirrors	2

Division 09 – Finishes

09 05 61	Common Work Results for Flooring Preparation	7
09 06 00	Room Finish Schedule	7
09 21 16	Gypsum Board Assemblies	9
09 22 16	Non-Structural Metal Framing	5
09 24 00	Cement Plastering	5
09 30 00	Tiling	9

09 51 00	Acoustical Ceilings	6
09 65 00	Resilient Flooring	10
09 65 66	Resilient Athletic Flooring	7
09 66 23	Resinous Matrix Terrazzo Flooring	6
09 68 13	Tile Carpeting	5
09 81 29	Sprayed Acoustic Insulation	3
09 84 30	Sound-Absorbing Wall and Ceiling Units	6
09 91 00	Painting	9

Division 10 – Specialties

10 14 00	Signage	2
10 21 13.17	Phenolic Toilet Compartments	4
10 22 39	Folding Panel Partitions	6
10 26 00	Wall and Door Protection	3
10 28 00	Toilet, Bath, And Laundry Accessories	6
10 44 00	Fire Protection Specialties	3
10 51 13	Metal lockers	3

Division 11 – Equipment

11 06 00	Equipment Schedule	3
11 66 23	Gymnasium Equipment	2

Division 12 – Furnishings

12 24 00	Window Shades	5
12 48 13	Entrance Floor Mats and Frames	2

FACILITY SERVICES SUBGROUP

Division 21 – Fire Suppression

21 05 00	Common Work for Mechanical	18
21 11 00	Fire Protection Piping	8
21 13 00	Sprinklers	5
21 14 50	Fire Extinguishers	4

Division 22 – Plumbing

22 05 81	Disinfection of Water Piping	3
22 10 00	Plumbing Piping	16
22 42 01	Plumbing Specialties	10
22 42 02	Plumbing Fixtures	5
22 47 00	Plumbing Equipment	4

Division 23 – Heating, Ventilating and Air Conditioning (HVAC)

23 05 16	Piping Expansion Compensation	5
23 05 19	Gauges and Meters	5
23 05 20	Hydronic Specialties	13
23 05 29	Supports and Anchors	10
23 05 48	Vibration Isolation	5
23 05 53	Mechanical Identification	3
23 05 93	Testing Adjusting and Balancing	13
23 07 13	Duct Insulation	11
23 07 16	Equipment Insulation	6
23 07 19	Piping Insulation	8

23 21 00	Hydronic Piping	10
23 21 23	HVAC Pumps	12
23 25 00	Chemical Treatment for Closed Systems	4
23 31 00	Duct Work	8
23 32 48	Sound Attenuators	4
23 33 00	Duct Work Accessories	8
23 34 16	Centrifugal Fans	10
23 37 00	Air Outlets and Inlets	6
23 55 10	Indirect Fired Air Units	8
23 82 00	Terminal Heat Transfer Units	6
23 82 16	Air Coils	4
Division 25 – Integrated Automation		
25 50 00	Instruments and Controls	58
25 90 00	Sequence of Operation	5
Division 26 – Electrical		
26 05 00	Common Work Results for Electrical	18
26 05 05	Selective Demolition for Electrical	3
26 05 19	Building Wire and Cable	6
26 05 26	Grounding and Bonding	4
26 05 29	Electrical Supporting Devices	2
26 05 33	Conduit	6
26 05 34	Boxes	4
26 05 53	Electrical Identification	6
26 05 80	Equipment Wiring	4
26 12 16	Transformer – Dry Type	4
26 24 16	Panelboards	5
26 27 16	Cabinets and Enclosures	3
26 27 26	Wiring Devices	6
26 51 13	Interior Luminaires	6
26 52 13	Emergency Lighting	7
26 56 29	Site Lighting	4
26 83 33	Electric Space Heating Units	3
Division 27 – Communications		
27 05 26	Grounding and Bonding for Communications Systems	2
27 05 28	Pathways for Communications Systems	2
27 10 05	Structured Cabling for Communication Systems	6
27 51 23	Public Address and Mass Notification	6
27 51 26	Assistive Listening Systems	3
Division 28 - Electronic Safety and Security		
28 10 00	Access Control	6
28 16 00	Intrusion Detection	4
28 46 00	Fire Alarm	7
Division 31 - Earthwork		
31 01 90	Tree Protection	3
31 22 13	Rough Grading	2
31 23 33.01	Excavation, Trenching and Backfilling	9

31 32 19.01	Geotextiles	3
Division 32 – Exterior Improvement		
32 11 23	Aggregate Base Courses	4
32 12 16	Asphalt Paving	4
32 14 13	Precast Unit Pavers	4
32 15 51	Riprap and Boulders	2
32 16 15	Concrete Walks, Curbs and Gutters	4
32 17 23	Pavement Marking	2
32 37 00	Exterior Site Furnishings	3
32 37 01	Exterior Site Traffic Signage	3
32 91 19	Topsoil and Finish Grading	4
32 92 23	Sodding	4
32 93 10	Tree, Shrub and Groundcover Planting	8
32 93 11	Landscape Maintenance	4
Division 33 – Utilities		
33 05 13	Manholes and Catch Basin Structures	3
33 31 13	Public Sanitary Utility Sewerage Piping	4
33 41 00	Storm Utility Drainage Piping	4
33 46 00	Subdrainage	2
APPENDICES		
Appendix 1A	New Additions and Building Geotechnical Investigation	49
Appendix 1B:	New Additions and Building Addendum No. 1 – Seismic Site Class	2
Appendix 2A	Hazardous Building Materials Assessment – Revision #2	97
Appendix 2B	Hazardous Building Materials Assessment – Pre-construction	82
Appendix 3	Phase 1 Environmental Site Assessment	154

END OF SECTION

COVER SHEET
TOPOGRAPHIC SURVEY

CIVIL

C1.0 SITE GRADING PLAN
C2.0 SITE SERVCING PLAN

LANDSCAPE

L1.1 EXISTING CONDITIONS & SITE DEMOLITION PLAN
L1.2 MATERIALS PLAN
L1.3 LAYOUT PLAN
L1.4 PLANTING PLAN
L1.5 SIGNAGE LAYOUT PLAN
L2.1 HARDSCAPE DETAILS
L2.2 SITE FURNITURE DETAILS
L2.3 SIGNAGE FLAGPOLE DETAILS
L2.4 SOFT LANDSCAPE DETAILS

ARCHITECTURAL

A0.1 MAIN FLOOR KEY PLAN
A0.2 LIFE SAFETY PLAN AND BUILDING CODE ANALYSIS

A1.0 CRAWLSPACE DEMOLITION PLAN
A1.1 MAIN FLOOR DEMOLITION PLAN
A1.2 MAIN FLOOR REFLECTED CEILING DEMOLITION PLAN
A1.3 ROOF DEMOLITION PLAN

A2.0 CRAWLSPACE CONSTRUCTION PLAN
A2.1 MAIN FLOOR CONSTRUCTION PLAN
A2.2 ROOF CONSTRUCTION PLAN

A3.1 CRAWLSPACE REFLECTED CEILING PLAN
A3.2 MAIN FLOOR REFLECTED CEILING PLAN
A3.3 CEILING DETAILS

A4.1 EXTERIOR ELEVATIONS
A4.2 BUILDING SECTIONS
A4.3 BUILDING SECTIONS & FRAME TYPES
A4.4 INTERIOR DOOR AND FRAME STYLES

A5.1 WALL SECTIONS
A5.2 WALL SECTIONS
A5.3 WALL SECTIONS
A5.4 WALL SECTIONS
A5.5 WALL SECTIONS
A5.6 PLAN DETAILS
A5.7 PLAN DETAILS
A5.8 PLAN DETAILS
A5.9 CRAWLSPACE DETAILS

- A5.10 ROOF DETAILS

- A7.1 ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS - WASHROOMS
- A7.2 ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS - KITCHEN
- A7.3 ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS - ADMINISTRATION

- A8.1 INTERIOR ELEVATIONS
- A8.2 INTERIOR ELEVATIONS
- A8.3 INTERIOR ELEVATIONS
- A8.4 INTERIOR ELEVATIONS
- A8.5 MILLWORK DETAILS
- A8.6 MILLWORK DETAILS
- A8.7 DETAILS
- A8.8 BENCH DETAILS
- A8.9 MILLWORK ELEVATIONS & DETAILS – CONCIERGE DESK
- A8.10 MILLWORK ELEVATIONS & DETAILS – ADMINISTRATION
- A8.11 ACOUSTIC WALL PATTERN AND DETAILS

- A9.1 MAIN FLOOR FINISH PATTERN

STRUCTURAL

- S1.1 GENERAL NOTES
- S1.2 SCHEDULES & TYPICAL DETAILS
- S1.3 TYPICAL DETAILS

- S2.1 FOUNDATION PLAN
- S2.2 MAIN FLOOR FRAMING PLAN
- S2.3 ROOF FRAMING PLAN
- S2.4 STEEL FRAMING ELEVATIONS
- S2.5 STEEL FRAMING ELEVATIONS

- S3.1 PLAN DETAILS
- S3.2 MAIN FLOOR SECTIONS
- S3.3 MAIN FLOOR SECTIONS
- S4.1 ROOF SECTIONS
- S4.2 ROOF SECTIONS

MECHANICAL

- M0.1 MECHANICAL SYMBOLS
- M1.1 ROOF PLAN

- ME2.1 MAIN FLOOR CEILING PLAN – MECH/ELEC COORDINATION

- MF1.1 EXISTING MAIN FLOOR - FIRE PROTECTION DEMOLITION PLAN
- MF2.0 CRAWLSPACE - FIRE PROTECTION PLAN
- MF2.1 MAIN FLOOR - FIRE PROTECTION PLAN
- MF4.1 DETAILS - FIRE PROTECTION PLAN

- MH1.0 EXISTING CRAWLSAPCE - HVAC DEMOLITION PLAN
- MH1.1 EXISTING MAIN FLOOR - HVAC DEMOLITION PLAN
- MH2.0 CRAWLSPACE - HVAC PLAN
- MH2.1 MAIN FLOOR - HVAC PLAN
- MH2.2 SECOND FLOOR - HVAC PLAN
- MH4.1 DETAILS - HVAC
- MH4.2 DETAILS - HVAC
- MH4.3 DETAILS - HVAC
- MH4.4 DETAILS -HVAC

- MP1.1 EXISTING MAIN FLOOR - PLUMBING DEMOLITION PLAN
- MP2.0 CRAWLSPACE - PLUMBING PLAN
- MP2.1 MAIN FLOOR - PUMBING PLAN
- MP4.1 DETAILS - PLUMBING
- MP4.2 DETAILS – PLUMBING

- MY1.1 EXISTING MAIN FLOOR – HYDRONIC DEMOLITION PLAN
- MY2.0 CRAWLSPACE - HYDRONIC PLAN
- MY2.1 MAIN FLOOR - HYDRONIC PLAN
- MY2.2 SECOND FLOOR - HYDRONIC PLAN
- MY4.1 DETAILS - HYDRONIC

- M5.1 MECHANICAL SCHEMATICS
- M5.2 CONTROLS SCHEMATICS
- M7.1 MECHANICAL SCHEDULES

ELECTRICAL

- E0.1 ELECTRICAL SYMBOLS AND ABBREVIATIONS
- E1.1 ELECTRICAL SITE PLAN

- ED2.1 MAIN FLOOR - DEMOLITION PLAN

- EL2.0 CRAWLSPACE - LIGHTING PLAN
- EL2.1 MAIN FLOOR - LIGHTING PLAN

- EP2.0 CRAWLSPACE - POWER & SYSTEMS PLAN
- EP2.1 MAIN FLOOR - POWER & SYSTEMS PLAN
- EP2.2 ROOF - POWER PLAN

- E4.1 ELECTRICAL DETAILS
- E4.2 ELECTRICAL DETAILS
- E5.1 ELECTRICAL DISTRIBUTION DIAGRAM
- E5.2 FIRE ALARM RISER DIAGRAM
- E6.1 ELECTRICAL SCHEDULES
- E6.2 ELECTRICAL SCHEDULES
- E6.3 ELECTRICAL SCHEDULES

END OF SECTION

Part 1 General

1.1 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 Data provided and opinions stated in following documents are sole responsibility of firms which prepared documents.
- .4 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.

1.2 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.

1.3 GEOTECHNICAL INVESTIGATION

- .1 Refer to Appendices for a copy of the following Geotechnical Investigation and addendum, prepared by Trek Geotechnical, on behalf of the City of Winnipeg.
 - .1 "*St. James Centre New Additions and Building Geotechnical Investigation*" dated May 9, 2018.
 - .2 "*St. James Civic Centre New Additions and Building Addendum No. 1 – Seismic Site Class*" dated February 22, 2024.

1.4 HAZARDOUS BUILDING MATERIALS ASSESSMENT

- .1 Refer to Appendices for a copy of the following Hazardous Building Materials Assessments prepared by Pinchin, on behalf of the City of Winnipeg, is attached at the end of this Section.
 - .1 "*Revision #2 Hazardous Building Materials Assessment, St. James Centre 2055 Ness Avenue, Winnipeg, Manitoba*" dated October 4, 2018.
 - .2 "*Hazardous Building Materials Assessment (Pre-construction), Expansion Project, St. James Centre 2055 Ness Avenue, Winnipeg, Manitoba*" dated May 23, 2023.
 - .3 *Specification Section 02 81 00, Hazardous Materials – General Provisions, 16 pages*
 - .4 *Specification Section 02 82 00.01, Asbestos Abatement – Type 1 Precautions, 4 pages*
 - .5 *Specification Section 02 83 11, Lead Abatement – Type 2 Moderate Risk Precautions, 6 pages*
 - .6 *Specification Section 02 84 00, Non-liquid Polychlorinated Biphenyl Abatement." 6 pages*

1.5 ENVIRONMENTAL SITE ASSESSMENT

- .1 Refer to Appendices for a copy of the following Environmental Site Assessment prepared by WSP, on behalf of the City of Winnipeg, is attached at the end of this Section.
 - .1 *"Phase 1 Environmental Site Assessment, St. James Civic Centre, Winnipeg, MB"* dated May 29, 2023.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Section 01 79 00 – Demonstration and Training.

1.2 REFERENCES

- .1 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
- .2 National Fire Protection Association (NFPA).

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The St. James Civic Centre Facility Expansion comprises of two building additions: the primary addition to the south, and a small addition to the north-east, just north of the existing hall.
 - .1 The primary single storey building addition to the south will extend the existing lobby, provide multi-purpose-rooms, a dance studio, a new pool viewing area, community kitchen and administration area. The addition will be of steel construction with concrete hollow core floor structure bearing on cast-in-place concrete foundation.
 - .2 The small addition to the east replaces an existing staff room with an office and new staff room. This addition will be of steel construction on a structural concrete slab.
 - .3 The project includes an interior renovation to the hall and hall washroom, including the demolition of the raised stage. Gender specific washrooms and existing kitchen are to become universal washrooms (gender neutral). The Hall is receiving new floor finish, lighting, coat storage millwork, and paint refresh, along as a new connection to the new community kitchen and multi-purpose room in the addition.
 - .4 Existing mechanical and electrical systems are being expanded to service the new additions and renovated areas, complete with new make-up air unit on the roof for servicing the community kitchen. Plumbing fixtures and equipment are included to suit the new layout.
 - .5 Site work include slight relocation of an existing natural gas line to accommodate the work, new lighting to suit the new parking lot layout, new concrete curbs, and landscaped allée creating a connection between the existing bus stop on ness avenue to the main building entrance, new soft landscape against the building and within parking aisle curbed islands.
 - .6 The sustainability goal of this project is to reach LEED Silver Certification.
- .2 This is a multi-phased project with a fully occupied building during construction.
 - .1 Phasing of the work is to be coordinated by the contractor. Prior to the start of Work, Contractor's proposed phasing plan is to be reviewed by the city and contract administrator for the purpose of coordinating city programming. The work is to have minimal impact on City programming.

- .2 City programming is scheduled in programming periods. Where major work is required in an area and the area requires to be closed to the public for the successful completion of the work, the area shall be closed to the public for the programming period, rather than being closed several times over the same programming period.
- .3 Seasonal blocks for the Pool, Fitness Room, and Hall are scheduled as follows:
 - Winter: January-March, inclusively
 - Spring: April-June, inclusively
 - Summer: July and August (Closed to the public)
 - Fall: September-December, inclusively
- .4 Seasonal blocks for the Arena (skating):
 - Fall/Winter: August-May, inclusively
 - Spring/Summer: June-July, inclusively (Closed to skating groups; alternate programming may occur. Access to Arena is to be maintained at all times unless otherwise permitted by City.)
- .3 Construct project in accordance with contract documents including project manual and project drawings for Civil, Landscape, Architectural, Structural, Mechanical and Electrical disciplines. Contractor and Subcontractors are responsible for co-ordination between trades. Distribution of documents by Contractor to their Subcontractors does not absolve Contractor or their Subcontractors from provisions stated in Division 01 – General Requirements of contract or co-ordination between parties.
- .4 *Part D: Supplemental Conditions, Part C: General Conditions for Construction*, and Division 01 – General Requirements sections apply to technical specification sections found in Project Manual.

1.4 CODES AND STANDARDS

- .1 Definition: Basis of Design Product: Specifically named manufacturer product, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating other acceptable products.
- .2 Work to meet or exceed requirements of applicable standards, building code, fire code and other codes and referenced documents. In event of conflict between any provisions of authorities, most stringent provision applies.
- .3 Safety of Work: perform work in accordance with the National Building Code of Canada including 2011 Manitoba Amendments, and other applicable regulations and requirements of other authorities having jurisdiction.
- .4 Fire Safety: comply with National Fire Protection Association (NFPA) codes and standards for fire safety.
- .5 Construction Safety:
 - .1 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Provincial Government Worker's Compensation Board, Workplace Safety and Health Act, Municipal Statutes and Authorities having jurisdiction.

1.5 SETTING OUT OF WORK

- .1 Before commencing work, contact utility companies to establish location and extent of existing utility or service lines in area of work. Be certain of their origin and destination.
 - .1 When breaking into or connecting to existing services or utilities, execute work at times directed by local governing authorities, with minimum of disturbance to work, and/or building.
 - .2 Protect, relocate or maintain existing active services.
 - .3 Cap off services, when indicated, in manner approved by authority having jurisdiction.
 - .4 Where unknown services are encountered, immediately advise Contract Administrator and confirm findings in writing.
 - .5 Record location of services in accordance with Section 01 78 00.
- .2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
 - .1 Provide devices needed to lay out and construct work.
 - .2 Supply stakes and other survey markers required for laying out work.

1.6 DEMONSTRATION AND TRAINING

- .1 Be responsible to provide comprehensive demonstration and training program to the City's personnel on operation and maintenance of Contractor supplied and installed equipment and systems in accordance with Section 01 79 00.

1.7 PLANNING OF WORK

- .1 Upon award of contract, immediately commence off-site work (preparation of shop drawings, ordering of materials, preparation of requested documents, etc.). On-site work is expected to commence as soon as possible upon award of contract. Co-operate with the City in scheduling work.
- .2 Plan work to ensure that emergency access and egress required by the City and by the authorities having jurisdiction are maintained, and all life safety and building occupancy requirements of all applicable codes and regulations are in force for construction areas and adjacent floor areas.

1.8 ACCESS TO WORK

- .1 Allow the City, Contract Administrator or both access to work, or other places where work is being fabricated in connection with contract for purposes of inspection and examination of workmanship and materials.
- .2 Maintain safety helmets on job site, ready for use, to be used in compliance with Workplace Safety and Health regulations.

1.9 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.
- .2 Contract Administrator will apply for foundation permit in advance of full permit.

1.10 NO SMOKING POLICY

- .1 Fully co-operate, respect and comply with Smoke-Free Workplace policy requirements established by the City throughout its facilities. Smoking is not permitted anywhere within the City's facilities or on the City's property.
- .2 Smoke-free workplace policy applies to everyone who works in workplace and to visitors.
- .3 During full term of contract, ensure that Contractors' employees, Subcontractors and Suppliers, performing work on site on Contractors' behalf, are instructed to comply with Smoke-Free Workplace policy requirements.

1.11 NO ENTERTAINMENT DEVICES

- .1 Fully co-operate, respect, and comply with the City's request that no entertainment devices (e.g. portable radios, stereos, MP3 players, etc.) will be played on site at any time by Contractor's work force or sub-contractors.

1.12 OCCUPANCY BY THE CITY

- .1 The City has right to enter and occupy building in whole or in part before substantial performance of work provided that, in opinion of Contract Administrator, such entry and occupancy does not prevent or interfere with Contractor in completion of contract.
- .2 Such occupancy by the City is not considered as acceptance of work and will not relieve Contractor from responsibility to complete contract or as acknowledgement of fulfillment of terms of contract.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Refer to *Form B: Prices* and *E5: Cash Allowance for Additional Work*.

1.2 CASH ALLOWANCES

- .1 Total amount of cash allowance will be separated from Total Bid Price, by Contract Administrator, with first Change in Work, and retained for sole purpose of paying for scheduled items of extra work when authorized by the City and as directed by Contract Administrator in subsequent Change in Work.
- .2 Total Bid Price to include Contractor’s overhead and profit in connection with cash allowances, rather than being included with cash allowance.

1.3 SCHEDULE OF ALLOWANCES

(excluding GST)

.1	Ground Seepage Testing during construction	\$2,500.00
.2	Concrete Testing	\$15,000.00
.3	Concrete Base Compaction and Concrete Pavement Testing	\$10,000.00
.4	Asphalt Base Compaction Testing	\$2,500.00
.5	Asphalt Pavement Testing	\$2,500.00
.6	Structural Steel Inspections	\$15,000.00
.7	Pile/Soil Testing and Inspection	\$25,000.00
.8	Roof Inspections	\$6,000.00
.9	Window Testing (Smoke, Pressure, Water)	\$15,000.00
.10	Exterior Building Signage	\$20,000.00
.1	“SJCC – St.James Civic Centre” signage on building upon entry	
.11	Exterior Site Pylon Sign (at Street)	\$90,000.00
.1	Structural pile, pylon sign structure, digital board, power and data	
.12	Exterior Site Signage	\$5,000.00
.1	Small scale parking lot signage, stall identifications, no smoking signs. Etc.	
.13	Concrete Testing for Flooring Preparation (moisture, pH, flatness, porosity, bond)	\$10,000.00
.14	Hazardous Materials Abatement, abatement work only.	\$60,000.00
.1	Inspections and air monitoring by Environmental Consultant engaged by City	
.15	Relocation of natural gas line	\$25,000.00
.16	Installation of Mop Sink in 2 nd Floor Service Room	\$10,000.00

.17 Investigation and Remediation of existing roof/water leak at existing lobby desk \$20,000.00

Scope may include any or all of the below, and not limited to:

1. Isotope leak testing on the existing roof from Grid Line 5-8, and Grid Line H-P, to confirm location and extent of an existing leak in the roofing system; Contractor to perform and co-ordinate testing with report to be provided to City and Contract Administrator's review.
- .2 Removal and salvaging of existing exterior metal cladding from vertical wall section along Grid Line 8 and Grid Line H.5-M.5. Contract Administrator to be notified once removal has been completed, so existing substructure and insulation can be reviewed and assessed for suitability for reuse; existing salvaged cladding to be reinstalled complete with associated flashings.
- .3 Removal of existing roofing 900 mm South of Grid Line 8 and Grid Line H.5-M.5; removal to include cap sheet, stripping, insulation and vapour barrier membrane; Contract Administrator review to be completed to review potential insulation saturation.
- .4 Reconstruction of roofing membranes, inclusive of new through wall flashing, supply and install of compatible modified bitumen roofing.

Total: **\$333,500.00**

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 78 00 – Closeout Submittals.

1.2 CONSTRUCTION SCHEDULE

- .1 Refer to *D24: Job Meetings, in Supplemental Conditions*.
- .2 Affix copy of construction schedule to wall of construction office during construction period and keep up to date and reviewed at each progress meeting.

1.3 START-UP MEETING

- .1 After award of Contract, but before start of Work, convene a start-up meeting to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the Contract Administrator, the City, Contractor, major Subcontractors are to attend.
 - .1 Agenda:
 - .1 Appointment of official representatives of participants in the work.
 - .2 Schedules of work, progress scheduling.
 - .3 Schedule of submission of shop drawings, product data, samples, test reports,
 - .4 Schedule for provision of mock-ups and field samples.
 - .5 Requirements for temporary utilities, temporary barriers and controls, construction facilities, site sign and other temporary construction.
 - .6 Record drawings.
 - .7 Maintenance Manuals.
 - .8 Take-over procedures, acceptance, warranties.
 - .9 Monthly progress claims, administrative procedures, holdbacks.
 - .10 Sustainable requirements.
 - .11 Commissioning.
- .3 Establish time and location of meeting and notify all concerned parties within five (5) Working Days of meeting.
- .4 Chair meeting, record minutes, and distribute minutes to all attending parties within four (4) Working Days after meeting.

1.4 CONSTRUCTION PROGRESS MEETINGS

- .1 Schedule and administer project meetings once every week throughout progress of work. Provide physical space for meetings.
- .2 Contractor, Subcontractors involved in work, Contract Administrator and the City are to be in attendance.
- .3 Person attending meetings to be empowered to act on behalf of organizations they represent.
- .4 Prepare agenda and record minutes of meetings and circulate to attending parties and affected parties not in attendance within four (4) days after meeting.

- .5 Meeting agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Significant proceedings and decisions. Identify action by parties.
 - .5 Problems which impede construction schedule.
 - .6 Review of off-site fabrication delivery schedules.
 - .7 Corrective measures and procedures to regain projected schedule.
 - .8 Revision to construction schedule.
 - .9 Progress schedule, during succeeding work period.
 - .10 Review submittal schedules: expedite as required.
 - .11 Maintenance of quality standards.
 - .12 Review proposed changes for effect on construction schedule and on completion date.
 - .13 Construction Safety.
 - .14 New business.

1.5 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy of each of following:
 - .1 Contract Drawings.
 - .2 Project Manual
 - .3 Addenda
 - .4 Reviewed shop drawings
 - .5 Proposed change notices
 - .6 Change orders
 - .7 Other modifications to contract
 - .8 Field test reports
 - .9 Copy of approved work schedule
 - .10 Manufacturers' installation and application instructions

1.6 JOB LOG

- .1 Keep permanent, written record on site of progress of work. Make record available for inspection by Contract Administrator and the City. Show dates of commencement and completion of all trades and parts of work, particulars regarding daily weather conditions, changes in work, field instructions, major deliveries, as well as number of employees of various trades involved.

1.7 REQUEST FOR INTERPRETATION PROCESS

- .1 General:
 - .1 Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Contract Administrator in the form specified.
 - .2 Contract Administrator will return RFIs submitted to Contract Administrator by other entities controlled by Contractor with no response. The RFI will then be considered closed.
 - .3 Co-ordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

- .4 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 (including building number).
 - .2 Project number.
 - .3 Date.
 - .4 Name of Contractor.
 - .5 Name of Contract Administrator.
 - .6 RFI number, numbered sequentially. (eg: RFI-001)
 - .7 RFI subject.
 - .8 Specification Section number, 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 Contract Time or the Contract Price, Contractor shall state impact in the RFI.
 - .12 Contractor's signature.
 - .13 Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, co-ordination 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 shall be electronic files in PDF format.
- .4 Contract Administrator's Action: Contract Administrator will review each RFI, determine action required, and respond. Allow ten (10) 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 co-ordination information already indicated in the Contract Documents.
 - .6 Requests for adjustments in the Contract Time or the Contract Sum.
 - .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 Contract Time or the Contract Sum, notify Contract Administrator in writing within 10 days of receipt of the RFI response. Failure to notify will result in the work being included as part of the contract.
- .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 ten (10) Working Days if Contractor disagrees with response.

1.8 LIFE SAFETY TESTING

- .1 Refer to the City of Winnipeg Life Safety Tests in Buildings document. Arrange and carry out life safety test with City of Winnipeg in accordance with this document. Provide all necessary management and co-ordination. Arrange all necessary involvement from sub-trades. Prepare test procedures and submit for review six (6) weeks prior to test date.
- .2 Arrange and carry out pre-'dry run' tests and submit written confirmation to Contract Administrator that test has adhered to procedures and that the system is correctly operating.
- .3 Arrange and conduct 'dry run' tests which will mimic the full life safety test. 'Dry run' test shall be conducted in presence of Contractor and Contract Administrator only.
- .4 Create procedures to demonstrate the operation of the life safety system. Procedures shall include, but shall not be limited to:
 - .1 Emergency and exit lighting including measurements where applicable.
 - .2 Operation of emergency power system.
 - .3 Operation of fire alarm including demonstration of all controls and interfaces with other systems including, but not limited to operation of smoke control systems, fire pump and security systems.
- .5 Demonstrate all systems under normal and essential power modes.
- .6 Tests shall not commence until fire alarm system is verified and free of all defects. Submit final verification report to Contract Administrator five (5) working days prior to life safety test for review.
- .7 Provide all fuel, personnel, communications equipment and attendance required.

1.9 SUBTRADE AND SUPPLIERS LIST

- .1 Submit within three (3) Working Days after contract award, all addresses, phone, email, and name of person in charge of subtrades and suppliers used on this project.

1.10 CONSTRUCTION PHOTOGRAPHS

- .1 Maintain and submit to Contract Administrator visual record of construction progress in following formats:
- .2 Use digital camera with capability of producing digital images at minimum 5.0 megapixels, uncompressed, saved in jpeg format.
- .3 Copy each set of images onto a USB drive.

- .4 Identify each USB with name and number of project, date of exposure, set number.
- .5 Pre-Construction Photographs
 - .1 Provide photographs of existing site and general photos prior to start of construction work.
 - .2 Provide photos of all mechanical and electrical panels, devices, prior to demolition. Photos to provide general context of location and a close up for model/brand and condition.
 - .3 Allow for minimum 30 interior and 15 exterior images.
 - .4 Viewpoints:
 - .1 Panoramic view of site from each compass point.
 - .2 Close ups of specific site details and surface features in locations as determined by Contract Administrator.
- .6 Construction Progress Photographs
 - .1 Provide photographs of construction during progress of the work, including site features.
 - .2 Allow for approximately 50 images for each set.
 - .3 Number of sets required (frequency): provide one set monthly with progress statement, plus one set of additional photograph as specified below.
 - .4 In addition to monthly progress images provide additional sets of photographs for:
 - .1 Completion of major elements of the Work such as:
 - .1 Main floor construction.
 - .2 Structural framing.
 - .3 Mechanical and electrical services before concealment.
 - .2 During installation of specific elements of the Work, as determined by Contract Administrator, including but not necessarily limited to:
 - .1 City Furnished Products (CFP).
 - .2 Major elements of interior work.
 - .5 Number of viewpoints: interior and exterior viewpoints including close ups of specific details, in locations as determined by Contract Administrator.
- .7 Photographs of Mock Ups.
 - .1 Number of sets required: one for each mock-up.
 - .2 Allow for approximately 25 images of each set.
 - .3 Number of viewpoints:
 - .1 Each interior elevation, including finishes on walls, floors and ceilings.
 - .2 Mechanical and electrical service outlets (gas, vacuum, switches, etc.)
 - .3 Equipment.
 - .4 Close ups of specific details and features, in locations as determined by Contract Administrator.
- .8 Final Photographs
 - .1 Number of sets required: one.
 - .2 Allow for approximately 100 images for each set.
 - .3 Number of viewpoints:
 - .1 Exterior elevations of each affected side of building.
 - .2 Interior of rooms and finishes as determined by Contract Administrator. Allow for approximately ten (10) photographs of each room.
 - .3 Close ups of specific details as determined by Contract Administrator.
 - .4 Locations of viewpoints as determined by Contract Administrator.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 31 00 – Project Management and Co-ordination.
- .3 Section 01 78 00 – Closeout Submittals.

1.2 ADMINISTRATIVE

- .1 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as not to 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. Work affected by submittals to proceed only after review is complete.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Contract Administrator. Stamp and sign submittals certifying review of submission. This review represents that necessary requirements have been checked and co-ordinated with requirements of work and contract documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of contract documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent work is co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator review of submittals.
- .9 Contractor's responsibility for deviation in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .10 Keep one reviewed copy of each submission on site.

1.3 REQUEST FOR INTERPRETATION PROCESS

- .1 Contractor shall prepare and submit an RFI in accordance with Section 01 31 00.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data provided by Contractor to illustrate details of portion of work.
- .2 Shop drawings that do not include the stamp, date, and signature of the person responsible for reviewing the shop drawings before submittal to the Contract Administrator, will be rejected and returned without being examined.

- .3 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada where specifically requested in the specifications. Shop drawings not bearing the required Engineer's stamp will be rejected and returned without being examined.
- .4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .5 Submit one (1) electronic copy (e.g. Adobe PDF format) of shop drawings for each requirement requested in specification sections and as the Contract Administrator may reasonably request. A hardcopy and electronic copy of shop drawings are to be included in Operation and Maintenance Manual as specified in Section 01 78 00.
- .6 Submit one (1) electronic copy (e.g. Adobe 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.
- .7 Submit one (1) electronic copy (e.g. Adobe PDF) of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within three (3) years of date of contract award for project.
- .8 Submit one (1) electronic copy (e.g. Adobe PDF format) of certificates for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract, complete with project name.
- .9 Submit one (1) electronic copy (e.g. Adobe PDF format) of manufacturers' instructions for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .10 Submit one (1) electronic copy (e.g. Adobe PDF format) of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .11 Allow minimum of ten (10) Working Days for Contract Administrator's review of each submission or a reasonable longer period of time for large or complex submissions.
- .12 For Contractors' use in preparation of drawings required under contract, Contractors may obtain from Contract Administrator, electronic AutoCAD drawing files subject to following:
 - .1 Removal by Contract Administrator of Contract Administrators' professional seals from electronic drawing file; and
 - .2 Receipt of Licence Agreement prepared by Contract Administrator and signed by Contractor(s) or user(s) of electronic files; and

- .3 Receipt of payment to Contract Administrator from each separate Contractor requesting an electronic drawing file, an amount of \$250.00 for first electronic file or drawing sheet requested plus an additional \$200.00 for each subsequent electronic file or drawing sheet requested at same time.
- .13 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.
- .14 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.
- .15 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 samples.
 - .5 Other pertinent data.
 - .6 Identify on each shop drawing the related specification section (number and title) for which the product/material applies.
- .16 Submissions to include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of Subcontractor, Supplier, 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, relation to adjacent structure or materials.
 - .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 Relation to adjacent structure or materials.
- .17 After Contract Administrator's review, distribute copies to subtrades as required.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copy will be returned and fabrication and installation of work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of work may proceed.

- .21 No extension of Contract Time will be allow for delays in the Work which may be caused for Contract Administrator's rejection of shop drawings.
- .22 Shop drawings which contain deviations from the Contract Documents which are not presented to the Contract Administrator in writing, will rejected and returned without being examined.

1.5 SAMPLES

- .1 Submit samples for review 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 materials against which installed work will be verified.

1.6 MOCK-UPS

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

1.7 CONSTRUCTION PHOTOGRAPHS

- .1 Submit construction photographs in accordance with Section 01 31 00.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

- .1 LEED requirements and procedures

1.2 RELATED SECTIONS

- .1 Section 01 57 13 - Temporary Erosion and Sediment Control
- .2 Section 01 74 19 - Construction and Demolition Waste Management
- .3 Section 01 81 19 - Indoor Air Quality Requirements
- .4 Division 03 – Concrete
- .5 Division 04 – Masonry
- .6 Division 05 – Metals
- .7 Division 06 – Wood, Plastics and Composites
- .8 Division 07 – Thermal and Moisture Protection
- .9 Division 08 – Openings
- .10 Division 09 – Finishes
- .11 Division 10 – Specialties
- .12 Division 12 – Furnishings
- .13 Division 22 – Plumbing
- .14 Division 23 – HVAC

1.3 DEFINITIONS

- .1 Canada Green Building Council (CaGBC): balanced, consensus based not-for-profit organization whose mission is to lead and accelerate the transformation to high-performing, healthy green buildings, homes and communities throughout Canada.
- .2 CDPH Standard Method v1.2: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.2–2017, for the emissions testing and requirements of products and materials.
- .3 Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
- .4 Composite Wood and Agrifibre: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.
- .5 Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer’s product and the product’s supply chain.

- .6 Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
 - .1 Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - .2 Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - .3 Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicitly recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- .7 Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.
- .8 Extraction Location: point(s) of origin of the material inputs that are transported to Manufacturing Location to create the product.
- .9 Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.
- .10 In-House Process Recycled Content: percentage by mass of in-house material (i.e. trimmings, cutoffs, and scrap) that is returned to the production process as a part of internal housekeeping.
- .11 LEED® Credit Forms: online form that supports the required declarations for each of the prerequisites and credits.
- .12 LEED® Credit: fundamental LEED® criteria that describe practices deemed to reduce the project's environmental, health and resource impacts. Each credit in the LEED® rating system has a defined number of possible points that may be awarded upon successful review of submittal documents demonstrating the credits' requirements were followed.
- .13 LEED® Divisions: CSI Master Format 2012 Division 3-10, 31, 32 and Division 11, 21-28.
- .14 LEED® Online: USGBC's web-based service that employs a series of active PDF forms to allow project teams to fill out credit forms and upload supporting documentation online.
- .15 LEED® Prerequisite: minimum requirement in a particular LEED® category. Meeting the requirements of a prerequisite does not contribute points to a project's score however all prerequisite requirements must be met for a project to be eligible to receive LEED® Canada certification.
- .16 LEED® Total Construction Cost: cost associated with the LEED® Divisions.
- .17 LEED® Total Materials Cost: actual materials cost (excluding labor and equipment) from the divisions included for calculating the LEED® Total Construction Cost. Project teams can apply a 45% factor to the LEED® Total Construction Cost (including labor and equipment) to establish a LEED® Total Materials Cost.

- .18 LEED: Leadership in Energy & Environmental Design is a voluntary, consensus-based, and market-responsive set of criteria that evaluate a project's environmental performance from a whole-building perspective. Successful projects are awarded credits towards LEED® Certification after detailed design and construction documentation, describing the building's performance attributes, are reviewed and accepted by a third party – the Green Building Certification Institute (GBCI)
- .19 Location Valuation Factor: products and materials that are extracted, manufactured, and purchased within 100 miles (160 kilometers) of the project are valued at 200% of their cost (i.e., the valuation factor is 2) in all cost-based Materials and Resources credits.
- .20 Manufacturing Location: last point of processing or assembly (i.e. a sawmill that turns harvested trees into framing lumber which is then used on-site)
- .21 Permanently Installed Building Product: An item that arrives on the project site either as a finished element ready for installation or as a component to another item assembled on-site. The product unit is defined by the functional requirement for use in the project; this includes the physical components and services needed to serve the intended function of the permanently installed building product. In addition, similar product within a specification, each contributes as a separate product.
- .22 Post-Consumer Recycled Content: percentage by mass of recycled material derived from previously used consumer products (i.e. aluminum and steel cans, glass and plastic bottles, asphalt from demolished sites, paper, carpet etc.)
- .23 Pre-Consumer Recycled Content: percentage by mass of recycled material derived from outside industrial sources (i.e. sawmill dust used in MDF board, blast furnace slag in mineral wool insulation, coal fly ash in concrete mixes etc.)
- .24 Recycled Content: sum of post-consumer recycled content plus one-half the pre-consumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
- .25 Supplementary Cementitious Materials (SCMs): materials such as fly ash, ground granulated blast furnace slag, and silica fume) used to reduce the amount of Portland Cement in cementitious materials.
- .26 Total Volatile Organic Compounds (TVOCs): A range of VOC content, measured as specified in California Department of Public Health (CDPH) Standard Method v1.2-2017, expressed in units of mg/m³.
- .27 U.S. Green Building Council (USGBC): private, membership-based non-profit organization that promotes sustainability in buildings design, construction, and operation. Best known for its development of the Leadership in Energy and Environmental Design (LEED) green building rating systems.
- .28 Urea-Formaldehyde (UF): combination of urea and formaldehyde the readily decomposes at room temperature. It is found in some glues/resins used to manufacture furniture, composite woods (e.g. particle board), agrifiber products and laminated assemblies. UF has detrimental effect on human health and may include symptoms such as eye, nose, and throat irritation, wheezing and coughing, fatigue, skin rash and severe allergic reaction.
- .29 Volatile Organic Compounds (VOCs): organic chemicals that produce vapors readily at room temperature and normal atmospheric pressure (e.g. gasoline, solvents, etc.). VOCs react with sunlight and nitrogen to form ground-level ozone, a chemical that has detrimental effect on human health, agricultural crops, forests, soil, groundwater and ecosystems.

- .30 Weatherproofing System: a system which protects the building from the exterior environment (wind and water) and is defined as the air barrier within the wall and roof assemblies.

1.4 ACRONYMS

- .1 Used in the LEED® Reference Guide for Building Design and Construction v4 and v4.1, this Section and related Sections identified under Paragraph 1.2 Related Sections.

ACRONYMS	
IP	Integrative Process
LT	Location and Transportation
SS	Sustainable Sites
WE	Water Efficiency
EA	Energy and Atmosphere
MR	Materials and Resources
EQ	Environmental Quality
IN	Innovation
RP	Regional Priority

1.5 REFERENCES

- .1 U.S. Green Building Council. Reference Guide for Building Design and Construction, v4 and v4.1 Beta Guide.
- .2 LEED® Online Forms. <http://www.usgbc.org/leedonline.new>
- .3 LEED® Credit Library: LEED® Interpretations, Credit Requirement Summaries, Reference Guide Addenda and Errata. <http://www.usgbc.org/credits>
- .4 USGBC Building Product Disclosure and Optimization Calculator. <http://www.usgbc.org/resources/bpdo-calculator>
- .5 UL Sustainable Product Database: searchable database of building products with various types of documentation that may be suitable for LEED® v4 and v4.1. <http://www.ul.com/global/eng/pages/offerings/businesses/environment/databasesearch/>
- .6 Global Reporting Initiative Sustainability Disclosure Database: searchable database of Corporate Sustainability Reports which may be compliant with LEED® v4 and v4.1. <http://database.globalreporting.org/search>
- .7 Pharos Project: searchable database of Manufacturer Inventories which may be compliant with LEED® v4 and v4.1. <https://www.pharosproject.net/>
- .8 Cradle to Cradle Certified Products Registry: searchable database of C2C Certified products. <http://www.c2ccertified.org/products/registry>
- .9 HPD Collaborative: manufacturer resource for the creation of Health Product Declarations. <http://hpdcollaborative.org/>
- .10 Declare: searchable database of Declare certified products which may be compliant with LEED® v4 and v4.1. <https://access.living-future.org/declare-products>
- .11 Forest Stewardship Council. www.fsc.org.

- .12 South Coast Air Quality Management District (SCAQMD) Rules 1168, October 6, 2017 and Rule 1113, February 5, 2016. <http://www.aqmd.gov/home/regulations/rules/scaqmd-rule-book/table-of-contents>.
- .13 California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings.
- .14 California Department of Public Health (CDPH) Standard Method v1.2-2017. <http://www.cdph.ca.gov/programs/IAQ/Pages/default.aspx>
- .15 Canadian VOC Concentration Limits for Architectural Coatings. <http://ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=117>
- .16 FloorScore Program – Resilient Floor Covering Institute. <http://www.rfci.com/knowledge-center/floorscore/>
- .17 NSF-332 Sustainability Assessment for Resilient Floor Coverings. <http://www.nsf.org/services/by-industry/sustainability-environment/sustainability-standards-protocols/floor-coverings/>
- .18 California Air Resources Board (CARB) ATCM 93120 Formaldehyde Requirements. <http://www.arb.ca.gov/toxics/compwood/compwood.htm/>
- .19 SCS Indoor Advantage Program. <http://www.scsglobalservices.com/certified-indoor-air-quality>
- .20 UL Greenguard Gold Certification Program. http://www.greenguard.org/en/CertificationPrograms/CertificationPrograms_childrenSchools.aspx
- .21 ANSI/BIFMA M7.1-2011 (R2016) Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components and Seating. www.bifma.org
- .22 ANSI/BIFMA e3–2014e Furniture Sustainability Standard: [bifma.org](http://www.bifma.org)
- .23 Chemical Abstracts Service (CASRN): cas.org/
- .24 GreenScreen: cleanproduction.org/Greenscreen.v1-2.php
- .25 Health Product Declaration: hpdcollaborative.org/
- .26 ISO 16000 parts 3, 6, 7, 11: iso.org
- .27 ISO 17025: iso.org
- .28 ISO Guide 65: iso.org
- .29 Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH): echa.europa.eu/support/guidance-on-reach-and-clp-implementation

1.6 OBJECTIVES

- .1 Construct a building that uses land, water, energy and material resources appropriately and efficiently and provides a safe, comfortable and productive indoor environment for building occupants in accordance with LEED® requirements.
- .2 Be responsible, either in whole or in part, for the following LEED® credits targeted for this Project with regards to coordination, training, verification and execution:
 - .1 SSp1 Construction Activity Pollution Prevention
 - .2 EAp1 Fundamental Commissioning and Verification
 - .3 EAc1 Enhanced Commissioning
 - .4 MRp2 Construction and Demolition Waste Management Planning

- .5 MRc2 Building Product Disclosure and Optimization – Environmental Product Declarations
- .6 MRc3 Building Product Disclosure and Optimization – Sourcing of Raw Materials
- .7 MRc4 Building Product Disclosure and Optimization – Material Ingredients
- .8 MRc6 PBT Source Reduction – Lead, Cadmium, and Copper
- .9 EQc1 Enhanced Indoor Air Quality Strategies
- .10 EQc2 Low-Emitting Materials
- .11 EQc3 Construction Indoor Air Quality Management Plan
- .12 EQc4 Indoor Air Quality Assessment
- .3 Source and select materials that meet sustainable criteria detailed herein
 - .1 No single manufacturer, fabricator, or subcontractor can fulfill the total requirements for LEED® certification for the project. LEED® certification requires the cooperation and diligence of all project participants for a successful application and acceptance for LEED® certification.
 - .2 Failure to provide products or methods of construction contributing towards LEED® prerequisites will result in The City achieving a Certification less than that specified or none at all. The City reserves the right to seek compensation where failure to achieve Certification is a result of direct neglect or misrepresentation of any material or construction method.
- .4 Review and sign off on LEED® Forms for credits listed above using LEED® Online as an accurate indication of construction performance.

1.7 DESCRIPTION OF WORK

- .1 A LEED® Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all construction activities associated with LEED® certification.
- .2 LEED® coordination activities shall include:
 - .1 Coordinate with subcontractors and ensuring the successful implementation of LEED® strategies, programs and plans
 - .2 Report construction activity progress to the Contract Administrator as it relates to the LEED® aspects of the Project
 - .3 Supply the LEED® documentation and submittals outlined within this specification and related sections to the Contract Administrator to demonstrate that LEED® requirements have been met
 - .4 Other duties as detailed in the related Sections listed in Paragraph 1.2 Related Sections
- .3 The LEED® requirements in this section and the related sections under Paragraph 1.2 Related Sections shall apply to all Sections and Work for this Project, whether specifically indicated or not.
- .4 Compliance with requirements needed to obtain LEED® prerequisites and credits will be used as one criterion to evaluate requests for substitutions or alternates.

1.8 LEED® KICK-OFF MEETING

- .1 Prior to mobilization on-site, the Contractor and the LEED® Champion shall hold a kick-off meeting with the Contract Administrator to review the LEED® requirements. This meeting shall include a review of:
 - .1 LEED® certification and performance objectives
 - .2 LEED® requirements and procedure
 - .3 LEED® documentation and submittals

1.9 LEED® COORDINATION MEETING

- .1 Prior to start of construction, the Contractor and the LEED® Champion shall hold a coordination meeting with the construction team to explain the LEED® requirements to the Sub-Contractors. This meeting shall include a review of:
 - .1 LEED® certification and performance objectives
 - .2 LEED® requirements and procedures
 - .3 LEED® documentation and submittals
- .2 The Contractor shall ensure that the appropriate Sub-Contractors attend this meeting. If Sub-Contractors are unable to attend this meeting, the Contractor shall make arrangements to host additional LEED® Coordination Meetings to suit.

1.10 SUBMITTALS

- .1 Contractor to provide a LEED® Action Plan a minimum of 14 days prior to the start of construction to the Contract Administrator, a preliminary plan outlining the contribution of each trade to credits listed under Paragraph 1.6.2.
 - .1 The plan shall be based on projected materials and budgets
 - .2 The plan shall include the following:
 - .1 Temporary Erosion and Sediment Control Plan as required in Section 01 57 13
 - .2 Construction and Demolition Waste Management Plan as required in Section 01 74 19
 - .3 Indoor Air Quality Management Plan as required in Section 01 81 19
 - .4 LEED® total construction cost
 - .5 Material costs based on specification division
- .2 Contractor to provide a LEED® Progress Report to the Contract Administrator at the end of each month that includes the following items:
 - .1 Photographs specified in the sections 01 57 13 and 01 81 19. All photos taken for LEED® documentation purposes shall conform to the following requirements:
 - .1 Date Stamp: Standard indicating Year, Month and Day
 - .2 Provide a brief description (a sentence(s) or points) for each photo identifying how LEED® requirements are met
 - .2 Temporary Erosion and Sediment Control inspection logs/reports as required in Section 01 57 13, conducted on a weekly basis or as directed by the Contract Administrator.
 - .3 Construction Waste Diversion report as required in Section 01 74 19, including the respective Disposal Tickets indicating weight or volume of materials removed from the site.
 - .4 Indoor Air Quality inspection logs/reports as required in Section 01 81 19, conducted on a bi-weekly basis or as directed by the Contract Administrator.
 - .5 Ongoing completion of LEED® Online Credit Forms assigned by the Contract Administrator for credits listed in Paragraph 1.6.2
- .3 Submit Schedule S1 – Material Information Data Sheet and supporting documentation (letters from suppliers, MSDSs, product literatures etc.) for all products / materials listed in this Section and as requested by the Contract Administrator
 - .1 Submit completed schedules and supporting product literature to the Contract Administrator for review at subcontractor Contract award
- .4 Submit the mass of Portland cement, mass of supplementary cementitious materials (fly ash, slag cement, silica fume, etc.), and the total mass of all cementitious materials used in each concrete mix design.

- .1 Submit completed schedules to the Contract Administrator for all concrete mix designs after the Structural Engineer has approved the designs, and prior to delivery of any concrete to the site
- .2 A letter signed by the concrete supplier / manufacturer will be accepted that states the total reduction in Portland cement for all concrete used on the project in lieu of submitting mix designs, if the documentation is prepared for each concrete mix (averaging recycled content is not permitted) and identifies the mix recycled content calculated as per the table below.

Mix #	Mass of Portland Cement* (lbs)	Mass of recycled SCMs (lbs)	Mass of total cementitious materials (lbs)	SCMs as a percentage of total cementitious materials (%)	Dollar value of all cementitious materials (from concrete supplier)	Recycled content value per yard [(SCM/2) x dollar value]
2	200	50	250	20%	\$35	\$3.50
3	300	100	400	25%	\$45	\$5.63

*This column also includes any other cementitious ingredients that are not recycled.

- .5 The Contractor will complete all LEED® Online Credit Forms required to document the successful completion of the prerequisites and credits listed under Paragraph 1.4.1.
- .6 The Contractor will provide clarification, back-up materials, and remedial works which may be required by the GBCI within 25 business days of their request.

1.11 PENALTIES

- .1 The City reserves the right to withhold Progress Payments pending the submission of documentation or completion of actions required in the Sections listed under Paragraph 1.2 Related Sections
- .2 If the Contract Administrator finds the Contractor to be in contradiction of any requirements listed in Sections identified under Paragraph 1.2 and which results in the loss of a LEED® point or credit, The City will withhold enough funds to purchase one LEED® point under credit EAc7 Green Power and Carbon Offsets.

Part 2 Products

2.1 SECTION OVERVIEW

- .1 Product requirements for attempting LEED® credits under Section 1.6.2.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION – ENVIRONMENTAL PRODUCT DECLARATIONS

- .1 Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the disclosure criteria below:
 - .1 Industry-wide (generic) EPD. Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator are valued as one product for purposes of credit achievement calculation.
 - .2 Product-specific Type III EPD. Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator are valued as one and a half products for purposes of credit achievement calculation.

- .3 Product-specific Type III EPD. Internally Reviewed. Products with an internally critically reviewed LCA in accordance with ISO 14071. Products with product-specific internal EPDs which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope are valued as one whole product for the purposes of credit achievement calculation.
- .4 Life-Cycle Assessment. Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope are valued as one product for the purposes of credit achievement calculation.
- .5 USGBC approved program. Products that comply with other USGBC approved environmental product declaration frameworks. When published, these will be listed in the LEED® Credit Library (see References section).
- .2 At a minimum, the following materials shall meet one of the disclosure criteria as per 2.2.1:
 - .1 Cast in Place and Precast Concrete
 - .2 Rebar
 - .3 Architectural Concrete Masonry Units
 - .4 Structural Steel
 - .5 Metal Deck
 - .6 Corrugated Metal Cladding and Architectural Precast Cladding
 - .7 Roofing Membranes
 - .8 Softwood Lumber
 - .9 Aluminum Extrusions and Aluminum Composite Material
 - .10 Interior and Exterior Aluminum Framed Glazing Systems
 - .11 Gypsum Board
 - .12 Acoustical Ceiling Tiles, Metal Panel Ceilings, and Suspension Systems
 - .13 Architectural Woodwork
 - .14 Composite Wood (plywood, MDF, particleboard, doors, etc.)
 - .15 Flooring (carpets, hard-surfaces, tiles, under pads, etc.)
 - .16 Wall Base
 - .17 Solid Surfaces
 - .18 Metal Doors and Frames
 - .19 Systems Furniture and Furnishings
- .3 Submit supporting documents as per 1.10.3 and 1.10.4 for each product or material listed above or used to meet credit MRc2 requirements

2.3 Building Product Disclosure and Optimization—Sourcing of Raw Materials

- .1 Use products sourced from at least three different manufacturers that meet at least one of the responsible sourcing and extraction criteria below for at least 20%, by cost, of the total value of permanently installed building products in the project.
 - .1 Extended producer responsibility. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.
 - .2 Bio-based materials. Bio-based products must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material.

- .1 Bio-based products that meet the criteria above: value at 50% of cost multiplied by the biobased content of the product for the purposes of credit achievement calculation.
- .2 Bio-based products that meet the Sustainable Agriculture Network’s Sustainable Agriculture Standard: value at 100% of cost multiplied by the biobased content of the product for the purposes of credit achievement calculation.
- .3 Materials reuse. Includes salvaged, refurbished, or reused products. Products meeting materials reuse criteria are valued at 200% of their cost for the purposes of credit achievement calculation.
- .4 Recycled content. Select products / materials that contain recycled content, tracking both pre- and post-consumer recycled content. Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement calculation. At a minimum, the following materials shall include recycled content:

Material	Min. Post-Consumer (%)	Min. Pre-Consumer (%)	Combined (%)*
Acoustic Ceiling Tile	5	40	25
Asphalt	20	0	20.0
Carpet	5	30	20.0
Ceramic Tile (Floor)	0	30	15
Ceramic Tile (Wall)	0	35	17.5
Composite Wood (MDF, Particle Board)	0	90	45
Composite Wood (MDF, Particle Board)	0	90	45
Concrete (% SCM Content in Cement)	0	25	Varies
Concrete Reinforcement	30	65	62.5
Engineered Fill	25	10	30.0
Fiberglass Insulation	60	0	60
Fiberglass Insulation	60	0	60
Gypsum	5	90	50
Gypsum (Interior)	5	90	50
Light Steel Framing (Steel Studs)	25	5	26
Linoleum	0	35	17.5
Masonry – Light Weight or Acoustic (% slag content in aggregate)	0	80	Varies
Masonry (% SCM Content in Cement)	0	25	Varies
Mineral Wool Insulation	0	40	20
Mineral Wool Insulation	0	40	20
Precast Concrete Products (% SCM Content in Cement)	0	25	Varies
Rubber Flooring	60	5	62.5
Steel Deck, Roofing and Siding	20	25	32.5
Structural Steel	25	40	45
Suspended Ceiling T-Grid (Aluminum)	90	0	90
Suspended Ceiling T-Grid (Steel)	0	25	12.5

- .1 *Note: If the minimum Post-Consumer and Pre-Consumer recycled values cannot both be met for a product or material, the combined recycled content value can be used.
- .5 Location Valuation Factor (Regional Material). Where possible, select products / materials that are extracted, manufactured and purchased locally if they fall within the LEED® Divisions to help achieve MRc2, 3, and 4.
 - .1 Products / materials are deemed local if they are extracted, manufactured, and purchased within 160km of the project site (straight-line distance). If only a fraction of a product or material is extracted, manufactured, and purchased locally, then only that percentage (by weight) can contribute to the regional value.
 - .2 Products/materials that are deemed local as above may be valued at 200% of their cost (location valuation factor of 2) for MRc2, 3, and 4 if they also meet at least one sustainability criteria.
 - .3 The following materials / products are recommended to be of regional content
 - .1 Landscaping Material
 - .2 Asphalt
 - .3 Concrete
 - .4 Granular Material
 - .5 Concrete Reinforcement
 - .6 Masonry
 - .7 Structural Steel
 - .8 Steel Deck, Roofing and Siding
 - .9 Light Steel Framing (Steel Studs)
 - .10 Fiberglass Insulation
 - .11 Mineral Wool Insulation
 - .12 Gypsum
 - .13 Acoustic Ceiling Tile
 - .2 Submit supporting documents as per 1.10.3 and 1.10.4 for each product or material listed above or used to meet credit MRc3 requirements

2.4 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION – MATERIAL INGREDIENTS

- .1 Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm):
 - .1 Manufacturer Inventory. The manufacturer has published a publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN) and/or European Community Number (EC Number). Materials defined as trade secret or intellectual property may withhold the name and/or CASRN but must disclose role, amount and hazard score/class using either:
 - .1 Greenscreen List Translator (LT) score and/or Full GreenScreen Benchmark (BM)
 - .2 The Globally Harmonized System of Classification and Labeling of Chemicals rev.6 (2015) (GHS). The hazard screen must be applied to each trade secret ingredient and the inventory lists the hazard category for each of the health hazards.

- .2 Health Product Declaration (HPD). The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open Standard.
- .3 Cradle to Cradle. Product has Material Health Certificate or is Cradle to Cradle Certified under standard version 3 or later with a Material Health achievement level at the Bronze level or higher.
- .4 Declare Certificate. Declare labels designated as Red List or Declare. Declare labels designated as LBC Compliant that demonstrate content inventory to 0.1% (1000ppm).
- .5 Product Lens Certification
- .6 Facts – NSFANSI 336: Sustainability Assessment for Commercial Furnishing Fabric
- .7 ANSI-BIFMA e3 Furniture Sustainability Standard. The documentation from the assessor or scorecard from BIFMA must demonstrate the product earned at least 3 points under 7.5.1.3 Advanced Level in e3-2014 or 3 points under 7.4.1.3 Advanced Level in e3-2012.
- .2 Any compliant reports above with third-party verification that includes the verification of content inventory are worth 1.5 products for credit achievement calculations.
- .3 At a minimum, the following material / products shall meet one of the chemical inventory programs as per 2.4.1:
 - .1 Cast in Place and Precast Concrete
 - .2 Rebar
 - .3 Architectural Concrete Masonry Units
 - .4 Structural Steel
 - .5 Metal Deck
 - .6 Corrugated Metal Cladding and Architectural Precast Cladding
 - .7 Roofing Membranes
 - .8 Softwood Lumber
 - .9 Aluminum Extrusions and Aluminum Composite Material
 - .10 Interior and Exterior Aluminum Framed Glazing Systems
 - .11 Gypsum Board
 - .12 Acoustical Ceiling Tiles, Metal Panel Ceilings, and Suspension Systems
 - .13 Architectural Woodwork
 - .14 Composite Wood (plywood, MDF, particleboard, doors, etc.)
 - .15 Flooring (carpets, hard-surfaces, tiles, under pads, etc.)
 - .16 Wall Base
 - .17 Wall Tile and Grout
 - .18 Solid Surfaces
 - .19 Metal Doors and Frames
 - .20 Systems Furniture and Furnishings

- .21 Paints
- .22 Millwork Laminates
- .23 Concrete Curing Compounds
- .24 Bulletin Boards
- .25 Envelope Waterproofing
- .26 Adhesives
- .27 Sealants
- .4 Submit supporting documents as per 1.10.3 and 1.10.4 for each product or material listed above or used to meet credit MRc4 requirements.

2.5 INTERIOR ADHESIVES, SEALANTS, PAINTS, AND COATINGS

- .1 At least 75% of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the California Department of Public Health (CDPH) Standard Method v1.2-2017, EN 16516:2017 or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL Greenguard Gold
 - .2 SCS Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 Collaborative for High Performance Schools (CHPS)
- .2 All wet-applied adhesives, sealants, paints and coatings applied on site and within the weatherproofing membrane must comply with the following criteria:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD), RULE 1168, 2017		
Product Type	Reference Standard	VOC Limit (g/L)
ADHESIVES		
Carpet pad adhesives	SCAQMD 1168, 2017	50
Ceramic glass, porcelain and stone tile adhesives	SCAQMD 1168, 2017	65
Cove base adhesives	SCAQMD 1168, 2017	50
Dry wall and panel adhesives	SCAQMD 1168, 2017	50
Multipurpose construction adhesives	SCAQMD 1168, 2017	70
Rubber floor adhesives	SCAQMD 1168, 2017	60
Structural glazing adhesives	SCAQMD 1168, 2017	100
Structural wood member adhesives	SCAQMD 1168, 2017	140

Subfloor adhesives	SCAQMD 1168, 2017	50
VCT and asphalt tile adhesives	SCAQMD 1168, 2017	50
Wood flooring adhesive	SCAQMD 1168, 2017	100
All other indoor floor covering adhesives	SCAQMD 1168, 2017	50
Computer diskette manufacturing adhesive	SCAQMD 1168, 2017	350
Contact adhesive	SCAQMD 1168, 2017	80
Edge glue adhesive	SCAQMD 1168, 2017	250
ABS welding cement	SCAQMD 1168, 2017	325
ABS to PVC transition cement	SCAQMD 1168, 2017	510
CPVC welding cement	SCAQMD 1168, 2017	490
PVC welding cement	SCAQMD 1168, 2017	510
All other plastic welding cements	SCAQMD 1168, 2017	100
Special purpose contact adhesive	SCAQMD 1168, 2017	250
Thin metal laminating Adhesive	SCAQMD 1168, 2017	780
Top and trim adhesive	SCAQMD 1168, 2017	250
Waterproof resorcinol glue	SCAQMD 1168, 2017	170
All other adhesives	SCAQMD 1168, 2017	250
Metal to metal substrate-specific adhesives	SCAQMD 1168, 2017	30
Plastic foam substrate-specific adhesives	SCAQMD 1168, 2017	50
Porous material (except wood) substrate-specific adhesives	SCAQMD 1168, 2017	50
Wood substrate-specific adhesives	SCAQMD 1168, 2017	30
Fiberglass substrate-specific adhesives	SCAQMD 1168, 2017	80
Reinforced plastic composite substrate-specific adhesives	SCAQMD 1168, 2017	200
SEALANTS		
Architectural sealant - Clear, paintable and immediately water-resistant	SCAQMD 1168, 2017	250
Architectural sealant - Foam insulation	SCAQMD 1168, 2017	250
Architectural sealant - Foam sealant	SCAQMD 1168, 2017	250
Architectural sealant - Grout	SCAQMD 1168, 2017	250
Architectural sealant - Non-staining plumbing putty	SCAQMD 1168, 2017	250
Architectural sealant - Potable water sealant	SCAQMD 1168, 2017	250
Architectural sealant - All other architectural sealants	SCAQMD 1168, 2017	50
Marine deck sealant	SCAQMD 1168, 2017	760
Other sealant	SCAQMD 1168, 2017	420
ADHESIVE PRIMERS		
Plastic adhesive primer	SCAQMD 1168, 2017	550
Pressure sensitive adhesive primer	SCAQMD 1168, 2017	250
All other adhesive primers	SCAQMD 1168, 2017	250
SEALANT PRIMERS		
Architectural non-porous sealant primer	SCAQMD 1168, 2017	250
Architectural porous sealant primer	SCAQMD 1168, 2017	775

Marine deck sealant primer	SCAQMD 1168, 2017	760
Modified bituminous sealant primer	SCAQMD 1168, 2017	500
Other sealant primer	SCAQMD 1168, 2017	750

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD), RULE 1113, 2016		
Product Type	Reference Standard	VOC Limit (g/L)
PAINTS AND COATINGS		
Bond breakers	SCAQMD 1113, 2016	350
Building envelope coating	SCAQMD 1113, 2016	50
Concrete - Curing compounds	SCAQMD 1113, 2016	100
Concrete - Curing compounds for roadways and bridges	SCAQMD 1113, 2016	350
Concrete surface retarder	SCAQMD 1113, 2016	50
Default	SCAQMD 1113, 2016	50
Driveway sealer	SCAQMD 1113, 2016	50
Dry-fog coatings	SCAQMD 1113, 2016	50
Faux finishing coatings - Clear topcoat	SCAQMD 1113, 2016	100
Faux finishing coatings - Decorative coatings	SCAQMD 1113, 2016	350
Faux finishing coatings - Glazes	SCAQMD 1113, 2016	350
Faux finishing coatings - Japan	SCAQMD 1113, 2016	350
Faux finishing coatings - Trowel applied coatings	SCAQMD 1113, 2016	50
Fire-proofing coatings	SCAQMD 1113, 2016	150
Flats	SCAQMD 1113, 2016	50
Floor coatings	SCAQMD 1113, 2016	50
Form release compound	SCAQMD 1113, 2016	100
Graphic arts (sign) coatings	SCAQMD 1113, 2016	200
Industrial maintenance coatings	SCAQMD 1113, 2016	100
Industrial maintenance coatings - Colour Indicating Safety Coatings	SCAQMD 1113, 2016	480
Industrial maintenance coatings - High Temperature IM Coatings	SCAQMD 1113, 2016	420
Industrial maintenance coatings - Non-Sacrificial Anti-Graffiti Coatings	SCAQMD 1113, 2016	100
Industrial maintenance coatings - Zinc-rich IM primers	SCAQMD 1113, 2016	100
Magnesite cement coatings	SCAQMD 1113, 2016	450
Mastic coatings	SCAQMD 1113, 2016	100
Metallic pigmented coatings	SCAQMD 1113, 2016	150
Multi-Color coatings	SCAQMD 1113, 2016	250
Nonflat coatings	SCAQMD 1113, 2016	50
Pre-treatment wash primers	SCAQMD 1113, 2016	420
Primers, sealers, and undercoaters	SCAQMD 1113, 2016	100
Reactive penetrating sealers	SCAQMD 1113, 2016	350

Recycled coatings	SCAQMD 1113, 2016	150
Roof coatings	SCAQMD 1113, 2016	50
Roof coatings, aluminum	SCAQMD 1113, 2016	100
Roof primers, bituminous	SCAQMD 1113, 2016	350
Rust preventative coatings	SCAQMD 1113, 2016	100
Sacrificial anti-graffiti coatings	SCAQMD 1113, 2016	50
Shellac - Clear	SCAQMD 1113, 2016	730
Shellac - Pigmented	SCAQMD 1113, 2016	550
Specialty primers	SCAQMD 1113, 2016	100
Stains	SCAQMD 1113, 2016	100
Stains, interior	SCAQMD 1113, 2016	250
Stone consolidant	SCAQMD 1113, 2016	450
Swimming pool coatings - Repair	SCAQMD 1113, 2016	340
Swimming pool coatings - Other	SCAQMD 1113, 2016	340
Tile and stone sealers	SCAQMD 1113, 2016	100
Traffic coatings	SCAQMD 1113, 2016	100
Tub and tile refinishing coatings	SCAQMD 1113, 2016	420
Waterproofing sealers	SCAQMD 1113, 2016	100
Waterproofing concrete/masonry sealers	SCAQMD 1113, 2016	100
Wood coatings	SCAQMD 1113, 2016	275
Wood coatings - Varnish	SCAQMD 1113, 2016	275
Wood coatings - Sanding Sealers	SCAQMD 1113, 2016	275
Wood coatings - Lacquer	SCAQMD 1113, 2016	275
Wood conditioners	SCAQMD 1113, 2016	100
Wood preservatives - Below-ground	SCAQMD 1113, 2016	350
Wood preservatives - Other	SCAQMD 1113, 2016	350

CALIFORNIA AIR RESOURCES BOARD (CARB) 2007 SUGGESTED CONTROL MEASURE (SCM) FOR ARCHITECTURAL COATINGS		
Product Type	Reference Standard	VOC Limit (g/L)
Flat coatings	CARB 2007	50
Nonflat coatings	CARB 2007	100
Nonflat - High gloss coatings	CARB 2007	150
Aluminum roof coatings	CARB 2007	400
Basement specialty coatings	CARB 2007	400
Bituminous roof coatings	CARB 2007	50
Bituminous roof primers	CARB 2007	350
Bond breakers	CARB 2007	350
Concrete curing compounds	CARB 2007	350
Concrete/Masonry sealers	CARB 2007	100
Driveway sealers	CARB 2007	50
Dry-fog coatings	CARB 2007	150

Faux finishing coatings	CARB 2007	350
Fire resistive coatings	CARB 2007	350
Floor coatings	CARB 2007	100
Form-release compounds	CARB 2007	250
Graphic arts coatings (sign paints)	CARB 2007	500
High temperature coatings	CARB 2007	420
Industrial maintenance coatings	CARB 2007	250
Low solids coatings	CARB 2007	120
Magnesite cement coatings	CARB 2007	450
Mastic texture coatings	CARB 2007	100
Metallic pigmented coatings	CARB 2007	500
Multi-color coatings	CARB 2007	250
Pre-treatment wash primers	CARB 2007	420
Primers, sealers, and undercoaters	CARB 2007	100
Reactive penetrating sealers	CARB 2007	350
Recycled coatings	CARB 2007	250
Roof coatings	CARB 2007	50
Rust preventative coatings	CARB 2007	250
Shellac - Clear	CARB 2007	730
Shellac - Opaque	CARB 2007	550
Specialty primers, sealers, and undercoaters	CARB 2007	100
Stains	CARB 2007	250
Stone consolidants	CARB 2007	450
Swimming pool coatings	CARB 2007	340
Traffic marking coatings	CARB 2007	100
Tub and tile refinish coatings	CARB 2007	420
Waterproofing membranes	CARB 2007	250
Wood coatings	CARB 2007	275
Wood preservatives	CARB 2007	350
Zinc-rich primers	CARB 2007	340

.3 Submit supporting documentation as per 1.10.3 for each product / material listed above

2.6 FLOORING

- .1 At least 90% of all flooring products hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, by cost or surface area, within the waterproofing membrane must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017, or recognized by one of the following equivalent programs:
- .1 FloorScore (Resilient Floor Covering Institute) certified for hard flooring
 - .2 NSF-332 certified for carpet products
 - .3 CRI Green Label Plus for carpet products

- .4 UL Greenguard Gold
- .5 SCS Indoor Advantage Gold
- .6 Blue Angel
- .7 MAS Certified Green
- .8 Berkeley Analytical ClearChem
- .9 EMICODE EC1 or EMICODE EC1 Plus
- .10 Intertek ETL Environmental VOC+
- .11 Eco-INTITUT-Label
- .12 Collaborative for High Performance Schools (CHPS)
- .2 All setting adhesives and grout must meet South Coast Air Quality Management District (SCAQMD) Rule 1168 listed in Paragraph 2.5 above.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.
- .4 Submit supporting documentation as per 1.10.3 for each product / material listed above.

2.7 COMPOSITE WOOD

- .1 At least 75% of all composite wood, by cost or surface area, shall have low-formaldehyde emissions that meet the Composite Wood Products Regulations (CARB) ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or contain no added formaldehyde resins. Composite wood and agrifibre products include:
 - .1 Particleboard
 - .2 Medium Density Fiberboard (MDF)
 - .3 Plywood
 - .4 Wheatboard
 - .5 Strawboard
 - .6 Panel substrates
 - .7 Door Cores
- .2 Salvaged and reused architectural millwork more than one year old at the time of occupancy is considered compliant, provided it meets the requirements for any site-applied paints, coatings, adhesives and sealants in Paragraph 2.5 above.
- .3 Submit supporting documentation as per Paragraph 1.10.3 for each product / material listed above

2.8 CEILINGS, WALL PANELS AND INSULATION

- .1 At least 90% of ceilings, 75% of wall panels, and 75% insulation building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017, or recognized by one of the following equivalent programs:

- .1 UL Greenguard Gold
 - .2 SCS Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
 - .3 The ceilings product category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights. Overhead structural elements (exposed, finished, and unfinished) are excluded.
 - .4 The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation. Insulation for HVAC ducts and plumbing piping are excluded.
 - .5 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.
 - .6 Submit supporting documentation as per Paragraph 1.10.3 for each product / material listed above

2.9 FURNITURE

- .1 At least 75% of all furniture in the project scope of work, by cost, must be tested in accordance with ANSI/BIFMA Standard Method M7.1–2011 (R2016). Comply with ANSI/BIFMA e3-2014e Furniture Sustainability Standard, Sections 7.6.2 and 7.6.3, using either the concentration modeling approach or the emissions factor approach. Model the test results using the open plan, private office, or seating scenario in ANSI/BIFMA M7.1, as appropriate, or recognized by one of the following equivalent programs:
 - .1 UL Greenguard Certified
 - .2 UL Greenguard Gold
 - .3 SCS Indoor Advantage - Furniture
 - .4 SCS Indoor Advantage Gold - Furniture
 - .5 Intertek ETL Environmental VOC+
 - .6 MAS Certified Green, following ANSI/BIFMA M7.1-2011
 - .7 TUV Rheinland Green Product Mark Furniture

- .2 Salvaged and reused furniture more than one year old at the time of use is considered compliant, provided it meets the requirements for any site-applied paints, coatings, adhesives, and sealants.
- .3 Submit supporting documentation as per Paragraph 1.10.3 for each product / material listed above

2.10 PBT SOURCE REDUCTION – LEAD, CADMIUM, AND COPPER

- .1 For lead applications:
 - .1 Use lead-free roofing and flashing
 - .2 Use electrical wire and cable with lead content less than 300 parts per million
 - .3 Do not use interior or exterior paints containing lead
- .2 For lead applications where water is intended for human consumption:
 - .1 Solder and flux used to connect plumbing pipes for water intended for human consumption must meet the California AB1953 standard, in which solder cannot contain more than 0.2% lead, and flux not more than a weighted average of 0.25% lead for wetted surfaces.
 - .2 Pipes, pipe fittings, plumbing fittings, and faucets shall meet the California law AB1953 of a weighted average lead content of the wetted surface area of not more than 0.25% lead
- .3 For cadmium applications:
 - .1 Do not use interior or exterior paints containing intentionally added cadmium.
- .4 For copper pipe applications:
 - .1 Reduce or eliminate joint-related sources of copper corrosion: use mechanically crimped copper joint systems; or specify that all solder joints comply with ASTM B828 2002, and specify and use ASTM B813 2010 for flux

Part 3 Execution

3.1 NOT USED

END OF SECTION

Complete for all permanently installed products in Divisions 03-10, 31, and 32 as well as 11, 21-28.
Submit to Contract Administrator 14 days prior to ordering product/material.

Contractor Name:		Contractor Contact:	
Manufacturer:		Product Use:	
Product Name:		Material Cost*:	

* cost excluding labour, including overhead and profit. Material cost is required.

MRc2 Environmental Product Declarations: complete for all materials.

Environmental Product Declaration:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Classification:	<input type="checkbox"/> Industry-Wide <input type="checkbox"/> Product Specific Type III <input type="checkbox"/> Life-Cycle Assessment
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I have attached a copy of the Environmental Product Declaration

MRc3 Sourcing of Raw Materials: complete for all materials.

Extended Producer Responsibility:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Bio-based Content (%):	
Pre-Consumer Recycled Content (%):		Post-Consumer Recycled Content (%):	

I have attached supporting Manufacturer's documentation confirming all information completed above.

Location Valuation: complete for all materials.

	City	Prov./State	Distance from Project (km)
Extraction Location:			
Manufacturing Location:			
Purchasing Location:			

I have attached supporting Manufacturer's documentation confirming location of extraction, manufacture, and purchase.

MRc4 Material Ingredient Reporting and Optimization: complete for all materials.

Health Product Declaration:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Full Disclosure:	<input type="checkbox"/> Yes (required) <input type="checkbox"/> 1,000 ppm (required)
Cradle to Cradle Certificate:	<input type="checkbox"/> Yes <input type="checkbox"/> No	C2C Level:	<input type="checkbox"/> v3 Bronze <input type="checkbox"/> v3 Silver
Manufacturer Inventory Listing:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Full Disclosure:	<input type="checkbox"/> Yes (required) <input type="checkbox"/> 1,000 ppm (required)
Declare Certificate:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Full Disclosure:	<input type="checkbox"/> Yes (required) <input type="checkbox"/> 1,000 ppm (required)
ANSI/BIFMA e3 Furniture Sustainability Standard	<input type="checkbox"/> Yes <input type="checkbox"/> No	Full Disclosure:	<input type="checkbox"/> 3+ points earned (required)
Product Lens Certificate	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Facts – NSF/ANSI 336	<input type="checkbox"/> Yes <input type="checkbox"/> No		

I have attached a copy of the Material Ingredient Report

EQc2 Low-Emitting Materials

Adhesives, Sealants, Paints, Coatings, Ceilings, Walls, and Insulation: complete for products applied within the weatherproofing membrane.

Product Classification:	<u>Wet-Applied Products:</u> <input type="checkbox"/> Adhesive <input type="checkbox"/> Sealant <input type="checkbox"/> Paint <input type="checkbox"/> Coating	<u>Solid Products:</u> <input type="checkbox"/> Ceiling Product <input type="checkbox"/> Wall Product <input type="checkbox"/> Insulation
General Emissions Evaluation Reported Using:	<input type="checkbox"/> Emissions Certificate, completed using the California Department of Public Health (CDPH) Standard Method v1.2-2017 <input type="checkbox"/> UL Green Guard Gold Certification <input type="checkbox"/> SCS Indoor Advantage Gold Certification <input type="checkbox"/> Blue Angel Certification <input type="checkbox"/> Collaborative for High Performance Schools Certification	<input type="checkbox"/> MAS Certified Green Certification <input type="checkbox"/> Berkeley Analytical ClearChem Certification <input type="checkbox"/> EMICODE EC1 or EMICODE EC1 Plus Certification <input type="checkbox"/> Intertek ETL Environmental VOC+ Certification <input type="checkbox"/> eco-INTITUT-Label Certification <input type="checkbox"/> LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015)
For Wet-Applied Products, VOC Content (g/L):		For Wet-Applied Products, Estimated Volume (L):

- I have attached supporting Manufacturer’s documentation confirming VOC content for wet-applied products.
 I have attached a copy of the General Emission Evaluation Report noted above.

Flooring: complete for all flooring products.

General Emissions Evaluation Reported Using:	<input type="checkbox"/> Emissions Certificate, completed using the CDPH Standard Method v1.2-2017 <input type="checkbox"/> UL Green Guard Gold <input type="checkbox"/> SCS Indoor Advantage Gold <input type="checkbox"/> Blue Angel <input type="checkbox"/> Collaborative for High Performance Schools Certification <input type="checkbox"/> MAS Certified Green	<input type="checkbox"/> EMICODE EC1 or EMICODE EC1 Plus <input type="checkbox"/> Intertek ETL Environmental VOC+ <input type="checkbox"/> FloorScore <input type="checkbox"/> Green Label Plus <input type="checkbox"/> NSF / ANSI 332 <input type="checkbox"/> eco-INTITUT-Label <input type="checkbox"/> GUT <input type="checkbox"/> Berkeley Analytical ClearChem
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- I have attached a copy of the General Emission Evaluation Report noted above.

Wood & Composite Wood Products: complete for all composite wood products

Composite Wood Evaluation:	<input type="checkbox"/> CARB Ultra-Low-Emitting Formaldehyde (ULEF) <input type="checkbox"/> Does not contain added formaldehyde (NAF) <input type="checkbox"/> CARB Exempt
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- I have attached a copy of the Composite Wood Evaluation Report noted above.

Furniture and Furnishings: complete for all new furniture and furnishing products.

New Furniture and Furnishings:	<input type="checkbox"/> ANSI/BIFMA Standard Method M7.1-2011 <input type="checkbox"/> UL Greenguard Certified <input type="checkbox"/> UL Green Guard Gold <input type="checkbox"/> SCS Indoor Advantage - Furniture	<input type="checkbox"/> SCS Indoor Advantage Gold - Furniture <input type="checkbox"/> Intertek ETL Environmental VOC+ <input type="checkbox"/> MAS Certified Green <input type="checkbox"/> TUV Rheinland Green Product Mark Furniture
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- I have attached a copy of the evaluations report noted above.

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 31 00 – Project Management and Co-ordination.
- .3 Section 01 33 00 – Submittal Procedures.

1.2 REVIEW AND INSPECTION OF THE WORK

- .1 *Part C: General Conditions.*

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Contract Administrator for purpose of inspecting and/or testing portions of work as identified in specification sections and be paid for by cash allowance.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relieve Contractors of their responsibility to perform work in accordance with contract documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Contractor to correct defect and irregularities as advised by Contract Administrator, at no cost to the City, and pay costs for retesting and re-inspection.

1.4 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to the Work, offsite manufacturing, and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

- .1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in 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.

1.6 REPORTS

- .1 Submit four (4) copies of inspection and test reports promptly to the Contract Administrator.
- .2 Provide copies to Subcontractor of work being inspected/tested and manufacturer/fabricator of material being inspected/tested.

1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.

- .2 The cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by the Law of the Place of Work shall be appraised by the Contract Administrator and may be authorized as recoverable.

1.8 MOCK-UPS AND SAMPLE WORK

- .1 Prepare mock-ups and sample work specifically requested in specifications.
- .2 Construct mock-ups and sample work at locations acceptable to Contract Administrator.
- .3 Prepare mock-ups and sample work for Contract Administrator's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in work.
- .4 Failure to prepare mock-ups and sample work 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 Unless noted, approved mock-ups and sample work may remain as part of work.
- .6 When reviewed and approved, mock-ups and sample work become standard of workmanship, appearance, and materials approved for similar areas throughout project.

1.9 MILL TESTS

- .1 Submit mill test certificates as required of the specification Sections and as may be requested.

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit four (4) copies of adjustment and balancing reports for mechanical, electrical building equipment and systems.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 31 00 – Project Management and Co-ordination.
- .3 Section 01 61 00 – Common Product Requirements.
- .4 Section 01 74 00 – Cleaning.
- .5 Section 01 74 19 – Construction and Demolition Waste Management.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .2 CAN/CSA S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.
 - .3 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

1.3 TEMPORARY WORK

- .1 Temporary Electricity and Lighting.
 - .1 Contractor may connect to existing power supply for temporary power during construction for temporary lighting and the operating of power tools, except for purpose of power welding and electric heating. Cost of power reasonably so used will be provided without charge.
 - .2 Electrical power is available from existing feeders to existing panels as approved by the City. Power taken from these panels is not unlimited and must not exceed the capacity of the panels, nor interrupt any existing electrical services in the building.
 - .3 If available existing power is insufficient, provide additional temporary power as construction requirements demand. Contractor shall arrange for connection with appropriate utility company and pay for all costs of installation, maintenance and removal.
 - .4 Do not use existing electrical receptacles without permission from the City. Once permission is granted, use only designated receptacle. Do not exceed 90% of rated circuit capacity.
- .2 Temporary Fire Protection.
 - .1 Provide and maintain temporary fire protection equipment during performance of work required by insurance companies having jurisdiction, and governing codes, regulations and bylaws.
 - .2 Protect existing devices that are remaining for reuse. Damage occurred during construction to existing devices intended for reuse shall be repaired or replaced by the Contractor.
- .3 Temporary Heating and Ventilation.
 - .1 Contractor may make use of existing HVAC system. Cost of HVAC reasonably used will be provided without charge.
 - .1 Maintain minimum temperature of 10°C (or higher where specified) during construction.
 - .2 Ventilating.

- .1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gasses 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 completion of work to assure removal of harmful contaminants.
- .3 On work for which permanent heating and ventilation system is used, replace filters and comply with requirements of Mechanical General Provisions as applicable during Work and at time of final acceptance of Work.
- .4 Contractor's temporary use of HVAC equipment shall not contaminate equipment or ducting.
- .2 If existing HVAC system is not available, Contractor to arrange, pay for, operate and maintain temporary heat and ventilation and shelters used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment to keep work that requires protection from cold adequately warm and sheltered from elements.
 - .1 Acceptable temporary heaters to consist of warm forced air type, operated in well ventilated location and vented to exterior.
 - .2 Use of direct-fired heaters discharging waste products into work areas will not be permitted.
 - .3 Provide protection on floors and adjacent surfaces to prevent damage.
 - .4 Temporary heating and ventilation, shelters, fuel and fuel storage: satisfactory to authorities having jurisdiction.
 - .5 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 requirements for safe working environment.
 - .6 Maintain minimum temperature of 10°C (or higher where specified) during construction.
 - .7 Ventilating.
 - .1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gasses 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 completion of work to assure removal of harmful contaminants.

- .8 Maintain strict supervision of temporary heating and ventilating equipment to:
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .9 Be responsible for damage to work due to failure in providing adequate heat and protection during construction.
- .4 Temporary Telephone Service.
 - .1 Arrange, pay for and maintain temporary telephone service (landline or cellular) used during construction in accordance with authorities having jurisdiction. Provide at least one telephone in Contractor's field office available for use by the City, Contractor, Subcontractors and Contract Administrator.
- .5 Temporary Digital Co-ordination.
 - .1 Provide on-site lap top computer with internet access and digital camera to permit emailing of correspondence and photos of construction issues to Contract Administrator for prompt co-ordination and response.
- .6 Temporary Water Supply.
 - .1 Contractor may connect to existing potable water supply for construction use within construction area. Cost of water reasonably so used will be provided without charge.

1.4 CONSTRUCTION FACILITIES

- .1 Contractor Site Offices
 - .1 Provide office heat, lighted and ventilated, of sufficient size to accommodate site meetings and furnished with drawing lay down 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.
 - .4 Offices within building:
 - .1 When usable space is available within the project building and if approved by The City, the site office may be located within the building, utilizing rooms therein.
 - .2 Such areas may be used contingent upon there being no delay in completion of the work and there being no damages to material or finishes.
 - .5 Personal Protective Equipment:
 - .1 Provide and store within site office personal protective equipment for use of the City's personnel visiting the site.
 - .2 Provide twelve (8) each of the following:
 - .1 Hard hats.
 - .2 Protective eyewear (eyeglass type – not goggles for sanitary reasons).
 - .3 Earmuff hearing protection. Ear plugs are not acceptable for sanitary reasons.
 - .4 Hi-Visibility Safety vests.
 - .5 Safety shoes – either rubber boots with steel toes or strap-on type steel toe guards. Provide in several adult shoe sizes.

- .2 Construction Equipment, Tool, and Material Storage.
 - .1 Refer to Section 01 61 00.
 - .2 Provide and maintain, in clean orderly condition, adequate lockable, weather tight trailers for storage of materials, tools, and equipment which are subject to damage by weather. Co-ordinate location(s) with The City.
 - .3 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
 - .4 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- .3 First Aid.
 - .1 Provide and maintain clearly marked and fully stocked first-aid case in readily available location.
- .4 Sanitary Facilities.
 - .1 Contractor to provide sufficient sanitary facilities for work force in accordance with authorities having jurisdiction. Existing facilities are not to be used unless directly within area of work and not accessed by the public.
 - .2 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent new facilities may be used on approval of Contract Administrator.
 - .3 Keep areas and premises in sanitary condition. Damaged fixtures or accessories caused by use during construction are to be replaced at no cost to The City.
 - .4 Post notices and take such precautions as required by local health authorities.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads, sidewalk crossings, ramps, and construction runways to maintain access, and snow removal during period of Work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 Conform to requirements of governing authorities when required and, when necessary, make arrangements with adjacent property owners.
- .5 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
- .6 Maintain access to property including overhead clearances for use by emergency response vehicles.
- .7 parking permitted on site, limited to the existing parking lot.
- .8 Provide snow removal during period of Work, including to complete parking lot. Snow piling is permitted in the rear (west) parking lot along the western fence. Removal of snow pile is required; pile shall not exceed 10 feet in height and Contractor shall maintain access to existing Sea Cans and storage sheds.

1.6 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect adjacent private and public property from damage during the performance of work.

- .2 Be responsible for all damage incurred.

1.7 CONSTRUCTION AIDS

- .1 Construction Hoists and Cranes.
 - .1 Provide, operate and maintain hoists and cranes required for moving of works, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
 - .2 Operate hoists and cranes using qualified personnel.
- .2 Scaffolding and Platforms.
 - .1 Construct and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs in rigid, secure and safe manner in accordance with CAN/CSA S269.2.
 - .2 Erect scaffolding and platforms independent of walls. Remove promptly when no longer required.

1.8 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Site Enclosure.
 - .1 Erect temporary site enclosure to separate construction area from adjacent streets, property, and to protect public, workers, public and private property from injury or damage. At a minimum, provide chain link fence 2.4 m high minimum. Provide lockable gates as require for access to site by workers and vehicles.
 - .2 Provide snow fencing or other similar barriers around trees, natural features, bench marks, utility lines, etc. designated to remain. Protect from damage.
- .2 Weather Enclosures.
 - .1 Provide temporary weather tight enclosures and protection for exterior openings until permanently enclosed.
 - .2 Erect enclosures to allow access for installation of materials and working inside enclosure.
 - .3 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
 - .4 Design enclosures to withstand wind pressure and snow loading.
- .3 Protection of Building Finishes and Equipment.
 - .1 Provide protection for finished and partially finished building finishes and equipment during the performance of work.
 - .2 Provide necessary screens, covers and hoardings.
 - .3 Confirm locations and installation with Contract Administrator at least three (3) days prior to installation.
 - .4 Be responsible for damage incurred due to lack of or improper protection.
- .4 Site Storage and Over Loading.
 - .1 Refer to Section 01 61 00.
 - .2 Confine Work and operations of workforce to limits indicated by Contract Documents. If Work must be performed in another area, notify and obtain permission from the City.
 - .3 Do not unreasonably encumber site with material or equipment.
 - .4 Move stored products or equipment interfering with operations of the City.
 - .5 Do not load or permit to be loaded any part of Work with weight or force that will endanger Work.
 - .6 Obtain and pay for use of additional storage or work areas needed for operations or for delivered equipment or materials not required immediately on site.

- .7 Repair all existing site conditions damaged by use of site to match pre-construction conditions.
- .5 Guard Rails and Barricades.
 - .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stairwells, open edges of floors and roofs.
 - .2 Construct in accordance with requirements of authorities having jurisdiction.
- .6 Security Measures.
 - .1 In addition to requirement herein, provide hoarding and enclosures of sufficient strength and dimension to prevent unauthorized entry of all persons.
 - .2 Maintain at site, at all times, names and telephone numbers of all Contractor's and Subcontractor's representatives, available to hand for use in event of need for immediate response in emergency situations.

1.9 TEMPORARY CONTROLS

- .1 Dewatering.
 - .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water while work is in progress.
 - .2 Dispose of water in accordance with Section 01 74 00 and in manner not detrimental to public and private property, or any portion of work completed or under construction.
- .2 Shoring, Underpinning and Bracing.
 - .1 Conduct condition survey, including photographs of adjacent buildings before commencing excavation and investigate foundations to determine underpinning, etc., required.
 - .2 Take every precaution against any movement or settlement of existing and new construction, utilities, streets, paving, walks, lighting standards, piping, conduit, etc.
 - .3 Engage services of qualified professional engineer with demonstrated competence in work, registered in Province of Manitoba to design and inspect shoring, bracing and underpinning as required for work.
 - .1 Submit design and supporting data at least two (2) weeks prior to commencing work.
 - .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered in Province of Manitoba.
 - .4 Provide bracing, shoring, sheeting, sheet piling, underpinning and other retaining structures as required by aforementioned engineer and authorities having jurisdiction to assure horizontal and vertical support of adjacent areas.
 - .5 Assume responsibility for strength, adequacy, safety, and support of retaining structures, utilities, etc. with respect to any movement, settlement, or drainage; liability for injury resulting from inadequate shoring, bracing, and underpinning; responsibility for repair of damage caused.

1.10 SITE SIGNS AND NOTICES

- .1 Site Signs and Notices: signs and notices for safety or instruction to be in English language, or commonly understood graphic symbols to CAN/CSA Z321.
- .2 Maintain approved signs and notices in good condition for duration of project and dispose of off-site on completion of project or earlier if directed by Contract Administrator.

- .3 Maintain sign in clean condition throughout duration of project.
- .4 No other signs or advertisements, other than warning signs, are permitted on site, except by specific written permission by the City.
- .5 Signs and notices for safety and instruction shall be in both official languages Graphic symbols shall conform to CAN3-Z321.
- .6 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Contract Administrator.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

- .1 Work in this Section includes, but is not limited to, requirements for erosion and sedimentation controls during construction, which forms the Contractor's commitment for LEED® Construction Activity Pollution Prevention Prerequisite as follows:
 - .1 Contractor's responsibilities for development and implementation of an Erosion and Sedimentation Control Plan
 - .2 Contractor's responsibilities to confirm compliance with requirements of the Erosion and Sedimentation Control Plan.
- .2 This Section includes guidelines and recommendations for developing an Erosion and Sedimentation Control Plan; failure to implement the Contractor's responsibility for the Erosion and Sedimentation Control Plan has the potential to nullify LEED® Sustainable Sites Construction Activity Pollution Prevention Prerequisite resulting in The City receiving no LEED® Certification.

1.2 RELATED SECTIONS

- .1 01 33 29 General LEED® Requirements

1.3 REFERENCES

- .1 U.S Green Building Council: Sustainable Sites Construction Activity Pollution Prevention Prerequisite. LEED® Reference Guide for Building Design and Construction v4
<http://www.cagbc.org>
- .2 Environmental Protection Agency (EPA) Construction General Permit (CGP) 2012:
cfpub.epa.gov/npdes/stormwater/cgp.cfm

1.4 OBJECTIVES

- .1 Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- .2 Prevent sedimentation of storm sewer or receiving streams.
- .3 Prevent pollution of the air with dust and particulate matter.
- .4 Meet or exceed the requirements of LEED BD+C Sustainable Sites Construction Activity Pollution Prevention Prerequisite which requires compliance with 2012 U.S. EPA Construction General Permit OR local standards and codes, whichever is more stringent.

1.5 DESCRIPTION OF WORK

- .1 A LEED Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all aspects of LEED coordination (during construction) related to erosion and sedimentation control
- .2 Assess which ESC measures are needed based on a site evaluation that identifies the following:

- .1 The slope of the project site and where water will drain
- .2 The total area and duration of ground disturbance to identify air quality and rainwater runoff effects on neighboring properties
- .3 The location of existing rainwater management systems that must be protected
- .4 Planned construction sequencing that may require additional ESC measures over time
- .5 Weather and soil conditions that could cause rainwater runoff or generate dust
- .6 Construction entrances and their erosion and sedimentation effects on local roads servicing the project site
- .3 Erosion and Sedimentation Control activities shall include:
 - .1 Implementing erosion and sedimentation control measures shown on drawings and described in this Section
 - .2 Installing erosion and sedimentation control products in accordance with manufacturer instructions and the prescribed installation procedures in the referenced EPA document
 - .3 Supervising on site erosion and sedimentation control activities on a daily basis
 - .4 Coordinating erosion and sedimentation control tasks with subcontractors to ensure timely and orderly progress of the work
 - .5 Conducting erosion and sedimentation control inspections and making necessary repairs
 - .6 Maintaining an erosion and sedimentation control inspection log to document observations, deficiencies and corrective actions
 - .7 Preparing erosion and sedimentation control documentation and submittals as detailed herein
 - .8 Reporting erosion and sedimentation control progress to the Contract Administrator

1.6 SUBMITTALS

- .1 Submit an Erosion and Sedimentation Control Plan to the Contract Administrator for approval a minimum of 14 days prior to construction, the plan shall include all the requirements outlined in the Environmental Protection Agency (EPA) Construction General Permit (CGP) 2012 Section 2:
 - .1 Section 2.1, erosion and sedimentation control
 - .1 Providing natural buffers
 - .2 Installing perimeter controls
 - .3 Minimizing sediment track-out
 - .4 Controlling discharges from stockpiled sediment or soil
 - .5 Minimizing dust
 - .6 Minimizing the disturbance of steep slopes
 - .7 Preserving topsoil
 - .8 Minimizing soil compaction
 - .9 Protecting storm drain inlets
 - .10 Maintaining control measures
 - .2 Section 2.2, stabilization
 - .1 Deadlines for initiating and completing stabilization
 - .2 Criteria for stabilization
 - .3 Section 2.3, pollution prevention

- .1 Prohibited discharges
 - .2 General maintenance requirements
 - .3 Pollution prevention standards
 - .4 Emergency spill notification
 - .5 Fertilizer discharge restrictions
- .2 Identify whether ESC plan is in compliance with EPA standards or local codes. If local codes are used, submit a description on how they are more stringent than EPA standards.
- .3 Identify measures to be implemented on site for the following:
- .1 Site Arrangement
 - .2 Stabilized Construction Entrance
 - .3 Material Stockpiling
 - .4 Stabilization Practices (i.e. seeding, mulching, etc.)
 - .5 Structural Practices (i.e. silt fence, outlet protection, sediment trap etc.)
- .4 Submit product data indicating actual materials used for erosion and storm water controls
- .5 Inspections should follow the requirements the CGP, section 4.1.
- .6 Submit Schedule E1 – ESC Inspection Log
- .1 Complete the ESC Inspection log on a weekly basis. The log shall commence when the site is “disturbed” (i.e. when site work begins) and carry through until final landscaping is complete
 - .2 The ESC Inspection log shall be completed for each inspection and must document:
 - .1 Deficiencies related to the ESC measures
 - .2 Corrective actions taken to remedy the deficiencies
 - .3 Each deficiency must be initialed and each report signed after all corrective measures have been completed and documented
 - .3 All ESC Inspection Log shall include digital photographs showing:
 - .1 A minimum of 2 photographs of each ESC measure implemented on site
 - .2 Date Stamp: Standard indicating Year, Month and Day
 - .3 Identify what ESC measure is shown in each photo
 - .4 Submit an up-to-date copy of the ESC Inspection Report comprising the Schedule E1 and photographs to the Contract Administrator on a monthly basis

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 EROSION AND SEDIMENTATION CONTROL

- .1 Establish control measures before construction begins, according to requirements in CGP Section 2.1. Implement additional measures as needed based on site conditions and as construction progresses.

3.2 STABILIZATION REQUIREMENTS

- .1 Stabilize exposed portions of the site, according to requirements in CGP Section 2.2. Implement additional measures as needed based on site conditions and as construction progresses.

3.3 POLLUTION PREVENTION

- .1 Establish control measures before construction begins, according to requirements in CGP Section 2.3. Implement additional measures as needed based on site conditions and as construction progresses.
- .2 The following discharges are prohibited:
 - .1 Wastewater from washout of concrete, unless managed by an appropriate control as described in CGP, Part 2.3.3.4
 - .2 Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials, unless managed by an appropriate control as described in CGP, Part 2.3.3.4
 - .3 Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
 - .4 Soaps, solvents, or detergents used in vehicle and equipment washing
 - .5 Toxic or hazardous substances from a spill or other release.

3.4 BEST MANAGEMENT PRACTICES (BMPS)

- .1 Vehicle Wash-Down Area:
 - .1 Establish a wash down area for trucks and cars to remove mud and soil adhered to traffic
 - .2 Equip wash down area with sedimentation control devices and water supply
 - .3 Establish a filtering system to prevent gasoline, diesel fuel or anti-freeze from being flushed into surface drainage system.
 - .4 For storage of soaps, detergents, or solvents, you must provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these detergents from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas.
 - .5 Do not allow mud and soil to accumulate on public roadways
- .2 Sedimentation Control Basins, Silt Fences and Erosion Control Blankets:
 - .1 Establish a sedimentation pond of sufficient size or geotextile filtering system to control sedimentation from entering surface drainage or street drainage and sewerage systems.
 - .2 Regularly remove accumulations of silt and dispose off site at a recognized landfill facility.
 - .3 Reapply erosion control polymer as it biodegrades or is worn away from construction activities.
 - .4 Repair silt fences and erosion control blankets when torn; securely attach fabric to posts; firmly embed posts into ground.

- .5 Weight and peg erosion control blankets so that blankets are in full contact with ground; spaces and gaps under blankets will result in increased erosion rendering this measure ineffective.
- .3 Stabilized Construction Entrance:
 - .1 Establish a clean gravel pad at construction entrances of sufficient length and depth to trap clay and excavation debris; clean gravel on a regular basis to prevent build up of clay and prevent sediment from being tracked onto roadways.
- .4 Housekeeping:
 - .1 Monitor vehicles for leaks and repair where leakage of polluting liquids are observed; liquids include, but are not limited to: gasoline, oil, diesel fuel, anti-freeze, brake or transmission fluid or other substance that may be harmful if released into the environment or storm drainage systems.
 - .2 Store petroleum products in clearly labelled sealed containers; provide spill kits at fueling and maintenance areas; provide impermeable tarp at fueling and maintenance areas.
 - .3 Provide a covered hopper or collection skid for waste materials.
 - .4 Tightly seal and store paint containers and sealing or curing compounds when not required and store in a protected location; do not discharge excess materials into storm drainage system.
 - .5 Do not allow concrete trucks to washout, or discharge surplus concrete or drum wash water on site; dispose of at recognized disposal facility.
 - .6 Place absorbent materials to soak up excess form release agents; replace absorbent materials when they become saturated at a recognized disposal facility.

3.5 INSPECTION AND MAINTENANCE

- .1 Inspect all erosion and sedimentation control measures at least once each week and following any significant storm event (0.25 inches of precipitation or greater).
- .2 All erosion and sedimentation control measures must be maintained in good working order. If maintenance or repairs are identified they must be completed within 24 hours.
- .3 Schedule E1 – ESC Inspection Report must be completed for each inspection.
- .4 Inspection procedures specified below summarize the EPA document and shall be followed in conjunction with details, drawings, and manufacturer requirements.
 - .1 Stabilized Construction Entrance: Apply additional gravel as required, remove sediments and other materials from all areas to minimize clogging. Keep adjacent public roadway(s) free of sediment.
 - .2 Material Stockpile: Inspect for effective prevention of runoff and erosion.
 - .3 Temporary Seeding: If plants do not grow quickly or thick enough to prevent erosion, reseed the area as soon as possible. Keep seeded areas adequately moist. If irrigation is required, over-watering shall be avoided. Phosphorus-containing fertilizers are not to be used.
 - .4 Permanent Seeding: Inspect for sufficient growth and water conditions. Replant areas as per installation instructions (refer to 3.01C.2) if cover does not provide erosion control.

- .5 Mulching: Inspect to ensure mulching is not loose or removed. Apply additional mulch or reseed if necessary. If mulch binder is required, apply at rates specified by the manufacturer. Employ alternative controls if current measures are not effective.
- .6 Preservation of Natural Vegetation: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning, and weed and pest control, depending on the specific species and environmental conditions. Remove any debris, and ensure area is protected from traffic.
- .7 Buffer Zones: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning, and weed and pest control, depending on the specific species and environmental conditions. Remove any debris, and ensure area is protected from traffic.
- .8 Soil Retaining Measures: Inspect for structural damage and repair as required.
- .9 Sod Stabilization: Remove and replace dead sod. Ensure area receives sufficient water. If irrigation is required do not over-water.
- .10 Silt Fence: Silt fence to be inspected for depth of sediment, tears, loose fabric attachment at the fence posts, channel erosion beneath fence, sagging or collapse and to ensure the fence posts are firmly in the ground. Built up sediment is to be removed from silt fence when it has reached one-third the height of the fence. Repair such that fence is in original installation condition.
- .11 Outlet Protection: Inspect outlet for erosion and pooling of water. Necessary repairs to be made as required to reduce exit velocity of runoff. If a riprap apron is used, inspect for riprap displacement and damage to filter fabric.
- .12 Inlet Protection: Inspect that measures are in original installed condition. Ensure measures are effectively trapping sediment. Remove accumulated sediment and debris when it reaches ½ the design depth of the trap. Repair protection measures as required.
- .13 Surface Roughening: Inspect for small eroded watercourses, as little as a few inches deep, or washout of roughened grading. Fill, regrade, and reseed immediately.
- .14 Check Dams: Inspect for sediment and debris accumulation and erosion of sides. Sediment should be removed when it reaches one half the original dam height. Repair dams as required.
- .15 Drainage Swale: Inspect for dips or low points along the swale where water is pooling and ensure that runoff is being directed to sediment trapping measure used onsite.
- .16 Interceptor Dikes and Swales: For swales inspect for dips or low points along the swale where water is pooling and ensure that runoff is being directed to sediment-trapping measure used onsite. For dikes ensure runoff is being directed to sediment-trapping measure used onsite and that it is compacted and free of low points for water collection.
- .17 Earth Dike: Ensure runoff is being directed to sediment-trapping measure used onsite and that it is compacted and free of low points for water collection.
- .18 Gravel or Stone Filter Berm: Inspect for breach in structure caused by vehicles and accumulated sediment. Replace filter material if needed, and remove and properly dispose of accumulated sediment.

- .19 Sediment Trap: Remove sediment when it reaches 300mm in depth. If outlet becomes clogged with sediment it must be cleaned to restore flow capacity. Maintain until site area is permanently stabilized and/or permanent structures are in place. Ensure bank is sufficiently compacted and stabilized such that erosion into the basin does not occur.
- .20 Temporary Sediment Basin: Remove sediment when it reaches 300mm in depth. If outlet becomes clogged with sediment it must be cleaned to restore flow capacity. Maintain until site area is permanently stabilized and/or permanent structures are in place. Ensure bank is sufficiently compacted and stabilized such that erosion into the basin does not occur.
- .21 Pipe Slope Drains: Ensure runoff does not bypass the inlet, undercutting the structure. Repair undercutting at inlet if needed. If required, install a headwall, riprap, or sandbags around the inlet. Inspect pipes for leakage. Repair leaks and restore damaged slopes. If evidence exists of pipe movement, install additional anchor stakes to secure slope.
- .22 Subsurface Drains: Inspect for pipe breaks or clogging by sediment, debris, or tree roots. Remove blockage immediately, replace any broken sections, and re-stabilize the surface. Check inlets and outlets for sediment or debris, and remove and dispose of these materials properly.
- .23 Temporary Storm Drain Diversion: Ensure flow is being properly directed towards sediment-trapping device. When construction is complete, move diversion, flush storm drain prior to removal of sediment trap/basin, stabilize outfall, and restore grade areas.
- .5 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .6 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal. Erosion and sedimentation control measures shall be maintained and inspected until final landscaping is complete

END OF SECTION

Complete at least weekly, submit to LEED Contract Administrator monthly. Include three photo references for each measure listed (as applicable), photos are to be date stamped and submitted to the Contract Administrator as .jpeg files.

General Information

Company Name:		Inspection Date:	
Inspection Frequency (Note: you may be subject to different inspection frequencies in different areas of the site. Check all that apply.)			
Standard Frequency: <input type="checkbox"/> Weekly OR <input type="checkbox"/> Every 14 days and within 24 hours of a 6mm rain			
Increased Frequency: <input type="checkbox"/> Every 7 days and within 24 hours of a 0.25" rain (for areas of sites discharging to Sensitive Waters)			
Reduced Frequency:			
<input type="checkbox"/> Once per month (for stabilized areas)			
<input type="checkbox"/> Once per month and within 24 hours of a 6mm rain (for arid, semi-arid, or drought-stricken areas during seasonally dry periods or during drought)			
<input type="checkbox"/> Once per month (for frozen conditions where earth-disturbing activities are being conducted)			
Was this inspection triggered by a 6mm storm event? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, how was it determined? <input type="checkbox"/> Rain gauge on site <input type="checkbox"/> Local weather station			
Specify Weather station source:		Total rainfall amount that triggered the inspection (in mm):	
Check for the presence of conditions that could lead to spills, leaks, or other accumulations of pollutants on the site. Inspect the following (if applicable):			
<input type="checkbox"/> Fueling and maintenance of equipment or vehicles			
<input type="checkbox"/> Washing of equipment and vehicles;			
<input type="checkbox"/> Storage, handling, and disposal of construction materials, products, and wastes;			
<input type="checkbox"/> Washing of applicators and containers used for paint, concrete, or other materials.			

Erosion and Sediment Controls (CGP Part 2.1) & Pollution Prevention (CGP Part 2.3) Inspection Log

ID #	E&S/PP Control Measure	Repairs or Other Maintenance Required?	Corrective Action Required?	Notes – Repairs, maintenance and/or corrective actions taken	Photo Reference (attached as .jpeg)		
01	Silt Fence	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Tear noticed in section along North perimeter, replaced filter fabric in this section.	100100.jpeg	100101.jpeg	100102.jpeg
02	Stabilized Construction Entrance	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No				
03	Stockpiled Soil	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No				
04	Dust Control	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No				
05	Storm Drain Inlet	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No				

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 31 00 – Project Management and Co-ordination.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 50 00 – Temporary Facilities and Controls.
- .4 Section 01 74 00 – Cleaning.
- .5 Section 01 74 19 – Construction and Demolition Waste Management.

1.2 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Procedures for product substitution.
- .3 Manufacturer's instructions.
- .4 Quality of Work, co-ordination and fastenings.
- .5 Co-ordination:
 - .1 Contractor shall co-ordinate the exact location of mechanical and electrical fixtures, outlets, switches, panels, etc. which are located in architectural wall and ceiling finishes with Contract Administrator prior to rough-in and cutting of openings and recesses.
 - .2 Contractor shall be responsible for all costs associated with relocation of mechanical and electrical devices (including replacement of damaged wood veneer paneling, linear wood ceilings and other architectural finishes) resulting from failure to co-ordinate with Contract Administrator prior to rough-in.

1.3 LABOUR AND PRODUCTS

- .1 Products, material and equipment used to contain no asbestos fibre.

1.4 REFERENCE STANDARDS

- .1 *B7: Substitutes, of the Bidding Procedures.*
- .2 Within text of each specifications section, reference may be made to reference standards.
- .3 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4 If there is question as to whether any product or system is in conformance with applicable standards, Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.
- .5 Cost for such testing will be born by the City in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .6 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.5 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays in any items. 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.
- .2 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.

1.6 QUALITY AND CONFORMANCE

- .1 When material or equipment is specified by standard or performance specifications, upon request of Contract Administrator, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.
- .2 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.7 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, contamination, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in work.
- .3 Store products subject to damage from weather in weatherproof enclosures as specified in Section 01 50 00.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

- .6 Store construction materials on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .10 Cleaning in accordance with Section 01 74 00.
- .11 Waste Management and Disposal in accordance with Section 01 74 19.

1.8 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of work.
- .2 Transportation costs of products supplied by the City will be paid for by the City, unless specified otherwise. Unload, handle and store such products, unless otherwise specified.

1.9 MANUFACTURER'S INSTRUCTIONS

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

1.10 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 Enforce discipline and good order among workers.
- .3 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.
- .4 Decisions as to standard or fitness quality of work in cases of dispute rest solely with Contract Administrator, whose decision is final.

1.11 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Ensure Work of various Subcontractors does not conflict or create interference.

- .3 Be responsible for the proper co-ordination and placement of openings, sleeves, and accessories.
- .4 Supply all items required to be built in as and when required, together with templates, measurements and shop drawings.
- .5 Ensure all workers examine the drawings and specifications covering the Work of others that may affect the performance of their own Work. Examine the Work of others and report to the Contract Administrator, in writing, any defects, or deficiencies that may affect the Work. In the absence of any report, the Contractor shall be held to have waived all claims for damage to or defects in such Work.
- .6 Ensure that components requiring foundations or openings that are required for the installation of Work is co-ordinated. Furnish the necessary information to the Sections concerned in ample time to permit allowance for such items. Failure to comply with this requirement does not relieve the party at fault of the cost of cutting or drilling at a later date and subsequent patching.
- .7 Extras to the Contract where architectural, structural, or mechanical work requires relocation or modifications due to the failure of the Electrical Subcontractor to co-ordination the work and provide interference co-ordination drawings will not be accepted.

1.12 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.

1.13 REMEDIAL WORK

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

1.14 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate. Contract Administrator may move these up to 3m from position indicated, at no cost to the City, provided notice is given before related work has commenced.
- .2 Inform Contract Administrator of conflicting installation. Submit field drawings to indicated relative position of various services and equipment when required by Contract Administrator. Install as directed.
- .3 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .4 Contractor shall be responsible for all costs associated with relocation of mechanical and electrical devices (including replacement of damaged stone veneer cladding and wood paneling) resulting from failure to co-ordinate with Contract Administrator prior to rough-in.

1.15 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 request 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 minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.16 FASTENINGS - EQUIPMENT

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

1.17 PROTECTION OF WORK IN PROGRESS

- .1 Protect Work completed or in progress.
- .2 Prevent overloading of any part of the building. Do not cut, drill, or otherwise sleeve any load bearing structural member unless specifically indicated on drawings or in Specifications without written approval of the Contract Administrator.

Part 2 Products

2.1 PRODUCT OPTIONS

- .1 Products specified by reference standards or by description only: any product meeting those standards or description is acceptable for use.
- .2 Products specified by naming one or more manufacturers: submit request for substitution for any manufacturer not named.

2.2 SUBSTITUTIONS

- .1 Refer to Section 01 33 00 and *B8: Substitutes, of Bidding Procedures*.
- .2 The Work is based on the Materials and methods specified in the specifications.

- .3 Should substitutions be required because of unavailability the Contract Administrator will consider proposals to substitute specified products/materials with alternate products/materials.
- .4 Substitutions are not allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- .5 Each proposal must:
 - .1 Include sufficient information in the form of product data, specifications, drawings, and other manufacturer's data to enable the Contract Administrator to properly evaluate the proposal.
 - .2 Identify changes required in the applicable Work which would become necessary to accommodate the substitute.
- .6 The Contract Administrator reserves the right to accept or reject any proposal without prejudice for any reason whatsoever and reserves the right to disclose or not to disclose their reasons for such rejection.
- .7 In submittal of a request for substitution it is hereby understood that the person or entity submitting the request is certifying that the proposed substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule.

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Work of this Section consists of the supply and installation of City Furnished Products (CFP) as indicated.

1.2 RELATED SECTIONS

- .1 Section 11 06 00 – Equipment Schedule.

1.3 DEFINITIONS

- .1 Refer to drawings for the City Furnished Product listed as follows:
 - .1 City Furnished Products (CFP-A), Contractor Installed.
 - .2 City Furnished Products (CFP-B), Vendor Installed (under contract with the City), Contractor Co-ordinated.
 - .3 Planning Code C: Existing City Furnished Products (CFP-C), Contractor Installed.
 - .4 Planning Code D: Existing City Furnished Products (CFP-D), Vendor Installed (under subcontract to Contractor), Contractor Co-ordinated.
- .2 Vendor: equipment manufacturer or equipment manufacturer's authorized supply and installation representative.
- .3 Assemble or Assembly: fit together of multiple components and accessories in accordance with manufacturer's printed instructions/manuals, and specifications.
- .4 Install or Installation: provide structural support and/or blocking, placing into position, anchorage and adjusting of CFP as indicated by drawings, specifications and manufacturer's printed installation instructions/manuals.
- .5 Connect or Connection: provide mechanical and electrical services and/or architectural and structural elements as indicated and required to interface with building services for proper operation, as indicated by drawings, specifications and manufacturer's printed installation instructions/manual.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 City to obtain and issue to Contractor, one printed copy or one electronic copy of manufacturer's product/equipment data, shop drawings, electrical and mechanical connections, installation instructions, O & M Manuals, and all other relevant information for each CFP to assist Contractor with his work.
 - .2 Contractor to review shop drawings received from the City and forward to Contract Administrator in accordance with Section 01 33 00.
- .2 Closeout Submittals.
 - .1 City to obtain and issue to Contractor, operating and maintenance instructions, parts lists, wiring diagrams, installation instructions/manuals, etc. for each CFP for incorporation into Operations and Maintenance Manual provided by Contractor as specified in Section 01 78 00.
 - .2 Contractor to turn over to the City, spare parts, maintenance materials, maintenance manuals, etc. included with product delivery in accordance with Section 01 78 00.

- .3 Certificates of Insurance.
 - .1 Contractor to issue to the City, confirmation of insurance carried on CFP.
 - .2 Contractor to obtain estimated value of CFP to be insured from City.
- .4 Record Drawings.
 - .1 Contractor to incorporate CFP into Project Record Drawings as specified in Section 01 78 00.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 City to arrange and pay for delivery of CFP in accordance with Contractor's construction schedule. Contractor to provide the City with delivery and packing slips accompanying deliveries.
- .2 City and Contractor to inspect CFP delivered to site, and jointly record shortages and damaged or defective CFP. City to submit claims for transportation damage of CFP, and arrange for replacement of damaged, defective, or missing CFP.
- .3 Contractor to receive, unload, inventory, unpack, transport, and set in place in designated room, CFP in accordance with Section 01 61 00.
- .4 Contractor to be responsible for temporary storage in heated, secure, off-site facility including delivery charges for all CFP that arrive to site but are not ready for installation due to Contractor's failure to conform to mutually agreed-upon schedule for the Work, or for delays Contractor is responsible for.
- .5 Cleaning in accordance with Section 01 74 00.
- .6 Construction and Demolition Waste Management in accordance with Section 01 74 19.

1.6 SCHEDULING

- .1 Contractor to provide City with dates required for receipt of submittals as specified in this Section, and for required delivery dates of CFP to site for incorporation into project. Contractor to incorporate CFP installation dates into construction schedule.
- .2 Contractor to be responsible for safety and overall co-ordination of CFP installed by the City's Vendor or Vendor's authorized supply and installation representative within overall project schedule, and ensure their attendance at regular project safety and toolbox meetings.

1.7 WARRANTY

- .1 City to obtain and issue to Contractor, copy of manufacturer's standard warranty documents for each CFP for incorporation into Operations and Maintenance Manual provided by Contractor in accordance with Section 01 78 00.

1.8 INSURANCE

- .1 Contractor to include value of all new and existing City Furnished Products (CFP) under the Contract insurance policy.
- .2 Insurance coverage for all new CFP shall commence on the date CFP is delivered to the Site and has been accepted by the City and Contractor.
- .3 Insurance coverage for all existing CFP shall commence on the date the Contractor commences removal of the CFP from the existing location for incorporation into the new location.

1.9 COMMISSIONING

- .1 City to arrange and pay for commissioning and certification of all installed CFP as required.

1.10 MAINTENANCE

- .1 City to obtain and pay for replacement parts and accessories and/or maintenance service as may be required to ensure existing CFP functions properly.

Part 2 Products

2.1 CITY FURNISHED PRODUCTS (CFP)

- .1 Refer to drawings for the City Furnished Product listed as follows:
 - .1 CFP-A - City Furnished Products, Contractor Installed.
 - .2 CFP-B - City Furnished Products, Vendor Installed (under contract with the City), Contractor Co-ordinated.
 - .3 CFP-C - Existing City Furnished Products, Contractor Installed.
 - .4 CFP-D - Existing City Furnished Products, Vendor Installed (under subcontract to Contractor), Contractor Co-ordinated.
 - .5

Part 3 Execution

3.1 PREPARATION

- .1 Contractor to develop and co-ordinate project schedule with the City who will in turn co-ordinate with their Vendor or Vendor's authorized supply and installation representative.
- .2 Contractor to obtain from City, manufacturer's shop drawings for CFP including mechanical and electrical requirements relating to details of service connections or rough-ins.
- .3 Contractor to provide necessary rough-ins for CFP -B including but not limited to, blocking, backing, supports, conduits, wiring, electrical boxes, piping, ductwork, inserts, depressions, trimming, openings, drains, canting and core drilling as indicated on shop drawings and as directed by City's Vendor or Vendor's authorized supply and installation representative.
- .4 Contractor to allow City's Vendor or Vendor's authorized supply and installation representative access to the site, and co-ordinate the work performed by the Vendor or Vendor's authorized supply and installation representative.

3.2 INSTALLATION

- .1 Planning Code A: City Furnished Products (CFP-A), Contractor Installed.
 - .1 Contractor to receive, unload, inventory, unpackage, transport, and set CFP-A in designated rooms.
 - .2 Contractor to assemble, install and connect CFP-A to architectural and/or structural elements and mechanical and/or electrical services as required. Anchor fixed components firmly, square, level, and plumb.
 - .3 Contractor to co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Contract Administrator.
 - .4 Contractor to install CFP-A including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions/manuals.

- .5 Contractor to clean, lubricate, and perform initial start-up and testing to ensure proper function.
 - .6 Contractor to participate as required in City arranged commissioning and certification.
 - .7 Contractor to repair or replace CFP-A damaged by own forces on site (under Contractor control).
- .2 Planning Code B: City Furnished Products (CFP-B), Vendor Installed (under contract with the City), Contractor Co-ordinated.
- .1 Contractor to be responsible for preparation and co-ordination as described in item 3.1 Preparation above.
 - .2 City to employ the services of a Vendor or Vendor's authorized supply and installation representative for the supply and installation of CFP-B.
 - .3 Supply and installation costs for CFP-B are not included. However, Contractor co-ordination is included.
 - .4 Unless the Contractor and Vendor mutually agree otherwise, the Vendor or Vendor's authorized supply and installation representative shall:
 - .1 Receive, unload, inventory, unpackage, transport, and set CFP-B in designated rooms.
 - .2 Assemble, install, and connect CFP-B to architectural and/or structural elements, and mechanical and/or electrical services as required. Anchor fixed components firmly, square, level, and plumb.
 - .3 Clean, lubricate, and perform initial start-up and testing to ensure proper function.
 - .4 Install CFP-B including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions/manuals.
 - .5 Contractor and Vendor or Vendor's authorized supply and installation representative shall co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Contract Administrator.
 - .6 Clean, lubricate, adjust, and do initial start-up and testing to ensure proper function.
 - .7 Contractor and Vendor or Vendor's authorized supply and installation representative shall participate as required in City arranged commissioning and certification.
- .3 Planning Code C: Existing City Furnished Products (CFP-C), Construction Manager Installed.
- .1 Construction Manager to disconnect, disassemble (if required) existing CFP from existing services and set in place in designated room. Construction Manager to co-ordinate with the City for disconnection from architectural and/or structural elements and mechanical and/or electrical services as required.
 - .2 Construction Manager to reassemble (if required), install, and connect to architectural and/or structural elements and mechanical and/or electrical services as required. Anchor fixed components firmly, square, level, and plumb.
 - .3 Construction Manager to cap-off existing services abandoned in existing equipment location.
 - .4 Construction Manager to co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Contract Administrator.
 - .5 Construction Manager to install CFP including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions.

- .6 Construction Manager to replace worn or damaged parts and accessories with replacement parts supplied by the City.
- .7 Construction Manager to clean, lubricate, adjust, and do initial start-up and testing to ensure proper function.
- .8 Construction Manager to participate as required in City arranged commissioning and certification.
- .9 Construction Manager to repair or replace CFP damaged by own forces on site (under Construction Manager's control).
- .4 Planning Code D: Existing City Furnished Products (CFP-D), Vendor Installed (under subcontract to Construction Manager), Construction Manager Co-ordinated.
 - .1 Construction Manager to be responsible for preparation and co-ordination as described in paragraph 3.1 Preparation.
 - .2 Construction Manager to employ the services of a Vendor for the installation of existing CFP classified as Planning Code D.
 - .3 Installation costs for existing CFP classified as Planning Code D to be included in Building Contract.
 - .4 Unless the Construction Manager and Vendor mutually agree otherwise, the Vendor shall:
 - .1 Receive, unload, inventory, unpack, transport, and set existing CFP in designated rooms.
 - .2 Assemble, install and connect existing CFP to architectural and/or structural elements and mechanical and/or electrical services as required. Anchor fixed components firmly, square, level, and plumb.
 - .3 Install CFP including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions/manuals.
 - .4 Replace damaged parts and accessories with replacement parts supplied by City.
 - .5 Clean, lubricate, and perform initial start-up and testing to ensure proper function.
 - .6 Construction Manager and Vendor shall co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Contract Administrator.
 - .7 Clean, lubricate, adjust, and do initial start-up and testing to ensure proper function.
 - .8 Construction Manager and Vendor shall participate as required in City arranged commissioning and certification.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services.
 - .1 Contractor or Vendor (based on who is responsible for installation) to arrange for manufacturer's field services representative to co-ordinate mechanical and electrical rough-ins prior to and during installation and connection of CFP.
- .2 Site Tests, Inspection.
 - .1 Contractor or Vendor (based on who is responsible for installation) to perform initial start-up of CFP with the City and manufacturer's representative present.
 - .2 Contractor or Vendor (based on who is responsible for installation) to request inspection of installations as required by Authorities Having Jurisdiction.

3.4 ADJUSTING

- .1 Contractor or Vendor (based on who is responsible for installation) to adjust and recalibrate components to assure proper alignment and operation, in accordance with the manufacturer's requirements.
- .2 Contractor or Vendor (based on who is responsible for installation) to repair (if acceptable to the City), or replace worn or damaged parts or improperly operating items with replacement parts supplied by the City.

3.5 CLEANING

- .1 Contractor or Vendor (based on who is responsible for installation) to clean surfaces immediately after installation and adjustment to remove marks, soil and foreign matter.
- .2 Prior to Substantial Completion, Contractor or Vendor (based on who is responsible for installation) to recheck components and perform required additional cleaning.

3.6 DEMONSTRATION

- .1 City will arrange for demonstration and maintenance instruction of all CFP to facility personnel as required in accordance with Section 01 79 00.

3.7 PROTECTION

- .1 Contractor to provide protection from damage during construction for all CFP.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 19 – Construction and Demolition Waste Management.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM E1971-05(2011), Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings.
- .2 Canadian Federal Legislation.
 - .1 Canadian Environmental Protection Act (CEPA).
 - .2 Canadian Environmental Assessment Act (CEAA).
 - .3 Transportation of Dangerous Goods Act (TDGA).
 - .4 Motor Vehicle Safety Act (MVSA).
- .3 Refer: *General Conditions*.

1.3 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by the City or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building, remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 – Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.4 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris including that caused by the City or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of. 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, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds as applicable.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean equipment and fixtures to sanitary condition; replace filters of mechanical equipment.
- .16 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

- .1 Work in this Section includes, but is not limited to, requirements for Construction and Demolition Waste Management during construction, which forms the Contractor's commitment for LEED Prerequisite MRp2 Construction and Demolition Waste Management and Credit MRc5 Construction and Demolition Waste Management.
- .2 Waste Management Plan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.
- .3 Identifying any special programs, landfill options or alternatives to landfill.
- .4 The City has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.
- .5 The City recognizes that waste in any project is inevitable, but indicates that as much of the waste materials as economically feasible shall be reused, salvaged, or recycled in order to divert materials away from landfill.

1.2 RELATED SECTIONS

- .1 Section 01 33 29 General LEED Requirements

1.3 REFERENCES

- .1 Canadian Construction Association Standard Construction Document:
 - .1 CCA 27-1997: A Guide on Construction Environmental Management Planning.
 - .2 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.
- .2 Canada. Public Works and Government Services Canada. 2002 National Construction Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

1.4 OBJECTIVES

- .1 Minimize the amount of solid waste generated by construction, renovation and demolition (CRD) activities.
- .2 Meet the requirements of LEED v4 prerequisite MRp2 Construction and Demolition Waste Management by writing a Construction and Demolition Waste Management Plan and issuing a Total Construction Waste Report.
- .3 Divert at least 75% of the total construction and demolition materials from landfill using at least four material streams to achieve LEED v4 credit MRc9 Construction and Demolition Waste Management.
 - .1 A waste stream can be either of the following:

- .1 A specific material category that is diverted in a specific way (plastic, metals, etc.); or
- .2 A mixture of several material categories that are diverted in a specific way (materials sent to reuse markets, commingled waste sent to mixed waste recycling facility, source separation where each material is sent to a specific facility, manufacturers or suppliers take-back of materials, and reuse of deconstructed materials on site).
- .4 All construction waste is to be site separated into bins specific to each material (e.g. metal, wood, gypsum, concrete, plastics, etc.)
- .5 Comply with all applicable local environmental regulations related to waste management and pollution control.
- .6 Comply with Canadian Construction Association's "Code of Practice" outlined in Standard Construction Document CCA 27-1997 to encourage improved waste management practices. Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.

1.5 DESCRIPTION OF WORK

- .1 A LEED Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all aspects of LEED coordination (during construction) related to construction waste management and disposal
- .2 Construction Waste Management activities shall include:
 - .1 Arranging waste management service agreements with waste haulers and waste receiving facilities
 - .2 Supervising on-site waste management activities on a daily basis
 - .3 Coordinating waste management tasks with Subcontractors to ensure timely and orderly progress of the work
 - .4 Preparing waste management documentation and submittals to summarize all shipments of waste materials from the project site
 - .5 Reporting waste management progress to the LEED Contract Administrator

1.6 SUBMITTALS

- .1 Submit a Construction and Demolition Waste Management Plan to the Contract Administrator for approval a minimum of 14 days prior to construction
- .2 The plan shall include the following:
 - .1 Establish waste diversion goals for the project by identifying at least five materials (both structural and nonstructural) targeted for diversion. Include an approximation of the overall project waste that these materials represent.
 - .2 Specify whether materials will be separated on site or comingled
 - .3 Describe the diversion strategies planned for the project and account for all materials, including land-clearing debris, alternate daily cover, and other materials.
 - .4 Describe specifically to which facility diverted materials will be taken and how the recycling facility will process the materials. Include letters for each receiving facility confirming the end use of the materials.

- .5 Describe methods for safe removal and disposal of hazardous materials. Hazardous materials must be tracked separately and not included in the projects total waste.
- .3 Submit a final Total Construction Waste Report detailing all major waste streams generated, including disposal and diversion rates
- .4 Submit the following on a monthly basis to track waste diversion performance throughout construction
 - .1 Waybills, invoices, letters and other documentation that clearly indicates the receiving facility, end use (reused, recycled or landfill) and quantity of waste for each shipment of waste generated on the project site. Record each shipment using the Waste Tracking Log
 - .2 Submit an up-to-date copy of the Waste Tracking Log, including records of each waste shipment and the following associated information:
 - .1 Date of shipment
 - .2 Waste hauler
 - .3 Recycling Receiving Facility
 - .4 Waybill and/or invoice number with corresponding landfilled Mass and/or recycled material mass. Materials are to be recorded by type (ex. Gypsum, wood, concrete, plastic, metal, cardboard, etc.)
 - .5 Total mass of each recycled material type and landfilled mass
 - .6 Calculated diversion rate
 - .3 Certificate of the facility that processes and recycles commingled (mixed) construction and demolition waste materials.

Part 2 Products

2.1 Not Used

Part 3 Execution

3.1 Waste Management Plan Implementation

- .1 Waste Reduction
 - .1 Encourage Suppliers and Subcontractors to retrieve/retain packaging (i.e. skids, plastic wrap, etc.) for reuse
 - .2 Suppliers and Subcontractors must provide a letter stating the item(s) will be reused and documenting the quantity removed from the site
 - .3 Prevent damage of materials due to mishandling, improper storage, and contamination
 - .4 Where possible, use prefabricated assemblies built at a central facility to avoid waste generation at the site
 - .5 Contact local salvaging/recycling facilities and arrange for recycling/reuse services. At a minimum, the proposed facilities must recycle/reuse the following waste materials that will be generated throughout construction:
 - .1 Land clearing debris
 - .2 Asphalt

- .3 Concrete/masonry/stone
- .4 Steel and other metals
- .5 Wood
- .6 Gypsum
- .7 Cardboard
- .8 Plastic
- .9 Exclude excavated soil, land-clearing debris, and alternative daily cover (ADC).
- .6 Include wood waste converted to fuel (biofuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit.
- .7 Provide a Construction and Demolition Waste Management Plan to the Contract Administrator for approval a minimum of 14 days prior to construction
- .8 Contractor shall distribute copies of the Construction and Demolition Waste Management Plan to the Job Site Foreman and each Subcontractor
- .9 Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods to be used by all parties at the appropriate stages of the Project.
- .10 Contractor shall layout and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
 - .1 Commingled waste sent to a mixed waste recycling facility counts as a single material stream regardless of the number of different materials included.
 - .2 Hazardous wastes shall be separated, stored, and disposed of according to local regulations.
- .2 Complete and submit Waste Tracking Log along with waybills, invoices, letters and other documentation to the Contract Administrator on a monthly basis, as outlined in Paragraph 1.6.
- .3 Conduct daily inspections of material separation bins to check for and remedy cross-contamination

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 31 00 – Project Management and Co-ordination.
- .2 Section 01 33 00 – Submittals Procedures.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Refer to *D30: Warranty, of Supplemental Conditions and General Conditions*.
- .2 Pre-warranty Meeting:
 - .1 Convene meeting one (1) week prior to contract completion with Contractor's representative, the City and Contract Administrator:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Contract Administrator to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Submit one (1) electronic copy in Adobe PDF format, plus one (1) hard copy to Contract Administrator for their review prior to submitting final copies. One (1) copy will be returned after final review, with Contract Administrator's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Submit to Contract Administrator, two (2) weeks prior to Substantial Performance of the Work, final revised copies of Operating and Maintenance manuals, in English, consisting of one (1) electronic copy in PDF format, plus one (1) hard copy.
- .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 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.4 AS-BUILT DOCUMENTS AND SAMPLES

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

1.5 PROJECT RECORD DOCUMENTS

- .1 Maintain at construction site, three (3) sets of white prints for record drawing purposes. Mark one (1) set "FIELD DRAWINGS" and use to record initial data when field measurements are made. Mark other two sets "RECORD DRAWINGS".
- .2 Store record drawings in field office apart from other documents used for construction. Maintain record drawings in clean, dry and legible condition. Do not use record drawings for construction purposes.
- .3 Record "as-built" information in red ink, accurately and concurrently with construction progress. Do not conceal work until required information is recorded.
- .4 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 Addenda, Change Order and Field Instruction.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.

- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.
- .8 At completion of project and prior to final review, neatly transfer "as-built" notations to second and third set of white prints and submit to Contract Administrator along with field drawings. In addition, submit on USB, AutoCAD files of project with all changes included to reflect "as-built" conditions. Drawings must be generated in most current AutoCAD version, and consistent with Bid Documents prepared in AutoCAD 2021.
 - .1 For Contractors' use in preparation of "as-built" drawings required under this contract, Contractors may purchase from Contract Administrator, electronic AutoCAD drawing files in accordance with Section 01 33 00.

1.6 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Contract Administrator.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Contract Administrator.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Contract Administrator.
 - .2 Include approved listings in Maintenance Manual.
- .4 Delivery, Storage, And Handling:
 - .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
 - .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
 - .3 Store components subject to damage from weather in weatherproof enclosures.
 - .4 Store paints and freezable materials in a heated and ventilated room.

- .5 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

1.7 OPERATION AND MAINTENANCE MANUALS

- .1 Prepare one (1) hardcopy and one (1) electronic copy (PDF) of Operation and Maintenance Manual for the project as indicated above. Electronic (PDF) file to be tabbed and OCR'd.
- .2 Prepare Operation and Maintenance Manuals for each Architectural, Mechanical and Electrical component of project.
- .3 Format.
 - .1 Organize data in form of an instructional manual.
 - .2 Binders for hardcopy: vinyl, hard covered, 3 "D" ring, loose leaf spine and fact pockets.
 - .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
 - .4 Cover: Identify each binder with printed title "Operation and Maintenance Manual"; list title of project and identify subject matter of contents.
 - .5 Arrange content under Section numbers and sequence of Table of Contents.
 - .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .7 Text: Manufacturer's printed data, or typewritten data.
 - .8 Hardcopy drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .4 Contents (each volume).
 - .1 Table of Contents: provide title of project; date of submission; names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
 - .2 For each product or system; list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .3 Product Data; Mark each sheet to clearly identify specific products and component parts and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.
 - .6 A hardcopy and electronic copy of shop drawings as specified in Section 01 33 00.
- .5 Equipment and Systems.
 - .1 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
 - .2 Include installed colour coded wiring diagrams.
 - .3 Operating Procedures: Include complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number. Provide written explanation of operation of each system with instructions for trouble shooting of operational failures. 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.

- .4 Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - .5 Provide servicing and lubrication schedule, and list of lubricants required.
 - .6 Include manufacturer's printed operation and maintenance instructions.
 - .7 Include sequence of operation by controls manufacturer.
 - .8 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - .9 Provide installed control diagrams by controls manufacturer.
 - .10 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
 - .11 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - .12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - .13 Include test and balancing reports as specified.
 - .14 Additional requirements: including one complete set of final reviewed and stamped shop drawings; cop of hardware and paint schedules; requirements specified in individual specification sections.
- .6 Materials and Finishes.
- .1 Building Products, Applied Materials and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products as applicable.
 - .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .4 Additional Requirements: As specified in individual specifications sections.

1.8 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics, and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.

- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified.
- .15 Additional requirements: As specified in individual specification sections.

1.9 CONSTRUCTION PHOTOGRAPHS

- .1 Submit construction photographs as specified in Section 01 31 00.

1.10 WARRANTIES AND BONDS

- .1 Refer to *D30: Warranty, of Supplemental Conditions and General Conditions*.
- .2 Develop warranty management plan to contain information relevant to Warranties.
- .3 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator approval.
- .4 Warranty management plan to include required actions and documents to assure that Contract Administrator receives warranties to which it is entitled.
- .5 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .6 Submit, warranty information made available during construction phase, to Contract Administrator for approval prior to each monthly pay estimate.
- .7 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) Working Days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions:
 - .1 Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.
- .11 Warranty Tags
 - .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Contract Administrator.
 - .2 Attach tags with copper wire and spray with waterproof silicone coating.

- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.

1.2 DESCRIPTION

- .1 Provide comprehensive demonstration and training program to the City's personnel on operation and maintenance of all Contractor supplied and installed equipment and systems. This program to commence two (2) weeks prior to date of Substantial Performance of the Work and/or two (2) weeks prior to obtaining Interim Occupancy of phased areas of work ready to be turned over to City.
- .2 The City will provide list of personnel to receive demonstration and training, and will co-ordinate their attendance at agreed-upon times.
- .3 Schedule demonstration and training sessions by manufacturer's authorized representative, and provide manufacturer produced training manuals and USB's if available for demonstration purposes.
- .4 In event that manufacturer produced training USB's are not available, video record demonstration and training sessions digitally recorded on USB.

1.3 SUBMITTALS

- .1 Submit proposed schedule of time and date for demonstration and training of each item of equipment and each system prior to designated dates, for the City's approval.
- .2 Submit report within one week after completion of each demonstration and training session, that session has been satisfactorily completed. Identify time and date of each session, including list of the City's personnel present.

1.4 CONDITIONS FOR DEMONSTRATION AND TRAINING

- .1 Equipment and systems have been reviewed by Contract Administrator.
- .2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals and test reports for use in demonstrations and instructions.

1.5 DEMONSTRATION AND TRAINING

- .1 Demonstration and training to include start-up, operation, control, adjustment, trouble-shooting, servicing and maintenance of each item of equipment at scheduled times, at equipment location.
- .2 Instruct the City's personnel in all aspects of operation and maintenance of equipment and systems referencing manufacturer's operation and maintenance manuals.
- .3 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

- .4 Perform demonstration and training program provided under Contract to the City's satisfaction by quality persons knowledgeable in operation and maintenance of installed equipment and systems, and for duration acceptable to the City.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

- .1 Work in this Section includes, but is not limited to, requirements for Indoor Air Quality (IAQ) Management during construction, which forms the Contractor's commitment for LEED Credits EQc3 Construction IAQ Management Plan and EQc4 Indoor IAQ Assessment as follows:
 - .1 Contractor's responsibilities for development and implementation of an IAQ Management Plan.
 - .1 Contractor's responsibilities to confirm compliance with IAQ Management Plan before building occupancy by testing air quality
 - .2 Contractor's responsibilities to confirm compliance with IAQ Management Plan before building occupancy by providing a building flush using 100% fresh air.

1.2 RELATED SECTIONS

- .1 Section 01 33 29 General LEED Requirements

1.3 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE): ANSI/ASHRAE 52.2-2010 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM D5197-09e1 Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology).
 - .2 ASTM D5149-02(2008) Standard Test Method for Ozone in the Atmosphere: Continuous Measurement by Ethylene Chemiluminescence.
- .3 British Standard 5228 -2009.
- .4 California Department of Public Health, Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers, v1.1-2010.
- .5 Infection Control Risk Assessment (ICRA) Standard, published by the American Society of Healthcare Engineering (ASHE) and the U.S. Centers for Disease Control and Prevention (CDC) (Healthcare).
- .6 ISO - International Organization for Standardization
 - .1 ISO 16000-3, Indoor air-Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air-Active sampling.
 - .2 ISO 16000-6, Indoor air-Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID.
 - .3 ISO 4224 Ambient air-Determination of carbon monoxide-Nondispersive infrared spectrometric method.

- .4 ISO 7708 Air quality—Particle size fraction definitions for health-related sampling.
- .5 ISO 13964 Air quality—Determination of ozone in ambient air—Ultraviolet photometric method.
- .7 NIOSH, Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs, Publication No. 2003-112 (Healthcare). cdc.gov/niosh/topics/asphalt
- .8 Sheet Metal and Air Conditioning Contractors National Association (SMACNA): SMACNA IAQ Guidelines for Occupied Buildings under Construction 2nd Edition 2007, ANSI/ SMACNA 008-2008 (Chapter 3)
- .9 U.S. EPA United States Environmental Protection Agency
 - .1 U.S. EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air, IP-1: Volatile Organic Compounds, IP-3: Carbon Monoxide and Carbon Dioxide, IP-6: Formaldehyde and other aldehydes/ketones, IP-10 Volatile Organic Compounds
 - .2 U.S. EPA Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, TO-1: Volatile Organic Compounds, TO-11: Formaldehyde, TO-15: Volatile Organic Compounds, TO-17: Volatile Organic Compounds.

1.4 OBJECTIVES

- .1 Meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning Contractors National Association 2nd Edition 2007, ANSI / SMACNA 008-2008, Chapter 3.
- .2 Protect construction workers and future building occupants from indoor air quality problems resulting from construction activities.
- .3 Reduce the production and circulation of pollutants during construction.
- .4 Protect equipment and absorptive materials stored and installed on-site from moisture, dust and dirt accumulation during construction.
- .5 Prepare the building for occupancy following construction and prior to occupancy by completing indoor air quality testing
- .6 Prepare the building for occupancy following construction and prior to occupancy by completing a building-flush out.

1.5 DESCRIPTION OF WORK

- .1 A LEED Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all aspects of LEED coordination (during construction) related to construction waste management and disposal
- .2 Indoor Air Quality Management activities shall include:
 - .1 Identifying, implementing and documenting measures to achieve the indoor air quality management objectives
 - .2 Supervising on-site indoor air quality management activities on a daily basis

- .3 Coordinating indoor air quality management tasks with Subcontractors to ensure timely and orderly progress of the work
- .4 Conducting indoor air quality management inspections and making necessary repairs
- .5 Maintaining an indoor air quality inspection log to document observations, deficiencies and corrective actions
- .6 Preparing indoor air quality management documentation and submittals as detailed herein
- .7 Reporting indoor air quality management progress to the Contract Administrator

1.6 SUBMITTALS

- .1 Submit an Indoor Air Quality Management Plan to the Contract Administrator for approval a minimum of 6 months prior to start of duct work installation. The plan shall include the following:
 - .1 Specify procedures for protecting stored and installed absorptive materials from moisture damage.
 - .2 Highlight the non-smoking policy. Prohibit the use of smoking inside the building and within 7.5 meters, or more if required by the local jurisdiction, of the building entrance at all times.
 - .3 Confirm if air handlers will be operated during construction, and specify compliant filtration procedures for permanent equipment that will be used if operated.
 - .4 Outline approach to all five SMACNA Guidelines and measures that will be in place to ensure guidelines are met.
 - .1 HVAC Protection
 - .2 Source Control
 - .3 Pathway Interruption
 - .4 Housekeeping
 - .5 Scheduling
 - .5 Building flush-out and/or indoor air quality testing procedures prior to occupancy.
 - .6 Inspections and reporting procedures.
- .2 Submit completed Schedule I1 – Indoor Air Quality Inspection Log on a monthly basis.
 - .1 Inspections shall commence when building is enclosed or duct work installation starts and carry through to building turnover.
 - .2 The inspection log shall be completed for each weekly inspection and document:
 - .3 Indoor air quality management measures implemented on site
 - .1 Condition of each measure
 - .2 Deficiencies and corrective actions taken to remedy the deficiencies
 - .3 Three different photos are to be provided for each measure listed on the inspection log.

Part 2 Products

2.1 FILTRATION MEDIA REQUIREMENTS

- .1 Air filter minimum efficiency reporting value (MERV) rating shall be determined by ASHRAE 52.2-2017
- .2 If air handling equipment is used during construction, install MERV 8 (or higher) filters
- .3 Prior to flush-out and prior to occupancy, install new MERV 13 filters in all air handling equipment

Part 3 Execution

3.1 INDOOR AIR QUALITY MANAGEMENT PLAN IMPLEMENTATION

- .1 Develop and implement an Indoor Air Quality Plan in accordance with Submittals section 1.6 above, including the five SMACNA Indoor Air Quality Management Practices as follows:

3.2 SOURCE CONTROL

- .1 Identify potential sources of indoor air pollutants on construction site.
 - .1 Any construction activity or material producing odour and/or dust is considered a source of air pollutant. Pollutant sources include but are not limited to:

Odour Emitting Products	Dust Creating Products
Paints Caulking Stain Fuels Sealants Grouts Pesticides Epoxy Flooring Coatings Solvents Adhesives Cleaning Products	Concrete Insulation Acoustic Ceiling Tile Wood Products Gypsum Board Ceramic Tile
Combustion/Odour Emitting Equipment	Pollutant Disrupting Activities
Generators Vehicles Torches / Welders Soldering Guns	Demolition Repair Renovation Exterior Site Work

Compressors Portable Heaters	Standing Water Tobacco Smoke
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- .2 Minimize pollutants generated inside building from sources identified in 3.1 using following measures:
 - .1 Prohibiting the use of tobacco products (smoking, e-cigarettes, chewing tobacco, etc.) inside building and within 7.5m of all building entrances at all times during construction
 - .2 Fueling up equipment outside building
 - .3 Storing gasoline or solvents outside building
 - .4 Restricting outdoor vehicular/equipment traffic and operation where emissions can enter building
 - .5 Reducing on-site emissions by using equipment that burns propane/natural gas or is powered by electricity
 - .6 Exhausting pollutant sources directly outside using temporary or permanent ventilation equipment. Where exhaust is not feasible, locally re-circulate air through a portable air cleaner
 - .7 Collecting and bagging sawdust from woodworking tools
 - .8 Covering and/or sealing indoor sources of odour and dust
 - .9 Using painting techniques minimizing odour (e.g roller instead of spraying)
 - .10 Using cleaning practices minimizing dust (e.g. vacuum instead of sweeping)
 - .11 Using cleaning Products minimizing pollution, fumes, VOC's, etc.

3.3 PATHWAY INTERRUPTION

- .1 Prevent movement of pollutants from sources identified under "Pollutant Source Identification" to other areas in building using following measures:
 - .2 When possible, perform pollutant generating activities outside building
 - .3 Move equipment, work and other pollutant sources to locations where they will have minimum impact on indoor air quality
 - .4 Setup small, contained, designated work areas to contain pollutants
 - .5 Avoid open areas and areas with high drafts
 - .6 Erect dust curtains and barriers
 - .7 Depressurize areas using temporary or permanent ventilation equipment.
 - .8 Use portable fans to exhaust pollutants (e.g. gas engine exhaust) to exterior through windows, doors, etc. Ensure adjacent windows, doors, etc. will not allow pollutants to re-enter building
 - .9 Close windows and doors adjacent to pollutant sources (e.g. dust, vehicle emissions, etc.) outside of building. If windows and doors have not been installed, temporarily seal exterior openings with plastic, wood, etc.
 - .10 Pressurize occupied or completed areas of building using temporary or permanent ventilation equipment

- .11 Prohibiting burning of garbage.

3.4 HOUSEKEEPING

- .1 Prevent accumulation of moisture, dust and dirt in building from sources identified under “Pollutant Source Identification” using following measures:
 - .2 Frequently cleaning interior surfaces to minimize dust and dirt accumulation by:
 - .3 Dusting with damp rags
 - .4 Wet mopping
 - .5 Sweeping using wetting agents and sweeping compounds
 - .6 Vacuuming with equipment containing HEPA filtration and/or a wet scrubber
 - .7 Localized cleaning should occur immediately after a construction activity is completed and/or at end of each Day. Perform a full building clean-up at least once a week.
 - .8 Close exterior windows and doors or create temporary enclosures using plastic or wood to prevent moisture accumulation indoors.
 - .9 Immediately remove any water accumulated indoors to protect interior surfaces and materials.
 - .10 Cover, seal and protect materials stored and installed on-site from moisture, dust and dirt accumulation.
 - .11 Elevate materials stored on-site off ground to protect from moisture and dirt accumulation.
 - .12 Do not install materials with evidence of moisture damage or excessive moisture accumulation.
 - .13 If necessary, use ventilation/dehumidification to control humidity levels within the building.
 - .14 Promptly clean spills (fuels, lubricants, paints, adhesives, etc.).
 - .15 Clean or remove excess application of solvent-containing Products.

3.5 HVAC PROTECTION

- .1 Before and during Installation:
 - .1 Cover (with plastic) and elevate (off ground) ductwork, fittings, insulation, acoustic lining and equipment stored on site during construction.
 - .2 Seal supply, return and exhaust openings as well as temporary ductwork openings not under immediate work (e.g. open ends in ductwork runs) with plastic. Seal openings immediately after installation in areas that will no longer be under work.
 - .3 Close or cover hatches and access doors in HVAC equipment that will not be under work.
 - .4 Seal HVAC equipment openings (e.g. inlets or outlets of air handlers, fans, VAV boxes, etc.) with plastic until ductwork is connected.

- .5 Do not use mechanical rooms to store or collect construction waste materials.
- .6 Install ceiling tiles and seal openings into plenum with plastic prior to final cleaning.
- .2 After Installation (select Option 1 or Option 2 for each HVAC system):
 - .1 Option 1: HVAC Equipment Not Used During Construction (Recommended):
 - .1 Do not operate any permanent HVAC equipment or systems during construction, until the building is considered dust-free.
 - .2 Seal openings in HVAC systems, ductwork and plenums.
 - .3 If HVAC system protection measures are not implemented, or if system is operated during construction, Contractor must provide duct cleaning services, plus necessary access doors, at no extra cost to Contract.
 - .4 Prepare systems for Testing, Adjusting and Balancing Contractor and Commissioning Agent.
 - .2 Option 2: HVAC Equipment Used During Construction:
 - .1 Install new filters in air handling equipment before any HVAC system is operated. Provide a duct-mounted filter (external to equipment) if necessary.
 - .2 Install new filters with a minimum efficiency reporting value (MERV) of 8 at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media.
 - .3 Temporarily shut down return and exhaust side of HVAC systems during heavy construction or demolition.
 - .4 Permanently close off return and exhaust side of HVAC systems in areas with high dust levels. Cover duct openings with plastic in these areas.
 - .5 If HVAC system is operated without above protection measures in place, Contractor must provide duct cleaning services, plus necessary access doors, at no extra cost to Contract.
 - .3 After construction and final cleaning work is complete Contractor shall:
 - .1 Remove HVAC protection measures.
 - .2 Start-up systems.
 - .3 Prepare systems for Testing, Adjusting and Balancing Contractor and Commissioning Agent
 - .4 Immediately before occupancy, replace all filtration media with the final design filtration media.

3.6 SCHEDULING

- .1 Schedule construction activities to minimize amount of VOC's, odours and fumes absorbed by porous materials (e.g. ceiling tiles, carpet, etc.).
- .2 Complete applications of wet and odorous materials such as paints, sealants and coatings before installing absorbent "sink" materials such as ceiling tiles, carpets and fabric-covered furnishings.

- .3 Allow for Testing, Adjusting and Balancing to be carried out following construction and before occupancy (refer to HVAC Protection Measures).
- .4 Allow for corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning to be carried out following construction and before occupancy.

3.7 MOISTURE

- .1 Protect stored on-site and installed absorptive materials from moisture damage
- .2 Immediately remove from site and properly dispose of any materials susceptible to microbial growth and replace with new, undamaged materials
- .3 Protect the building from moisture intrusion and prevent occupants' exposure to mould spores

3.8 INSPECTIONS AND MAINTENANCE

- .1 Inspect indoor air quality management measures and remedy any deficiencies on a bi-weekly basis.
- .2 Record inspections in I1 (1.5.2) IAQ Management Inspection Log and denote measures implemented at time of inspection, any deficiencies as well as corrective actions taken
- .3 Provide photos as specified by I2 (1.5.3) Photo Documentation Checklist) at various occasions during construction to prove continuous compliance
- .4 Pollutant containment, housekeeping and HVAC protection measures will be reviewed by the Contract Administrator during each site visit
- .5 Deficiencies identified by Contract Administrator must be remedied and documented in I1 (1.5.2) IAQ Management Inspection Log within 48 hours of notification
- .6 Clean or replace any equipment or materials incorrectly stored or improperly protected at no extra cost to Contract.

3.9 INDOOR AIR QUALITY ASSESSMENT

- .1 Conduct indoor air quality testing prior to occupancy
 - .1 Indoor air quality testing will be carried out by and at the expense of the Contractor.
 - .2 The Contractor shall allow 5 days after all construction and final cleaning work is complete and prior to building occupancy for the testing agency to conduct indoor air quality testing.
 - .3 The Contractor shall perform all corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning prior to indoor air quality testing.
 - .4 In order for IAQ Testing to be deemed complete, the test results must demonstrate that the air samples taken at all required locations are not above the limits established in the tables below:

Contaminant	Maximum Concentration	Allowed Test Methods
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Carbon Monoxide (CO)	9 ppm; and no greater than 2 ppm above outdoor levels	ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6 ISO 16000-3
Particulates (PM10):	ISO 14644-1:2015, cleanroom class of 8 or lower 20 µg/m ³	EPA Compendium Method IP-10 ISO 7708
Particulates (PM2.5):	12 µg/m ³	
Ozone	0.07 ppm	ASTM D5149 – 02 ISO 13964

Contaminant	Maximum Concentration (µg/m³)	Allowed Test Methods
Formaldehyde 50-00-0	20	ISO 16000-3, 4; EPA TO-11a, EPA comp. IP-6A ASTM D5197-16
Acetaldehyde 75-07-0	140	
Benzene 71-43-2	3	ISO 16000-6 EPA IP-1, EPA TO-17, EPA TO-15 ISO 16017-1, 2; ASTM D6196-15
Hexane (n-) 110-54-3	7000	
Napthalene 91-20-3	9	
Phenol 108-95-2	200	
Styrene 100-42-5	900	
Tetrachloroethylene 127-18-4	35	
Toluene 108-88-3	300	
Vinyl acetate 108-05-4	200	
Dichlorobenzene (1,4-) 106-46-7	800	
Xylenes-total 108-38-3, 95-47-6, 106-42-3	700	

- .5 All testing shall be carried out according to the requirements published in the LEED Credit EQc4 Indoor Air Quality Assessment
- .6 The number of test locations required shall be determined according to the requirements published in LEED Credit EQc4 Indoor Air Quality Assessment

- .7 In the event that the test results exceed the limits established in the table above, the Contractor is responsible for taking remedial actions as recommended by the Contract Administrator or testing agent and for scheduling and retesting for any contaminant concentrations that were exceeded. This process shall be repeated until all requirements have been met.
- .8 Upon successful completion of IAQ testing, the Contractor must provide the Contract Administrator with a copy of the IAQ testing results indicating the locations

3.10 BUILDING FLUSH-OUT

- .1 Conduct a building flush-out prior to occupancy
 - .1 After all construction, final cleaning and Testing, Adjusting and Balancing work is complete, and prior to building occupancy, conduct a building flush-out by:
 - .1 Supplying a total air volume of 4,270 m³ of outdoor air per (or 14,000 ft³ per ft²) of floor area
 - .2 Maintaining a temperature of at least 15°C (60°F) but not higher than 27°C (80°F) and,
 - .3 Where mechanical cooling is operated, maintaining a relative humidity no higher than 60%.
 - .4 Building flush-out prior to occupancy may be replaced by building flush-out overlapping with occupancy or IAQ testing prior to occupancy as determined by the Contractor and The City.
 - .2 Perform all corrective work related to general deficiencies, Testing, Adjusting and Balancing, and commissioning prior to commencing the building flush-out.
 - .3 Install new MERV 13 filters in all air handling equipment prior to commencing the building flush-out
 - .4 Replace all filtration media in air handling equipment with new filters as per paragraph 2.1.3 after the building flush-out and immediately prior to occupancy. Filtration media is to be replaced at the expense of the Contractor.
- .2 Conduct a building flush-out overlapping with occupancy
 - .1 After all construction, final cleaning and Testing, Adjusting and Balancing work is complete, and prior to building occupancy, conduct a building flush-out by:
 - .1 Supplying a total air volume of 1,066 m³ of outdoor air per m² (or 3,500 ft³ per ft²) of floor area,
 - .2 Maintaining a temperature of at least 15°C (60°F) but not higher than 27°C (80°F) and,
 - .3 Where mechanical cooling is operated, maintaining a relative humidity no higher than 60%.
 - .4 Building flush-out overlapping with occupancy may be replaced by building flush-out prior to occupancy or IAQ testing prior to occupancy as determined by the Contractor and The City.
 - .2 After the building is occupied, continue the building flush-out by:
 - .1 Supplying outside air at a minimum rate of 1.5 L/s/m² (0.3 cfm/ft²) for at least 3 hours prior to each time the building is occupied

- .2 Supplying outside air at the greater of 1.5 L/s/m² (0.3 cfm/ft²) or the design minimum outside air supply during times when the building is occupied and
- .3 Continuing the flush-out process described in the subparagraphs 3.7.2.1 and 3.7.2.2 until 4,270 m³ of outdoor air per m² (or 14,000 ft³ per ft²) has been supplied to the building.
- .3 Perform all corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning prior to commencing the building flush-out.
- .4 Install new filters in all air handling equipment as per paragraph 2.01 prior to Commencing the building flush-out.
- .5 Replace all filtration media in air handling equipment with new filters as per paragraph 2.1.3 after the building flush-out and immediately prior to occupancy. Filtration media is to be replaced at the expense of the Contractor.

3.11 REMOVAL OF PROTECTION MEASURES

- 1.1.1 Remove Products/materials installed as a part of indoor air quality management measures prior to building turnover. Any remedial work required as a result of removing measures is responsibility of Contractor.

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 O&M - Operation and Maintenance
 - .4 CVF - Component Verification Form
 - .5 FT – Functional Test
 - .6 TAB - Testing, Adjusting and Balancing

1.2 GENERAL

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

1.3 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.

1.4 COORDINATION

- .1 The following are members of the commissioning team:
 - .1 City Representative
 - .2 Commissioning Authority (CxA)
 - .3 Project Manager
 - .4 Contract Administrator
 - .5 Contractor
 - .6 Mechanical Subcontractor
 - .7 Electrical Subcontractor
 - .8 TAB representative
 - .9 Controls Subcontractor
 - .10 Any other installing subcontractors or suppliers of equipment.

1.5 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.

1.6 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 testing activities
 - .4 Functional testing dates
 - .5 Training
 - .6 Seasonal or deferred testing.
 - .7 10-Month occupancy review
- .3 All parties are responsible to address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.7 SYSTEMS TO BE COMMISSIONED

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

Electrical

Lighting and Lighting Controls

Electric Heaters

Plumbing

Domestic hot water heaters

Recirculation pumps

Sump Pumps

HVAC & Hydronics

Energy Recovery Ventilator

Air Handling Units

Split Condensing Units

Hydronic Heating/Cooling Coils

Fan Coil Units

VAV Terminal Units

Hydronic pumps

Infloor heating

Ceiling Fans

Testing, Adjusting and Balancing Work

Direct Digital Controls (DDC)

Central Building Automation System

1.8 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.

1.9 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.

1.10 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.

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1.11 SAMPLE COMPONENT VERIFICATION FORM

Project Name		Component Verification Form		
Owner City, Province	Unit Tag: AHU-# Equipment Type: Air Handling Unit System: HVAC Location: Rooftop Area Serviced: East Wing			
<i>This box for CKP use only.</i>		Form Audited?	YES <input type="checkbox"/> NO <input type="checkbox"/>	
CxA reviewer: _____				
Signature	Contractor (include company and print name)	Date		
Mechanical:	_____	_____		
Electrical:	_____	_____		
Controls:	_____	_____		
General:	_____	_____		
CKP Audit Verification				
Nameplate Data	IFC Schedule	Approved Submittal <i>note any changes</i>	Installed <i>note any changes</i>	Installer Verify
Manufacturer	AHU Maker			<input type="checkbox"/>
Model	AHU 12AB-24CD			<input type="checkbox"/>
DX Cooling Coil Model	CC-101			<input type="checkbox"/>
Total Cooling Capacity (MBH)	2500			<input type="checkbox"/>
Hot Water Coil Model	HW-102			<input type="checkbox"/>
Heating Capacity (MBH)	2500			<input type="checkbox"/>
Supply Fan Motor (HP)	5			<input type="checkbox"/>
Return Fan Motor (HP)	5			<input type="checkbox"/>
Electrical [V/Ph/Hz]	575/3/60			<input type="checkbox"/>
Details/Notes: Sample AHU				
Inspection Items	Comments	Installer Verify		
General Installation & Cleanliness				
Equipment is clean and free of debris		<input type="checkbox"/>	<input type="checkbox"/>	
Equipment is properly mounted and vibration isolation equipment is installed on motors		<input type="checkbox"/>	<input type="checkbox"/>	
Service hatches & filter access is not hindered by surrounding equipment		<input type="checkbox"/>	<input type="checkbox"/>	
Record the MERV rating of the filters in the unit		<input type="checkbox"/>	<input type="checkbox"/>	
Shipping mounts are removed		<input type="checkbox"/>	<input type="checkbox"/>	
Air filters installed correctly and clean		<input type="checkbox"/>	<input type="checkbox"/>	
Duct Installation				
Duct layout matches drawings and duct connections are sealed		<input type="checkbox"/>	<input type="checkbox"/>	
Smoke and fire dampers are properly installed according to contract documents		<input type="checkbox"/>	<input type="checkbox"/>	
Piping/Coil Installation				
Hydronic piping and accessories installed		<input type="checkbox"/>	<input type="checkbox"/>	
Piping is adequately supported		<input type="checkbox"/>	<input type="checkbox"/>	
Condensate piping installed to floor drain		<input type="checkbox"/>	<input type="checkbox"/>	
Coil has been combed with no visible damage		<input type="checkbox"/>	<input type="checkbox"/>	
Electrical Installation				
Wiring complete and electrical connections are tight		<input type="checkbox"/>	<input type="checkbox"/>	
Verify that overload breakers are installed and sized correctly		<input type="checkbox"/>	<input type="checkbox"/>	
Local disconnects are installed and labelled		<input type="checkbox"/>	<input type="checkbox"/>	
VFDs for fans installed per contract documents		<input type="checkbox"/>	<input type="checkbox"/>	
Controls Installation				
Controls wiring complete and electrical connections are tight		<input type="checkbox"/>	<input type="checkbox"/>	

Project Name		Component Verification Form	
Owner	Unit Tag: AHU-#		
City, Province	Equipment Type: Air Handling Unit		
	System: HVAC		
	Location: Rooftop		
	Area Served: East Wing		
Control actuator and sensor locations match contract documents		<input type="checkbox"/>	<input type="checkbox"/>
Control actuators and sensors labelled/tagged per contract documents		<input type="checkbox"/>	<input type="checkbox"/>
Insulation & Labelling			
Thermal Insulation complete as per contract documents		<input type="checkbox"/>	<input type="checkbox"/>
Unit is correctly labelled		<input type="checkbox"/>	<input type="checkbox"/>
Ducts and piping are labelled per contract documents and direction of flow is indicated		<input type="checkbox"/>	<input type="checkbox"/>
Startup			
Manufacturer startup report completed and provided		<input type="checkbox"/>	<input type="checkbox"/>
VFD startup report completed and provided		<input type="checkbox"/>	<input type="checkbox"/>
Verify fan rotation		<input type="checkbox"/>	<input type="checkbox"/>

1.12 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 startups forms (provided by 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 check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures.
- .4 Submit required startup documentation including, but not limited to:
 - .1 Mechanical Systems
 - .1 Major equipment manufacturers startup reports (AHUs, Boilers, Heat Pumps, etc.)
 - .2 Piping pressure tests
 - .3 TAB report
 - .2 Electrical Systems
 - .1 Electrical equipment test reports (megger tests, harmonic distortion testing)
 - .2 Low voltage lighting system test report
 - .3 Fire Alarm verification report.
 - .3 Controls
 - .1 Control point end-to-end verification report

1.13 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.

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1.14 SAMPLE FUNCTIONAL TEST

Project Name		Functional Testing Procedure	
Project Owner		New Addition HVAC	
Project Location			
New Addition HVAC			
Components: Air handling unit (AHU-#) consisting of supply and return fans with VFDs, a DX cooling coil and associated condenser, hydronic heating coil, filter section and motorized dampers, variable air volume terminal units (VAV-#), hydronic baseboards (BB-#)			
Description: AHU-# located on the rooftop provides ventilation and temperature control to the new addition. VAVs and perimeter baseboard heaters provide zone level temperature control. The system operates on an occupancy schedule. AHU discharge air temperature is reset based on the average room temperature and setpoint. Economizer damper modulates open to provide free cooling when OA conditions allow it or when CO2 levels rise above setpoint. The BMS monitors the operation of the system and generates alarms if required.			
Notes:			
	Test and Expectation	Remarks	Sign-Off
001	Occupancy Schedule The system operates based on an occupancy schedule. Verify user can adjust or override the schedule on the BMS.	Record occupancy schedule:	Date: Initials:
002	Unoccupied Mode Supply and return fans are disabled, outdoor air dampers are closed and return air damper is open. If any zone temperature drops below 13°C (adj.), AHU fans enable, motorized dampers remain in recirculation position (full return air) and unit operates in heating mode until the space temperatures rise above 15°C (adj.). Verify by adjusting schedule and heating setback temperature and operational check.		Date: Initials:
003	Occupied Mode Supply and return fans operate continuously. Verify by adjusting schedule and operational check.		Date: Initials:
004	Supply Fan Control Supply fan VFD modulates speed to maintain supply pressure setpoint, determined during air balancing. Verify by adjusting pressure setpoint and operational check.	Record pressure setpoint:	Date: Initials:
005	Return Fan Control Return fan VFD modulates speed to maintain building pressure at 5 Pa. Verify by adjusting pressure setpoint and operational check.		Date: Initials:
006	Heating Mode Heating mode enables when OAT<13°C. Glycol heating coil control valve modulates to maintain discharge air temperature setpoint. Setpoint is reset between 13°C and 22°C, based on average zone heating demand. Verify by adjusting setpoint and operational check.		Date: Initials:

	Test and Expectation	Remarks	Sign-Off
007	<p>Cooling Mode Cooling mode enables when OAT>13°C.</p> <p>Factory installed controls modulate cooling output to maintain discharge air temperature setpoint. Setpoint is reset between 13°C and 22°C so that the most open VAV damper position is 90% (adj.) open.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
008	<p>Economizer Mode Economizer mode enables when OAT≤13°C (adj.) and there is a call for cooling.</p> <p>Outdoor air, return air and relief air dampers modulate as required to maintain discharge air temperature setpoint.</p> <p>Economizer mode is locked out when the outdoor air enthalpy is greater than the indoor air enthalpy.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
009	<p>Minimum OA Damper Position Minimum outdoor air position determined during air balancing to maintain minimum ventilation requirements.</p> <p>Verify minimum OA damper position is set up in unit's control program.</p>	Record minimum OA damper position:	Date: Initials:
010	<p>CO2 Control The outside air damper modulates open from minimum position when required to maintain zone CO2 levels below setpoint 1000ppm (adj.).</p> <p>Relief air damper modulates to the same position and return air damper modulates opposite of the OA and relief damper positions.</p> <p>Adjust CO2 setpoint and verify motorized dampers response correctly.</p>		Date: Initials:
011	Classroom ## - VAV-#, BB-#		
012	<p>Zone Temperature Control - Heating VAV damper position remains constant to maintain design airflow (388 L/s).</p> <p>Hydronic baseboard heater 2-way control valve modulates to satisfy zone thermostat.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
013	<p>Zone Temperature Control - Cooling VAV damper position modulates between minimum and maximum position to satisfy zone thermostat (156 to 637 L/s).</p> <p>Hydronic baseboard heater 2-way control valve remains closed.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
014	Classroom ## & Corridor ## - VAV-#, BB-#		

	Test and Expectation	Remarks	Sign-Off
015	<p>Zone Temperature Control - Heating VAV damper position remains constant to maintain design airflow (467 L/s).</p> <p>Hydronic baseboard heater 2-way control valve modulates to satisfy zone thermostat.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
016	<p>Zone Temperature Control - Cooling VAV damper position modulates between minimum and maximum position to satisfy zone thermostat (187 to 637 L/s).</p> <p>Hydronic baseboard heater 2-way control valve remains closed.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
017	<p>Alarms: Supply Fan Failure Verify alarm at the operator interface for supply fan failure and shut down return fan.</p>		Date: Initials:
018	<p>Alarms: Return Fan Failure Verify alarm at the operator interface for return fan failure and shut down supply fan.</p>		Date: Initials:
019	<p>Alarms: Low Supply Air Temperature Verify alarm at the operator interface for non-critical low supply air temperature.</p>	Record low limit:	Date: Initials:
020	<p>Alarms: Dirty Filter Verify alarm at the operator interface for dirty filter alarm. Record differential pressure setpoint for a dirty filter.</p>		Date: Initials:
021	<p>Alarms: High CO2 levels Verify alarm at the operator interface for high space CO2 levels (10% above setpoint).</p>		Date: Initials:
022	<p>Operator Interface Graphics and Trends Verify the operator interface accurately represents the installed system. The following points are displayed and trended:</p> <ul style="list-style-type: none"> - AHU supply air temperature and setpoint - Return air temperature - Mixed air temperature - Supply duct pressure and setpoint - Building pressure - Supply fan command, status and speed - Return fan command, status and speed - Zone temperature and setpoint (x2) - Hydronic control valve positions (x2) - VAV damper position (x2) - Zone CO2 level (x2) 		Date: Initials:
023	<p>Operation Meets Generally Accepted Good Practice Record any discrepancies noted during testing and operation of the system.</p>		Date: Initials:

1.15 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.

1.16 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.

1.17 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.


1.18 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 sessions with attendance sheets.
- .16 A training evaluation form has been attached (Section 1.19) for bid purposes.

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1.19 SAMPLE TRAINING EVALUATION FORM



Owner Training Survey
Project Number: "[Click here and type]"
"[Click here and type date]"

[Project Name]
[Location]

Owner 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

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1

1.20 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 and building permits.

1.21 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 regulation of authority having jurisdiction.
- .3 Provide copies to the Contract Administrator and CxA within 5 days of test.

Part 2 Products

2.1 Not used.

Part 3 Execution

3.1 Not used.

Part 1 General

1.1 SECTION INCLUDES

- .1 Selective demolition of built site elements.
- .2 Selective demolition of building elements for alteration purposes.

1.2 RELATED REQUIREMENTS

- .1 Section 00 31 00 - Available Project Information: Existing building survey conducted by City; information about known hazardous materials.
- .2 Section 01 11 00 - Summary of Work: Limitations on Contractor's use of site and premises; sequencing and staging requirements.
- .3 Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers.
- .4 Section 01 57 13 - Temporary Erosion and Sediment Control.
- .5 Section 01 61 00 - Common Product Requirements: Handling and storage of items removed for salvage and relocation.
- .6 Section 01 74 00 - Cleaning: Progressive cleaning.
- .7 Section 01 74 19 - Construction and Demolition Waste Management: Limitations on disposal of removed materials; requirements for recycling; construction and demolition waste management plan.

1.3 REFERENCE STANDARDS

- .1 Province of Manitoba, Workplace Safety and Health Regulation - Manitoba Regulation 217/2006; 2022.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Site plan: Showing:
 - .1 Vegetation to be protected.
 - .2 Areas for temporary construction and site offices.
 - .3 Areas for temporary and permanent placement of removed materials.
- .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 Project record documents: Accurately record actual locations of capped and active utilities and subsurface construction.

Part 2 Products -- NOT USED

Part 3 Execution

3.1 SCOPE

- .1 Remove portions of existing buildings in the following sequence:
- .2 Remove paving and curbs as required to accomplish new work.
- .3 Remove concrete slabs on grade as indicated on Drawings.
- .4 Remove other items indicated, for salvage, relocation, and recycling.
- .5 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 Comply with applicable requirements of Province of Manitoba, Workplace Safety and Health Regulation .
 - .3 Use of explosives is not permitted.
 - .4 Take precautions to prevent catastrophic or uncontrolled collapse of structures or portions of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - .5 Provide, erect, and maintain temporary barriers and security devices.
 - .6 Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - .7 Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - .8 Do not close or obstruct roadways or sidewalks without permit.
 - .9 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.
 - .10 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.
- .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, PCB's, 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 and Demolition Waste Management.
 - .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.
- .10 Partial removal of paving and curbs: Neatly saw cut at right angle to surface.

3.3 SELECTIVE DEMOLITION FOR ALTERATIONS

- .1 Drawings showing existing construction and utilities are based on casual site observation and existing record documents only.
 - .1 Verify that construction and utility arrangements are as indicated.
 - .2 Report discrepancies to Contract Administrator before disturbing existing installation.
- .2 Separate areas in which selective demolition is being conducted from other areas that are still occupied.
 - .1 Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on Drawings.
 - .2 Provide sound retardant partitions of construction indicated on Drawings in locations indicated on Drawings.
- .3 Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- .4 Remove existing work as indicated and as required to accomplish new work.
 - .1 Remove items indicated on Drawings.
- .5 Services (including but not limited to HVAC, plumbing, fire protection, electrical, and telecommunications): Remove existing systems and equipment as indicated.
 - .1 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.
 - .2 Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - .3 Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - .4 See Section 01 11 00 for other limitations on outages and required notifications.

- .5 Verify that abandoned services serve only abandoned facilities before removal.
- .6 Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- .6 Protect existing work to remain.
 - .1 Prevent movement of structure; provide shoring and bracing if necessary.
 - .2 Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - .3 Repair adjacent construction and finishes damaged during removal work.
 - .4 Patch as specified for patching new work.

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 - Construction and Demolition Waste Management.
- .3 Leave site in clean condition, ready for subsequent work.
- .4 Clean up spills and wind-blown debris from public and private lands.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Related work specified elsewhere:
 - .3 Section 02 82 00.01 Asbestos Abatement – Type 1 (Low Risk) Procedures
 - .4 Section 02 83 11 Lead Abatement – Type 2 (Moderate Risk) Precautions
 - .5 Section 02 84 00 Non-Liquid Polychlorinated Biphenyl Abatement
- .6 Site Conditions identifies all known hazardous building materials within the Project Area. The information provided is for general reference only. Each Contractor must confirm existing conditions on site prior to tender close.
 - .1 The specification fulfils the requirements of Part 36 and 37 of Manitoba Workplace Safety and Health Regulation 217/2006.
- .7 The Outline of Work identifies the location, condition and quantities of hazardous building materials to be removed as part of this project.
 - .1 It is the intent that work prescribed this Section will result in the removal of all hazardous materials as outlined and the decontamination of all surfaces or materials which may have been or become contaminated by hazardous materials either during or prior to work of this Contract.

1.2 Site Conditions

- .1 Refer to the report entitled “Hazardous Building Materials Assessment (Pre-construction) Expansion Project St. James Civic Centre, 2055 Ness Avenue, Winnipeg, Manitoba”, dated May 23, 2023, prepared by Pinchin Ltd., file number 234838.408.
- .2 General Building Conditions
 - .1 Heat and smoke detectors to remain live throughout work.
 - .2 Sprinklers to remain live throughout work.
 - .3 Fire detection and suppression systems in the Work Area are to be disabled and Contractor is responsible to provide fire watch when workers are not present in the Abatement Work Area.

1.3 Outline of Work

- .1 Coordinate the following items with the City’s Project Manager and the Construction Manager, including but not limited to electrical isolations, GFI connection, HVAC and exhaust ventilation system isolation, bin placement, schedule, disconnects, etc.
- .2 Refer to the Contract Drawings prepared by LM Architectural Group for the extent of construction work and the Work Areas.
- .3 Install Hoarding Walls between Abatement Work Areas and Occupied where required.
- .4 Using procedures prescribed in the Sections identified in Related Work, remove and dispose of the following:
 - .1 Duct insulation with asbestos-containing black mastic at locations scheduled for demolition or alterations;
 - .2 Ducts with asbestos-containing mastic at locations scheduled for demolition;
 - .3 Asbestos-containing vinyl floor tiles at locations scheduled for demolition;
 - .4 Demolition of walls covered with lead-containing brown paint in the Stage as well as removal of lead-containing finishes to prepare finishes for new paint; and
- .5 Refer to Specification Sections identified in the Related Work for specified personnel protective measures for the safe handling, removal, clean-up, or repair of hazardous materials in each phase or work area.
- .6 Visit the site prior to tender close to confirm the location and extent of any hazardous building materials or materials contaminated by hazardous materials.
- .7 Protect surfaces, building fabrics and items remaining within the Abatement Work Area.
- .8 Without disturbing hazardous materials, perform removals where required, prior to abatement work.
 - .1 Maximize waste diversion by use of resale of building materials, or recycling.
- .9 Isolate the Abatement Work Area from adjoining Occupied and Non-Occupied Areas whether present at an interior or exterior location.
- .10 Maintain emergency and fire exits from Abatement Work Area, or establish alternative exits satisfactory to Provincial Fire Marshall and local authorities having jurisdiction. Maintain extra routes from occupied areas. Place emergency exit signs at locations to clearly mark exit route. Seal emergency exit doors so as not to impede use of door during emergency evacuation.

- .11 Perform selective demolition of mechanical and electrical equipment, building components, materials and items scheduled for demolition at locations required to facilitate asbestos removal. Refer to all Contract Documents for responsibility of demolition work and disposal.
- .12 Remove and dispose of as appropriate waste, building components, materials and items contaminated by hazardous materials that cannot be effectively cleaned.
- .13 Final clean work area to remove visible signs of asbestos and other hazardous materials, other debris or settled dust.
- .14 Apply lock-down agent to exposed surfaces throughout the work area and to surfaces from which any hazardous materials have been removed.
 - .1 Do not apply lock-down to materials which would be damaged by its application.
- .15 Unless otherwise specified, the handling, removal, clean-up or repair of hazardous materials or surfaces contaminated with hazardous materials is to be performed following wet removal techniques.

1.4 Schedule

- .1 Provide necessary manpower, supervision, equipment and materials to maintain and complete the project on schedule.
- .2 Work Hours:
 - .1 Coordinate all work, scheduling and phasing with the City.
 - .2 NOTE: Duration for which HVAC systems may remain shutdown to accommodate quiet hours work will vary in accordance with outside weather conditions and internal demand. Duration of quiet hours work will have to be scheduled accordingly and in consultation with the Abatement Consultant.
- .3 Provide 48 hours written notice to the Abatement Consultant of any request to work outside normal working hours. Obtain written approval before proceeding.

1.5 Definitions

- .1 Abatement Consultant: City's Representative providing inspection and air monitoring.
- .2 Abatement Contractor: Contractor or sub-contractor performing work of this section.
- .3 Abatement Work Area: Area where work takes place which will, or may, disturb hazardous materials.
- .4 Amended Water: Water with wetting agent added for the purpose of reducing surface tension to allow thorough wetting of materials.

- .5 Asbestos: Any of the fibrous silicates defined in Regulation 217/2006 including: actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.
- .6 Asbestos-Containing Material (ACM): Material identified under Site Conditions including any debris, overspray, fallen material and settled dust.
- .7 Authorized Visitors: The City, Abatement Consultant, or designated representative, and persons representing regulatory agencies.
- .8 Competent Worker: A worker who is qualified because of knowledge, training and experience to perform the work, is familiar with applicable regulations and guidelines, and has knowledge of the potential or actual danger to health and safety in the work.
- .9 Contaminated Waste: Material identified under Site Conditions, including fallen material, settled dust, other debris and materials or equipment deemed to be contaminated by the Abatement Consultant.
- .10 Curtained Doorway: Doorway consisting of two (2) overlapping flaps of rip-proof polyethylene arranged to permit ingress and egress from one room to another while permitting minimal air movement between rooms.
- .11 DOP Test: A testing method used to determine the integrity of the Negative Pressure unit or vacuum using a Dispersed Oil Particulate (DOP) or Poly Alpha Olefin (PAO) HEPA filter leak test. This test is to be conducted on site where units are to be installed. Refer to the Environmental Abatement Council of Ontario (EACO) DOP/PAO Testing Guideline 2013 or ANSI/ASME N510-2007.
- .12 Friable Material: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .13 HEPA Filter: High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.
- .14 Lead-Containing: Paints containing lead at a concentration of 0.009% (90 ppm) or greater.
- .15 Lead Waste: Waste generated from removal of lead-containing materials, or the substrate and paint finish where left intact.
- .16 Milestone Inspection: Inspection of the Abatement Work Area at a defined point in the abatement operation.
- .17 Negative Pressure: A reduced pressure within the Abatement Work Area (> 0.02 inches of water column) established by extracting air directly from Abatement Work Area and discharging it to exterior of building.
- .18 Non-Friable Material: Material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

- .19 Occupied Area: Any area of the building or adjoining space outside the Abatement Work Area.
- .20 Personnel: All Contractor's employees, sub-contractors employees, supervisors.
- .21 PCBs: Monochlorinated or Polychlorinated Biphenyls (or any mixture of both).
- .22 PCB Material: means solid material containing PCBs at a concentration of more than fifty milligrams per kilogram (mg/kg) or 50 parts per million (ppm), or liquid with greater than 2 mg/kg or ppm.
- .23 PCB Waste: PCB Equipment, PCB Material, PCB Liquids and materials or items contaminated with PCBs.
- .24 PCM: Phase Contrast Microscopy.
- .25 Remove: Remove means remove and dispose of (as applicable type of waste) unless followed by other instruction (e.g. remove and turn over to the City).
- .26 Toxicity Characteristic Leachate Procedure (TCLP): Laboratory analysis to determine leachable parameters in lead waste.

1.6 Regulations and Guidelines

- .1 Comply with Federal, Provincial, and local requirements, provided that in any case of conflict among those requirements or with these Specifications, the more stringent requirements shall apply. Work shall be performed under regulations in effect at the time work is performed.
- .2 Where regulations are not present, follow accepted industry standards and applicable Guideline documents.
- .3 Regulations and Guidelines include but are not limited to the following:
 - .1 Workplace Safety and Health Act W210.
 - .2 Workplace Safety and Health Regulation M.R. 217/2006
 - .3 Safe Work Manitoba Guide for Asbestos Management
 - .4 The Dangerous Goods Handling and Transportation Act C.C.S.M c. D12.
 - .5 Hazardous Waste Regulation, M.R. 195/2015.
 - .6 Dangerous Goods Handling and Transportation Regulation, M.R. 55/2003.
 - .7 Transportation of Dangerous Goods Regulation (SOR 219/2019-101).
 - .8 PCB Regulations, SOR 2008-273.

.9 PCB Storage Site Regulation M.R. 474/88.

1.7 Quality Assurance

- .1 Removal and handling of hazardous materials is to be performed by persons trained in the methods, procedures and industry practices for Abatement.
- .2 Ensure work proceeds to schedule, meeting all requirements of this Specification.
- .3 Complete work so that at no time airborne dust, visible debris, or water runoff contaminate areas outside the Abatement Work Area.
- .4 Any contamination of surrounding area (indicated by visual inspection or air monitoring) shall necessitate the clean-up of affected area, and in the same manner applicable to an Abatement Work Area at no cost to the City.
- .5 All work of this Section involving electrical, mechanical, carpentry, glazing, etc., shall be performed by licensed persons experienced and qualified for the work required.

1.8 Supervision

- .1 Provide on site, an Overall Superintendent(s), who has authority to oversee all aspects of the work, including but not limited to, estimating and negotiation of changes to the contract, update of submission requirements, scheduling, manpower and equipment requirements, and direct communication and co-ordination with Abatement Consultant and City's representative.
- .2 Provide on site, in addition to the Overall Superintendent(s), and for each work shift, a Shift Superintendent, who has authority regarding all aspects related to manpower, equipment and production.
- .3 Supervisory personnel must hold a recognized certificate proving attendance at an asbestos removal training course (3 day minimum duration) and have performed supervisory functions on at least five (5) other asbestos abatement projects of similar size and complexity.
- .4 At all times during work, the Overall or Shift Superintendent(s) must be on site. Failure to comply with this requirement will result in a stoppage of all work, at no cost to the City.
- .5 Replace supervisory personnel, with approved replacements, within three (3) working days of a written request from the City. City reserves the right to request replacement of supervisory personnel without explanation.
- .6 Do not replace supervisory personnel without written approval from the City.

1.9 Notification

- .1 Not later than 5 days before commencing asbestos abatement work on this project, notify the local office of the Manitoba Workplace Safety and Health Division.

- .2 Notify Sanitary Landfill site as per local requirements.
- .3 Inform all trades on site of the presence and location of hazardous materials identified in the Contract documents.
- .4 Notify the City or City's Representative, if suspected asbestos-containing materials not identified in the contract documents are discovered during the course of the work. Stop work in these areas immediately.

1.10 Submittals

- .1 Submit prior to starting work:
 - .1 Provincial Workers' Compensation Board Clearance Certificate.
 - .2 Insurance certificates.
 - .3 Copy of Company Health and Safety Policy and applicable programs.
 - .4 Provincial Regulator Notice of Project form.
 - .5 Copy of Certificate of Approval for disposal of hazardous materials waste and location of landfill.
 - .6 Pre-removal damage survey of the Abatement Work Area(s), waste transport routes, and bin storage areas.
- .2 Submit the following information regarding personnel prior to starting work:
 - .1 Resumes of the supervisory personnel.
 - .2 Proof in the form of a certificate that supervisory personnel have attended a training course on asbestos (3 day minimum duration).
 - .3 Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.
 - .4 Proof of training for the following site specific hazards or conditions identified:
 - .1 Working at Heights;
 - .2 Elevated Work Platform; and
 - .3 Confined Space.
 - .5 Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.
 - .6 WHMIS training certificates for all personnel.

- .7 Certificate proving that each worker on site has been fit tested for the respirator appropriate for the work being performed.
- .8 Proof, satisfactory to the Consultant, that all persons involved in the transport and disposal hazardous materials have been trained in accordance with the requirements of Federal and Provincial Transportation of Dangerous Good Acts and Regulations.
- .3 Submit the following information regarding HEPA filtered devices prior to construction of enclosure or asbestos abatement:
 - .1 Performance data on HEPA filtered vacuums including DOP tests no more than 3 months old; and
 - .2 Performance data on negative air units including DOP tests which must be no more than 3 months old if the unit is vented outdoors or which must be performed on site immediately prior to initial usage and when HEPA filters are changed if the unit is vented indoors.
 - .3 DOP tests to be performed by an independent testing company.
 - .1 DOP testing company is required to submit a detailed technical report of testing protocol, including Introduction, Methodology, Results, Conclusions, and Recommendations, including results of the Air-Aerosol Mixing Uniformity test as per ASME N510-1989 (1995).
 - .2 DOP testing company must also provide calibration certificates from an independent calibration firm or from the manufacturer of the testing equipment for both the aerosol photometer and the pressure gauge on the aerosol generator dated within 1 calendar year from the on-site testing date.
 - .3 DOP testing company must also provide the National Sanitation Foundation (NSF) certification name and number of the on-site technician performing the testing.
 - .4 Proof of calibration of DOP testing equipment.
- .4 Submit the following prior to isolating the work area:
 - .1 Safety Data Sheets for chemicals or material used in the course of the Abatement Project.
- .5 Submit the following upon completion of the work.
 - .1 Manifests, waybills, bills of lading etc. as applicable for each type of waste.

1.11 Site Review

- .1 From commencement of work until completion of clean-up operations, the Abatement Consultant is empowered by the City to inspect for compliance with the requirements of governing authorities, adherence to specified procedures and materials, and to inspect for final cleanliness and completion.

- .2 The Abatement Consultant is empowered by the City to order a shutdown of work when leakage of asbestos from the controlled work area has occurred or is likely to occur.
- .3 Any deviation from the requirements of the Specifications or governing authorities that is not approved in writing may result in a stoppage of work, at no cost to the City.
- .4 Additional labour or materials expended by the Contractor to rectify unsatisfactory conditions and to provide performance to the level specified shall be at no additional cost to the City.
- .5 Site reviews and air monitoring performed as a result of Contractor's failure to perform satisfactorily regarding quality, safety, or schedule, shall be back-charged to the Contractor.
- .6 Facilitate site reviews and provide access as necessary. Make good work disturbed by site reviews and testing at no cost to the City.
- .7 Refer to the Sections identified in Related Work for specified milestone site reviews which are to take place at defined points throughout the abatement operation specific to each phase or work area.
- .8 Provide 24 hours written notice to the Abatement Consultant of any request for scheduling of milestone inspections or transportation of waste through Occupied Areas.
- .9 The following Milestone Site Reviews may take place, at the City's cost, as outlined in each related specification section:
 - .1 Milestone Site Review - Clean Site Preparation
 - .1 Review of preparations and set-up prior to contaminated work in the Abatement Work Area.
 - .2 Milestone Site Review – Bulk Removal Site Review
 - .1 Review during asbestos removal, monitoring removal methods, site deficiencies, performing occupied air monitoring, etc.
 - .3 Milestone Site Review - Visual Clearance
 - .1 Review of Abatement Work Area after completion of all abatement, but prior to application of lock-down agents or dismantling of enclosure.
 - .4 Milestone Site Review – Clearance Sampling
 - .1 Air monitoring performed following removal of asbestos and application of slow drying sealer to ensure fibre levels inside the enclosure(s) are within the acceptable limits.
- .10 Refer to the Sections identified in Related Work for specified milestone site reviews which are to take place at defined points throughout the abatement operation specific to each phase or work area.
- .11 Do not proceed with next phase of work until written approval of each milestone is received from the Abatement Consultant.

1.12 Air Monitoring - Asbestos

- .1 Air monitoring will be performed using Phase Contrast Microscopy (PCM) following the National Institute for Occupational Safety and Health Method 7400.
- .2 Co-operate in the collection of air samples, including providing workers to wear sample pumps for up to full-shift periods. Contractor will be responsible for the cost of testing equipment repairs or resampling resulting from the actions of the Contractor's forces.
- .3 Results of PCM samples of 0.05 fibres per cubic centimeter of air (fibre/cc) or greater, outside an Abatement Work Area, will indicate asbestos contamination of these areas. Respond as follows:
 - .1 Suspend work within the adjoining Abatement Work Area until written authorization to resume work has been received from the Abatement Consultant.
 - .2 Isolate and clean area in the same manner applicable to the Abatement Work Area.
 - .3 Maintain work area isolation and repeat clean-up operations until visual inspection and air monitoring results are at a level equal to that specified.
- .4 When results exceed 50% of maximum use concentration for the respirator being used within the work area respond as follows:
 - .1 Immediately stop work within the Abatement Work Area.
 - .2 Instruct workers to exit the Abatement Work Area via the Worker Decontamination Facility while observing specified personnel exiting procedures.
 - .3 Contractor's forces shall not re-enter the Abatement Work Area for a period of 8 hours or until authorized by the Abatement Consultant.
 - .4 Upon re-entry to the Abatement Work Area, mist the air, any fallen debris or exposed surfaces with amended water using an airless sprayer.
- .5 Additional labour or materials expended by the Contractor to rectify unsatisfactory conditions and to provide performance to the level specified shall be at no additional cost to the City.
- .6 Cost of additional inspection and sampling performed as a result of elevated fibre levels in areas outside the Abatement Work Area or from within the work area following completion of work, will be back-charged to the Contractor.

1.13 Worker Protection

- .1 Instruct workers before allowing entry to the Abatement Work Area. Instruction shall include training in use of respirators, dress, entry and exiting from an Abatement Work Area, and all other aspects of work procedures and protective measures.

- .2 Workers shall not eat, drink, chew gum or tobacco, or smoke in the Abatement Work Area.
- .3 Workers shall be fully protected at all times when possibility of disturbance of hazardous materials exists.
- .4 Provide soap, towels and facilities for washing of hands and face, which shall be used by all personnel when leaving the Abatement Work Area.
- .5 **Respiratory Protection**
 - .1 Refer to each particular Section of the Specification for specified type of respiratory equipment specific to each phase or work area.
 - .2 Respirators shall be:
 - .1 Certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Provincial regulator.
 - .2 Fitted so that there is an effective seal between the respirator and the worker's face. Ensure that no person required to enter an Abatement Work Area has facial hair which affects the seal between respirator and face.
 - .3 Assigned to a worker for their exclusive use.
 - .4 Maintained in accordance with manufacturer's specifications.
 - .5 Cleaned, disinfected and inspected by a competent person after use on each shift, or more often if required.
 - .6 Repaired or have damaged or deteriorated parts replaced.
 - .7 Stored in a clean and sanitary location.
 - .8 Provided with new filters as necessary, according to manufacturer's instructions.
 - .9 Worn by personnel who have been fit checked by qualitative or quantitative fit-testing.
 - .10 Instruction on proper use of respirators must be provided by a competent person.
 - .3 Provide protective clothing, to all personnel which:
 - .1 Is made of a material that does not readily retain nor permit penetration of asbestos fibres or lead dust.
 - .2 Consists of head covering and full body covering that fits snugly at the ankles, wrists and neck.
 - .3 Once coveralls are worn, treat and dispose of as contaminated waste.
 - .4 Is replaced or repaired if torn or ripped.
 - .4 Use hard hats, safety footwear and other protective equipment and apparel required by applicable construction safety regulations.

1.14 Visitor Protection

- .1 Provide clean protective clothing and equipment to Authorized Visitors.
- .2 Instruct Authorized Visitors in the use of protective clothing and Abatement Work Area entry and exit procedures.

- .3 Authorized visitors are required to be fit tested on respirators, prior to entering Abatement Work Area.

1.15 Signage

- .1 Asbestos Abatement Signs: Post signs at access points to the Abatement Work Area, stating at minimum, the following:
 - .1 There is an asbestos dust hazard.
 - .2 Access to the work area is restricted to persons wearing protective clothing and equipment.
- .2 Lead Abatement Signs: Post signs at access points to the Abatement Work Area, stating at minimum, the following:
 - .1 There is a lead dust, fume or mist hazard.
 - .2 Access to the work area is restricted to authorized persons.
 - .3 Respirators must be worn in the work area.
- .3 Bins and Asbestos Waste Containers: Post signs on both sides of every asbestos waste bin and on every asbestos waste container. Signs must display thereon in large, easily legible letters that contrast in colour with the background the word “CAUTION” in letters not less than ten centimetres in height and the words:
 - .1 CONTAINS ASBESTOS FIBRES
 - .2 Avoid Creating Dust and Spillage
 - .3 Asbestos May be Harmful to Your Health
 - .4 Wear Approved Protective Equipment.
- .4 Place placards in accordance with Transportation of Dangerous Goods Act.

1.16 Waste and Material Handling

- .1 Waste bins must be placed on grade or in receiving.
- .2 All bins for hazardous materials must be covered and locked when waste transfer is not being performed.
- .3 Ensure redundant non-ACM, rubble, debris, etc. removed during contaminated work are treated, packaged, transported and disposed of as appropriate waste.
- .4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area. Recycle metals.

- .5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste. Obtain prior written approval from the Abatement Consultant for each individual type of material.
- .6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.
- .7 Place all equipment, tools and unused materials that cannot be cleaned in Abatement Waste Containers.
- .8 As work progresses, and at regular intervals, transport the sealed and labelled waste containers from the Abatement Work Area to waste bin.
- .9 Place items in bins according to waste classification. Place asbestos waste, lead waste, metals, non-asbestos waste, etc. in separate bins.
- .10 Removal of waste containers and decontaminated tools and materials from the Abatement Work Area shall be performed as follows:
 - .1 Remove any visible contamination from the surface of non-porous or cleanable waste being removed from the Abatement Work Area. If the item can be cleaned, remove it from the site as clean waste.
 - .2 Place waste or item in Waste Container and seal closed.
 - .3 Wet wipe outside of Waste Container.
 - .4 Within Decontamination Facility, Transfer Room or at the perimeter of the Abatement Work Area, place in second Waste Container. Seal closed.
 - .5 Remove waste containers and transport to appropriate bin.
- .11 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with the City. Use a closed, covered cart to transport through Occupied Areas.
- .12 Use Low Risk Procedures while transporting asbestos waste through facility.
- .13 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled material in the case of a rupture of a Waste Container.
- .14 Pick-up and drop off of garbage bin shall be at pre-approved times and must not interfere with the City's operations.
- .15 Transport hazardous waste to landfill or waste transfer station in accordance with provincial requirements.

- .16 Cooperate with inspectors from the provincial regulator and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the City.

1.17 Re-establishment of Objects and Systems

- .1 Re-establish objects and items relocated by the Contractor's workforce to facilitate work.
- .2 Re-establish electrical, communication, HVAC and other services previously disconnected or otherwise isolated to accommodate work by this Section.
- .3 Make good at completion of work, all damage not identified in pre-removal survey.

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

- .1 Refer to the Sections identified in Related Work for specified materials, equipment or facilities specific to each phase or work area.
- .2 Materials and equipment must be in good condition and free of debris and fibrous materials. Disposable items must be of new materials only.
- .3 Airless Sprayer: AC powered pressure washer that allows wetting agent to mix with water, uses no air or compressed air, and has a nozzle to regulate power and pressure.
- .4 Amended Water: Water with wetting agent added for purpose of reducing surface tension to allow thorough wetting of materials.
- .5 Asbestos Waste Container: A container acceptable to disposal site, and the provincial regulator comprised of the following:
 - .1 Dust tight.
 - .2 Suitable for the type of waste.
 - .3 Impervious to asbestos.
 - .4 Identified as asbestos waste.
- .6 Discharge Ducting: Polyethylene Tubing. Reinforced with wire. Diameter to equal negative pressure machine discharge. Not to be longer than required, or so long that negative pressure is compromised.
- .7 Ground Fault Panel: Electrical panel as follows:
 - .1 Ground fault circuit interrupters of sufficient capacity to power temporary electrical equipment and lights in Asbestos Work Area.
 - .2 Interrupters to have a 5 mA ground fault protection.

- .3 Necessary accessories including main switch disconnect, ground fault interrupter lights, test switch to ensure unit is working, and reset switch.
- .4 Openings sealed to prevent moisture or dust penetration.
- .5 Inspected by the Electrical Safety Authority.
- .6 Panel uses CSA approved parts and been constructed, inspected and installed by a licensed electrician.
- .7 Provide one Ground Fault Panel for each 5,000 square feet (500 square metres) of Abatement Work Area.
- .8 HEPA Filtered Negative Pressure Machine: Portable air handling system which extracts air directly from the Abatement Work Area and discharges the air to the exterior of the building. Equipped as follows:
 - .1 Prefilter and HEPA filter. Air must pass HEPA filter before discharge.
 - .2 Pressure differential gauge to monitor filter loading.
 - .3 Auto shut off and warning system for HEPA filter failure.
 - .4 Separate hold down clamps to retain HEPA filter in place during change of prefilter.
- .9 HEPA Vacuum: Vacuum with necessary fittings, tools and attachments. Discharged air must pass through a HEPA filter.
- .10 Hose: Leak-proof, minimum bursting strength of 500 PSI or greater if required, abrasion resistant covering, reinforcing, and machined-brass couplings. Maintained and tested. Hose to be temperature resistant if it is to carry domestic hot water.
- .11 Lead Waste Container: An impermeable container acceptable to disposal site and provincial regulator, that is:
 - .1 Dust tight.
 - .2 Suitable for the type of waste.
 - .3 Evaluated for leachable lead content and disposed of in accordance with applicable regulations.
 - .1 Where lead waste exceeds 5.0 mg/L of lead in the TCLP analysis, label as lead waste and dispose of as leachate toxic hazardous waste.
 - .2 Where lead waste is below 5.0 mg/L of lead in the TCLP analysis, disposed of as construction waste.
- .12 OSB: Oriented Strand Board.

- .13 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.
- .14 Post Removal Sealant (or Lockdown): Sealant that when applied to surfaces serves the function of trapping residual asbestos fibres or other dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Post Removal Sealant shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate. Apply to manufacturer's instructions.
- .15 Protective Clothing: Disposable coveralls complete with head covering and full body covering that fits snugly at the ankles, wrists and neck.
- .16 Rip-Proof Polyethylene Sheeting: 8 mil (0.20 mm) fabric made up from 5 mil (0.13 mm) weave and two (2) layers of 1.5 mil (0.05 mm) poly laminate or approved equal. In sheet size to minimize on-site seams and overlaps.
- .17 Sprayer: Garden type portable manual sprayer or water hose with spray attachment if suitable.
- .18 Tape: Duct tape or tape suitable for sealing polyethylene to surfaces under both dry and wet conditions in the presence of Amended Water.
- .19 Wetting Agent: Non-sudsing surfactant added to water to reduce surface tension and increase wetting ability.

PART 3 EXECUTION

- .1 Refer to the Sections identified in Related Work for specified procedures for work area preparation, maintenance, site dismantlement, application of lock-down agent and all other procedures for the safe handling, removal and clean-up of hazardous materials specific to each phase or work area.

END OF SECTION

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PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

- .1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.
- .2 Isolate the Abatement Work Area from adjoining spaces through the installation of temporary barriers and partitions as specified herein.
- .3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up and disposal of asbestos-containing materials following Type 1 (Low Risk) procedures, and Pinchin and City specific requirements.

1.3 Instruction and Training

- .1 Provide instruction and training to all workers including the following:
 - .1 Hazards of asbestos;
 - .2 Use, care and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:
 - .1 Limitations of equipment;
 - .2 Inspection and maintenance of equipment;
 - .3 Proper fitting of equipment; and
 - .4 Disinfecting and cleaning of equipment.
 - .3 Personal hygiene to be observed when performing the work.
 - .4 Measures and procedures prescribed in the regulation and decontamination of the worker.
- .2 Instruction and training must be provided by a competent person.

1.4 Personal Protection

- .1 Protect all personnel at all times when possibility of disturbance of ACM exists.
 - .1 Provide non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters when requested by personnel.
 - .2 When requested by personnel, provide protective clothing.

1.5 Inspections

- .1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection - Visual Clearance
 - .2 Milestone Inspection – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

- .1 Refer to Section 02 81 00.

PART 3 EXECUTION

3.1 Site Preparation

- .1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.
- .2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.
- .3 Install polyethylene drop sheets below areas of work.
- .4 Install signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.
- .5 Shut down HVAC systems serving the Abatement Work Area.
 - .1 Install polyethylene sheeting over openings in ducts and diffusers and seal.
 - .2 HVAC to remaining areas of building must not be disrupted during work of this section.
 - .3 System shall remain inoperative until completion of work, unless ducts can be effectively capped.
 - .4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.
- .6 Provide power from ground fault interrupt circuits.
- .7 Provide amended water for wetting ACM, and adequate method of wetting (garden sprayers, airless sprayers, etc).
- .8 Without disturbing asbestos-containing materials, remove and dispose of non-hazardous materials as clean waste prior to asbestos removal work, where possible.
- .9 Do not commence contaminated work until authorized by the Abatement Consultant.

3.2 Maintenance of Abatement Work Area

- .1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.
- .2 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.
- .3 Maintain Abatement Work Area in tidy condition.
- .4 Remove any standing water on polyethylene/floor at the end of every shift.

3.3 Asbestos Removal - General

- .1 Do not use powered tools or non-hand held tools.
- .2 Do not use compressed air to clean or remove dust or debris.
- .3 Do not break, cut, drill, abrade, grind, sand or vibrate ACM if it cannot be wetted. Type 2 (Moderate Risk) procedures would be required if the material cannot be wetted due to hazard or damage.
- .4 Wet ACM prior to work and keep ACM wet throughout the removal process.

- .5 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.
- .6 Frequently and at regular intervals, place all waste in asbestos waste containers.
- .7 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.4 Asbestos Removal - Vinyl Asbestos Tile

- .1 Wedge a heavy-duty scraper in seam of two adjoining tiles and gradually force edge of one tile up and away from floor. Do not break off pieces of tile but continue to force balance of tile up.
- .2 Place tile, without breaking into smaller pieces, into Asbestos Waste Container.
- .3 Force scraper through tightly adhered areas by striking scraper handle with a hammer.
- .4 Heat tile thoroughly with a hot air gun until heat penetrates through tile and softens adhesive in areas where scraper will not remove tile.
- .5 Scrape up adhesive remaining on floor with a hand scraper until only a thin smooth film remains.
- .6 Use a hot air gun where deposits are heavy or difficult to scrape.
- .7 Deposit scrapings into asbestos waste disposal bag.
- .8 HEPA vacuum floor on completion of work in area.

3.5 Asbestos Removal - Removal of Ducts with Asbestos Beige Mastic

- .1 Remove ducts in sections. Avoid cutting through mastic where possible. If cutting through mastic is unavoidable use non-powered tools.
- .2 Wet mastic if cut through during work.
- .3 Wrap removed sections of ducts with two layers of rip proof polyethylene.

3.6 Asbestos Removal - Removal of Duct Insulation That is Covered with Asbestos Black Mastic

- .1 Wet all material to be disturbed.
- .2 Undo fasteners if necessary to remove material.
- .3 Break material only if unavoidable, and wet material if broken during work.
- .4 Use only non-powered hand-held tools to remove ACM.
- .5 Scrape to remove material adhered to substrate.
- .6 Place removed ACM directly into an asbestos waste container.

3.7 Abatement Work Area Dismantling

- .1 Schedule and obtain written approval of Milestone Inspection - Site Dismantlement before proceeding.
- .2 Wash or HEPA vacuum equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.
- .3 Place tools and equipment used in contaminated work site but not cleaned in polyethylene bags prior to removal from Abatement Work Area.

- .4 Clean polyethylene sheeting and drop sheets with HEPA vacuum or wet cleaning methods at completion of work.
- .5 Wet drop sheets and polyethylene sheeting.
- .6 Carefully roll polyethylene sheeting and drop sheets toward the centre. As polyethylene is rolled away, immediately remove visible debris beneath with a HEPA vacuum.
- .7 Remove remaining polyethylene sheeting and tape.
- .8 Place polyethylene sheeting, drop sheets, tape, disposal clothing and other contaminated waste in asbestos waste containers, wet wipe and place in second asbestos waste container.

3.8 Waste and Material Handling

- .1 Refer to Section 02 81 00.

END OF SECTION

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PART 1 GENERAL

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions.

1.2 Outline of Work

- .1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.
- .2 Isolate the Abatement Work Area from adjoining spaces through the installation of hoardings, seals and enclosures at the perimeter of each phase or work area as specified herein.
- .3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up and disposal of lead-containing materials following Class 2 or Moderate Risk procedures, and Pinchin and City specific requirements.
- .4 Comply with requirements of this Section when performing the following Work:
 - .1 Demolition of plaster or other building components that crumble, pulverize or powder and are covered with lead-containing surface coating.

1.3 Instruction and Training

- .1 Provide instruction and training to all workers including the following:
 - .1 Hazards of lead.
 - .2 Use, care and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:
 - .1 Limitations of equipment;
 - .2 Inspection and maintenance of equipment;
 - .3 Proper fitting of equipment; and
 - .4 Disinfecting and cleaning of equipment.
 - .3 Personal hygiene to be observed when performing the work.
 - .4 The measures and procedures prescribed by this section including decontamination of the worker.
 - .5 Instruction and training must be provided by a competent person.

1.4 Personal Protection

- .1 Provide the following respiratory protection to all personnel, at minimum:
 - .1 Non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters;
- .2 Provide protective clothing, t
- .3 o all personnel entering the Abatement Work Area, including:

- .1 Dust impermeable gloves appropriate for the work being completed.
- .2 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
- .4 Provide facilities for washing of hands and face to the personnel which shall be used by every worker when leaving the abatement work area. Lead-specific soaps and hygiene indicators are recommended to be provided for shower and hand-wash stations.

1.5 Inspections

- .1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection - Visual Clearance

PART 2 PRODUCTS AND FACILITIES

- .1 Refer to Section 02 81 00.

2.2 Hoarding Walls

- .1 Type A Hoarding Wall: One layer of rip-proof polyethylene sheeting installed floor to ceiling, secured with telescopic poles, clips, or other suitable methods.

2.3 Transfer Room

- .1 Transfer Room to be generally 2000 mm x 2000 mm x 2200 mm high. Increase size accordingly to accommodate number of workers.
- .2 Install walls as follows:
 - .1 Install 38 x 89 mm wood framing at 610 mm o/c with continuous top and sill plates; and
 - .2 Install one layer rip-proof polyethylene sheeting on interior walls of Transfer Room.
- .3 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting beneath entire Transfer Room.
- .4 Install one layer rip-proof polyethylene sheeting over roof.
- .5 Turn 600 mm of polyethylene down the sides over polyethylene on the perimeter walls.
- .6 Install a fire extinguisher, mount to wall.

2.4 Curtained Doorways

- .1 Construct as follows:
 - .1 Install two flap doors, full width and height of door opening at all doors to Abatement Work Area and both ends of Transfer Room;
 - .2 Construct each flap door of two layers of polyethylene sheeting with all edges reinforced with tape. Use wood strapping to securely fasten flap doors to head and alternate jambs;
 - .3 Install weights attached to bottom edge of each door flap; and
 - .4 Provide direction arrows on flaps to indicate opening.

PART 3 EXECUTION

3.1 Site Preparation - General

- .1 Provide washing facilities consisting of a wash basin, clean water, soap and towels.
 - .1 Workers are to use washing facilities each time leaving the Abatement Work Area.
- .2 Stored or non-fixed items, including but not limited to equipment, furniture, waste etc., shall be removed from the Abatement Work Area prior to abatement work.
- .3 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.
 - .1 Lock-out/tag-out power at electrical panels.
 - .2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.
- .4 Shut down HVAC systems serving the Abatement Work Area.
 - .1 Install polyethylene sheeting over openings in ducts and diffusers and seal.
 - .2 HVAC to remaining areas of building must not be disrupted during work of this section.
 - .3 System shall remain inoperative until completion of work, unless ducts can be effectively capped.
 - .4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.
- .5 Remove visible dust from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.
- .6 Provide amended water for wetting materials, and adequate method of wetting (garden sprayers, airless sprayers, etc.).
- .7 Provide electrical power and shut off for operation of powered tools and equipment. Provide ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard.
 - .1 Ensure safe installation of electrical lines and equipment.
- .8 Do not use compressed air to clean or remove dust or debris.
- .9 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.
- .10 Frequently and at regular intervals, place all waste in waste containers.
- .11 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.2 Site Preparation –Enclosure Required

- .1 Install Transfer Room where duration of work is to last longer than one 8 hour shift.
- .2 Install Curtained Doorways.

- .3 Install polyethylene sheeting at openings in walls (as required) and seal.
- .4 Seal openings in floor using tape, caulking, polyethylene, etc. Floor openings are to be sealed independently prior to installation of floor polyethylene.
- .5 Install polyethylene sheeting on floors of Abatement Work Area. Use sufficient layers to provide adequate protection for carpeting and equipment.
 - .1 Cover floors first so that polyethylene on walls is overlapped by at least 305 mm.
- .6 Install 6 mil polyethylene sheeting on walls to remain, within the Abatement Work Area., including existing walls that make up, or are within, the Abatement Work Area.
- .7 Install one layer of 6 mil polyethylene sheeting so as to protect all equipment and finishes in the Abatement Work Area that may be damaged.
- .8 Place required tools to complete the abatement with the Abatement Work Area.
- .9 Install temporary lighting in enclosure to a level that will provide for safe and efficient use of work area - minimum 550 LUX.
- .10 Establish negative pressure in Abatement Work Areas as follows:
 - .1 Provide sufficient HEPA filtered negative pressure machines to exchange a volume of air equivalent to that of the Abatement Work Area a minimum of every 20 minutes;
 - .2 Provide additional HEPA filtered negative pressure machines as required to ensure air flow from Occupied Area into Abatement Work Area;
 - .3 Operate HEPA filtered negative pressure machines continuously from first disturbance of lead containing material until completion of dismantling.
 - .4 Replace prefilters to maintain specified flow rate;
 - .5 Replace HEPA filter as required to maintain flow rate and integrity of unit;
 - .6 Discharge HEPA filtered negative air machines to building exterior, where possible.
 - .1 Direct discharge away from building access points.
- .11 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of lead hazard, and lead hazard where appropriate.
- .12 Do not commence contaminated work until authorized by the Abatement Consultant.
- .13 Do not commence contaminated work until authorized by the Abatement Consultant.

3.3 Maintenance of Abatement Work Area

- .1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.
- .2 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.
- .3 Inspect HEPA filtered negative pressure machines including discharge ducting at the beginning and end of each working period. Inspection must be performed by competent person.
- .4 Maintain Abatement Work Area in tidy condition.

- .5 Remove standing water on polyethylene/floor at the end of every shift.
- .6 Turn off water supply to any hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.

3.4 Lead-Containing Paint Abatement

- .1 Use the procedures described above under *Site Preparation – Enclosure Required*.
 - .1 Demolition of plaster or building components that crumble, pulverize or powder and are covered with lead-containing paints.
 - .2 Removal of lead-containing paints scraping or sanding (including wet sanding) using non-powered hand tools.
 - .3 Patch/repair the wall where the stage floor abutted the wall to make ready to receive new finish.
- .2 Provide washing facilities consisting of a wash basin, clean water, soap and towels.
 - .1 Workers are to use washing facilities each time leaving the Abatement Work Area.
- .3 Removal methods minimizing dust generation should be used wherever possible.
 - .1 Wet methods are to be used to reduce dust generation.
 - .1 Wetting agents should be used where possible.
 - .2 Wet method not be used if it creates a hazard or cause damage to equipment or to project.
- .4 Provide drop sheets below all lead operations that may produce dust, chips or debris containing lead.
- .5 Waste water from cleaning or removal operations must be contained, for treatment or disposal.
- .6 Waste generated should be maintained wet until cleaned and packaged.
- .7 After completion bulk removal, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .8 After wire brushing and wet sponging to remove visible lead based paint, wet clean entire work area, and equipment used in process.
 - .1 Compressed air or dry sweeping not be used to clean up lead-containing dust or waste.
 - .2 Ensure all waste is cleaned and packaged.
- .9 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. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .10 The Abatement Work Area is not to be dismantled until visual clearance is achieved.

3.5 Waste Management and Disposal

- .1 Per Section 02 82 00.

3.6 Final Cleaning

- .1 Following specified cleaning procedures, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Clean visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and seal. Dispose of in accordance with waste materials generated.
- .4 Clean Work areas and Transfer Room, where present.
- .5 Remove sealed waste containers and equipment used in Work and remove from work areas at appropriate time in cleaning sequence.
- .6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

END OF SECTION

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PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

- .1 Unless otherwise shown or specified it is the intent that work performed as per this section will result in the removal and destruction of:
 - .1 PCB-containing caulking
- .2 All Work shall be performed in strict accordance with the Project Documents and all governing codes, rules, and regulations. Where conflicts occur between the Project Documents and applicable codes, rules, and regulations, the more stringent shall apply.

1.3 Quality Assurance

- .1 Ensure the removal and handling of PCBs is performed by persons experienced in the methods, procedures and industry practices.
- .2 Complete work so that at no time do PCBs contaminate the building or environment.

1.4 Instruction and Training

- .1 Instruction and training must be provided to all workers and supervisors. Instruction and training includes the following:
 - .1 Hazards of PCBs.
 - .2 Use, care and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during work, including:
 - .1 Limitations of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Proper fitting of equipment.
 - .4 Disinfecting and cleaning of equipment.
 - .3 Personal hygiene to be observed when performing the work.
 - .4 The measures and procedures prescribed by this section.

- .2 Instruction and training must be provided by a competent, qualified person.

1.5 Personal Protection

- .1 Workers handling PCB-containing materials are advised to avoid skin and eye contact.
- .2 During removal of PCBs, personnel are to wear personal protective equipment appropriate to the task.
- .3 During removal of PCB caulking, personnel are to wear, at minimum:
 - .1 Provide workers, at a minimum, with non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters.
 - .2 Provide workers, with protective eye wear.
 - .3 Provide protective clothing, to all personnel entering the Abatement Work Area.
 - .4 Provide disposable gloves (nitrile), to all personnel entering the Abatement Work Area.

1.6 Inspections

- .1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection - Visual Clearance

PART 2 PRODUCTS

2.1 Materials

- .1 Containment Drums: new, not used double bung 45 gallon No. 16 gauge cold rolled steel drums with removable steel lid, PCB resistant gasket (nitrile rubber, cork or Teflon), and 12 gauge compression type ring closure with 5/8" bolt and forged lug. Drums shall be newly painted inside and out with bright white rust-resistant enamel. Metal pail of 16 gauge steel with removal steel lid, are also acceptable for smaller quantities of waste.
- .2 Decontamination Area: An established area for the purpose of decontaminating personnel and equipment.
 - .1 Of sufficient size to accommodate cleaning of equipment and removing personal protective equipment.
 - .2 Install PCB warning signs / tape at the entrance to the decontamination area.
 - .3 The floor shall be covered with polyethylene sheeting.

- .4 Include a hand washing station complete with soap and towels and 6 mil polyethylene bags for disposal of PCB-contaminated items such as gloves, Tyvek suite rags etc.
 - .5 All personnel must enter and exit the Abatement Work Area through the decontamination area.
 - .6 All equipment and surfaces of waste containers must be cleaned prior to removing them from the decontamination room or area.
 - .7 Work clothing must be cleaned with a HEPA vacuum before it is removed.
- .3 Drum liners: clear polyethylene bag, 36" x 60", 6 mil thick. Open one 36" end.
- .4 Label: appropriate PCB Labels and Placards of sufficient size to be clearly legible, for display on waste containers (bags, boxes, rolloffs or drums) which will be used to contain or transport PCB contaminated material, in accordance with TDG regulations.
- .5 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints. New materials only.

PART 3 EXECUTION

3.1 General

- .1 Do not contaminate building surfaces with PCBs.
- .2 Should visible PCB debris be observed outside the Work Area, immediately stop Work notify the Consultant and City; institute emergency procedures as directed. All costs incurred in decontaminating such non-Work Areas and the contents thereof shall be borne by the Contractor, at no additional cost to the City.
- .3 Notify City's Representative of any spills immediately.
 - .1 Any spills of PCBs are to be cleaned to the satisfaction of the City's Representative at the contractors cost. This includes removal and replacement of building materials as required.
- .4 Conduct PCB removal operations in a manner that fully protects Contractor's and Subcontractor's employees, the general public, other building occupants and the environment from exposure to PCB.
- .5 Non-PCB items remaining such as windows, doors, masonry, and all other building construction and components from which PCB materials are removed shall be decontaminated by physical or chemical means such that no visible residue remains. The removal of the PCB materials may require the use of scrapers, solvents, mastic removal chemicals, or other methods/procedures to ensure complete removal.
- .6 Use hand tools that generate the least amount of dust and will still complete the PCB caulk removal.

- .1 Grinding electromechanical tools (e.g. angle grinders, masonry groove cutters, circular saws, and slot mills, etc.) are not allowed to be used for exterior open-air PCB caulk removals.
- .7 Remove accessible caulk that could be disturbed before cutting building components.

3.2 Work Area Preparation - Exterior Removal:

- .1 Take appropriate precautions (e.g. install windscreens) to prevent dust and debris from migrating due to windy conditions;
- .2 All work platforms and ground surfaces exterior to the work area shall have a layer of 6 mil fire retardant plastic sheeting, attached to the building face and laid down on the surface below the exterior abatement work area, at least 10 feet wide or to the furthest point of gravity fall for dislodged debris by methods used, whichever is further;
- .3 For work at the second storey and above, extend 6 mil fire retardant plastic sheeting as necessary;
- .4 All operable windows within the work area and 25 ft from all sides of the work area shall be closed;
- .5 In the work area, isolate all HVAC equipment intakes by temporarily shutting down units during removals and installing plastic sheeting over the opening; and
- .6 Do not commence contaminated work until authorized by the Abatement Consultant.

3.3 Removal of Caulking

- .1 Remove caulking with non-powered tools.
- .2 Install polyethylene drop sheets in packaging area to protect surfaces and finishes.
- .3 Place PCB waste on polyethylene drop sheets immediately after removal.
- .4 Package PCB-containing caulking in Containment Drums, or on wood skids.
 - .1 Place caulking on end in Containment Drum. When full:
 - .1 Seal liner bag with duct tape;
 - .2 Seal drum with lid, gasket and compression ring;
 - .3 Affix specified and completed label; and
 - .4 Do not leave liner bags or drums open overnight.
- .5 Transport packaged PCB waste to a Ministry of the Environment approved incineration facility and destroy.

3.4 Equipment and Area Decontamination

- .1 When removal of PCB materials is completed, the decontamination process shall consist of HEPA vacuuming, wet wiping/mopping and a repeated HEPA vacuuming of the entire work area. All surfaces in and around the work area must be free of dust generated during the work.
- .2 Decontaminate all tools and equipment before removal from the work area.
- .3 If dust or debris has migrated to areas of the building other than the immediate work area, those areas shall be incorporated into the work area and thoroughly decontaminated to ensure all visible dust generated by the activity is eliminated.
- .4 Uncontaminated dust barriers and other protective sheeting shall be placed in disposable construction bags and disposed of as normal trash.
- .5 Visually inspect the area for any remaining dust or debris. HEPA vacuum and wet wipe until space is clean. Dispose of vacuum contents as PCB waste.
- .6 Schedule and obtain written approval of Milestone Inspection - Site Dismantlement before removing temporary dust barriers.
- .7 Failure of any visual inspection by the Consultant, the Contractor will clean the affected areas at no additional expense to the City.

3.5 Transportation and Reporting

- .1 All waste containers shall be fully enclosed and lockable (i.e. enclosed dumpster, trailer, etc.).
 - .1 While on-site, the container shall be labelled with PCB Warning Labels and as required by Federal and Provincial regulations.
- .2 All waste generated as part of the PCB project shall be removed from the site within ten (10) calendar days after successful completion of all PCB abatement work.
- .3 The Hauler, with the Abatement Contractor and the Abatement Consultant, shall inspect the transport container prior to the Hauler taking possession and signing the Hazardous Waste Manifests.
- .4 A Hazardous Waste Manifest shall be utilized solely as the waste Manifest for transportation. A hauler billing form or bill of lading may be used if the hauler needs an independent record, but shall not be used as a shipping document.
 - .1 The Manifest shall be completed by the Contractor and verified by the Consultant that all the information and amounts are accurate and the proper signatures are in place.
 - .2 The Manifest shall have the appropriate signatures of the City's Representative (the Generator) and the Hauler representative prior to any waste being removed from the site.

- .3 Upon arrival at the Disposal Site, the Manifest shall be signed by the Disposal Facility operator to certify receipt of PCB materials covered by the manifest.
- .4 The Disposal Facility operator shall return the original Manifest to the City's Representative (the Generator) as required by the Ministry of Environment.
- .5 Provide a copy of the completed waste manifest proving receipt of the PCB waste by the Disposal Facility.
- .5 Transport materials following Transportation of Dangerous Goods Act.
 - .1 Transport PCBs to approved incineration site for destruction and ensure materials are destroyed.
- .6 The facility used to process the PCBs shall be approved by the Ministry of the Environment and shall have valid Certificates of Approval to carry out the work outlined herein.
 - .1 The facility must issue a Certificate of Destruction identifying types and quantities of PCBs generated from the project.

END OF SECTION

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COW,2055Ness,HAZ,ASMT\Deliverables\Specification\Revised Specification\234838.408 Specification Non-Liquid PCB, 2055 Ness,
Winnipeg, MB, COW, Apr 15, 2024.docx

Part 1 General

1.1 SECTION INCLUDES

- .1 Surface treatments for concrete floors and slabs.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.3 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 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .3 CSA A23.1/A23.2 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete; 2019.
- .4 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .5 SCS (CPD) - SCS Certified Products; Current Edition.
- .6 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate the work with concrete floor placement and concrete floor curing.

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 Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .4 Installer qualification statement.
- .5 Maintenance data: Provide data on maintenance and renewal of applied finishes.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Skilled tradesman to be employed by specialty company recognized and trained as approved installer by manufacturer, normally engaged in this type of work with minimum three years successful experience on projects of similar size, requirements and complexity.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 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.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the CAL (CDPH SM) or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 Sealants: Complying with SCAQMD 1168.

2.2 CONCRETE FLOOR FINISH APPLICATIONS

- .1 Unless otherwise indicated, exposed concrete floors are to be finished using liquid densifier/hardener.
- .2 Liquid densifier/hardener:
 - .1 Use at locations: Shown in the Room Finish Schedule as "CSH".

2.3 DENSIFIERS AND HARDENERS

- .1 Liquid densifier/hardener - Type CSH: 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 Basis-of-Design Products:
 - .1 Euclid Chemical Co.; UltraSil Li+.
 - .2 Mapei; Mapecrete Hard SI.
 - .3 Sika; MasterKure HD 200WB.
 - .4 W.R. Meadows; Liqui-Hard Ultra.

- .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that floor surfaces are acceptable to receive the work of this section.
- .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.
- .2 Apply materials in accordance with manufacturer's instructions.

3.3 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 densifiers/hardeners in accordance with manufacturer's instructions, matching approved mock-ups for colour, special effects, sealing and workmanship.

3.4 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.

3.5 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

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Part 1 General

1.1 SECTION INCLUDES

- .1 Precast concrete crawlspace walkway pavers.
- .2 Precast concrete sump pits.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Sump pit cover.
- .2 Section 31 23 33.01 - Excavation, Trenching and Backfilling
- .3 Section 33 41 00 - Subdrainage.

1.3 REFERENCE STANDARDS

- .1 CSA A23.4 - Precast Concrete — Materials and Construction; 2016 (Reaffirmed 2021).
- .2 CSA A231.1 - Precast Concrete Paving Slabs / Precast Concrete Pavers; 2019.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: for each type of precast concrete specialty specified.
- .3 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Handle precast units to position, consistent with their shape and design.
- .2 Protect units to prevent staining, chipping, or spalling of concrete.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Precast concrete crawlspace walkway pavers: Precast concrete, natural colour, non-slip diamond finish, 610 by 610 by 45 mm thick.
- .2 Precast concrete sump pits: Interlocking minimum 1524 mm inside diameter by 100 mm wall thickness by modular lengths as indicated; complete with integral ladder.

2.2 FABRICATION

- .1 Fabricate to CSA A23.4 and CSA A231.1. Use rigid moulds, constructed to maintain precast unit uniform in shape, size, and finish. Maintain consistent quality during manufacture.

- .2 Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- .3 Minor patching in plant is acceptable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's written instructions.
- .2 Place units without damage to shape or finish.
- .3 Precast walkway pavers:
 - .1 Install precast walkway pavers in crawlspace as indicated. Install slabs level, true to grade and free of movement.
 - .2 Joints and lippage not to exceed 3 mm between slabs.
 - .3 Replace or repair damaged pavers.
- .4 Precast concrete sump pits:
 - .1 Excavate for sump pit in accordance with Division 31. Provide compacted granular base.
 - .2 Install and level section of concrete pipe on granular base.
 - .3 Stack additional concrete pipe sections on base section of modular lengths as required to suit depth of sump pit.
 - .4 Cast concrete slab in accordance with structural, inside precast pipe to elevation as indicated.
 - .5 Co-ordinate installation of drain inlets in accordance with Division 33.
 - .6 Backfill around concrete pipe in accordance with Division 31. Do not damage drain pipe.
 - .7 Cast concrete pad around top of pipe in accordance with structural.
 - .8 Verify drain line inlets are clean and free of obstructions. Remove debris from base of sump pit.
 - .9 Install sump pit cover in accordance with Section 05 50 00.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Concrete block.
- .2 Mortar and grout.
- .3 Reinforcement and anchorage.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Masonry notes and details.
- .2 Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

- .1 ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- .2 ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- .3 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .4 CAN/CSA A371 - Masonry Construction for Buildings; 2014 (Reaffirmed 2019).
- .5 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .6 CAN/CSA A165 Series - CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3); 2014 (Reaffirmed 2019).
- .7 CAN/CSA A179 - Mortar and Grout for Unit Masonry; 2014.
- .8 CAN/CSA A370 - Connectors for Masonry; 2014 (Reaffirmed 2018).
- .9 CSA A3000 - Cementitious Materials Compendium; 2018.
- .10 SCS (CPD) - SCS Certified Products; Current Edition.
- .11 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- .2 Product data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- .3 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .4 Installer qualification statement.

1.5 QUALITY ASSURANCE

- .1 Comply with provisions of CAN/CSA A371, except where exceeded by requirements of the Contract Documents.
- .2 Installer qualifications:
 - .1 Member in good standing with Manitoba Masonry Contractors Association (MMCA), and Manitoba Masonry Institute (MMI).
 - .2 All associated trade certification is mandatory including Red Seal Certification.
 - .3 Minimum five years experience on projects of similar size and complexity.
 - .4 If the successful Masonry Subcontractor chooses to sub-contract the work or portions of the work, that sub-contractor must also be a current member in good standing with MMCA and MMI. If the successful Masonry Subcontractor chooses to form a relationship with another entity which will undertake the work of portions of the work, that entity must also be a current member in good standing with MMCA and MMI.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 CONCRETE MASONRY UNITS

- .1 Concrete block: Comply with referenced standards and as follows:
 - .1 Size: Standard units with nominal face dimensions of 400 by 200 mm and nominal depths as indicated on Drawings for specific locations.
 - .2 Special shapes: Provide non-standard blocks configured for corners, lintels, and bond beams.
 - .1 Provide bullnose units for exposed outside corners, unless otherwise indicated.
 - .3 Non-loadbearing Units: In accordance with Facet System specified in CAN/CSA A165 Series
 - .1 Hollow (H)/15 MPa/A/M

2.3 MORTAR AND GROUT MATERIALS

- .1 Masonry cement: CAN/CSA A179, Type S.
- .2 Mortar cement: CAN/CSA A179, Type MCN.
- .3 Portland cement: CSA A3000.
- .4 Hydrated lime: ASTM C207, Type S.
- .5 Mortar aggregate: CAN/CSA A179.
- .6 Water: Clean and potable.

2.4 REINFORCEMENT AND ANCHORAGE

- .1 Horizontal joint reinforcement: CAN/CSA A370 and CAN/CSA A371, continuous welded wire reinforcing having a minimum diameter of 3 mm and maximum diameter of one-half joint thickness, or 5 mm whichever is less.
 - .1 Type: Ladder
 - .2 Configuration: Single wythe
 - .3 Material: Hot-dipped galvanized after fabrication
- .2 Top of wall anchors: CAN/CSA A370 steel support anchors providing lateral shear resistance for top of wall, permitting vertical deflection of structure above without transferring load to masonry construction.
 - .1 Type: Bent channel
 - .2 Material: Mill galvanized
 - .3 Gap filler: Compressible neoprene sponge
- .3 Strap anchors: CAN/CSA A370 bent steel shapes, 38 mm width, 2.7 mm thick, 600 mm length, with 38 mm long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

2.5 MORTAR AND GROUT MIXING

- .1 Mortar for unit masonry: CAN/CSA A179, using the Property Specification
 - .1 Interior, non-loadbearing masonry: Type S.
- .2 Grout: CAN/CSA A179; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 50 mm or less;

coarse grout for spaces with smallest horizontal dimension greater than 50 mm.

- .3 Mixing: Use mechanical batch mixer and comply with referenced standards.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are acceptable and are ready to receive masonry.
- .2 Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- .1 Direct and coordinate placement of metal anchors supplied for installation under other sections.
- .2 Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

- .1 Comply with requirements of CAN/CSA A371.

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 Concrete masonry units:
 - .1 Bond: Running.
 - .2 Coursing: One unit and one mortar joint to equal 200 mm.
 - .3 Mortar joints: Concave.

3.5 PLACING AND BONDING

- .1 Lay hollow masonry units with face shell bedding on head and bed joints.
- .2 Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- .3 Remove excess mortar and mortar smears as work progresses.
- .4 Interlock intersections and external corners.
- .5 Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- .6 Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- .7 Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- .8 Isolate masonry partitions from vertical structural framing members with a control joint.

- .9 Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 MODIFICATIONS TO EXISTING MASONRY

- .1 Match existing bond and coursing height of adjacent masonry to remain.
- .2 Tooth new masonry into existing masonry in run of wall and at intersections with existing partitions.
- .3 Clean bond areas of adjacent masonry to remain, remove loose material and prepare masonry to receive new masonry toothed in.
- .4 Install reinforcement as necessary to provide continuity of reinforcing and stability between existing and new masonry work.
- .5 Provide repair anchors as necessary to stabilize existing masonry adjacent to and affected by the Work.

3.7 REINFORCEMENT AND ANCHORAGE - GENERAL

- .1 Unless otherwise indicated on Drawings or specified under specific wall type, install horizontal joint reinforcement 400 mm on centre.
- .2 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
- .3 Place continuous joint reinforcement in first and second joint below top of walls.
- .4 Embed longitudinal wires of joint reinforcement in mortar joint with at least 16 mm mortar cover on each side.
- .5 Lap joint reinforcement ends minimum 150 mm.
- .6 Fasten anchors to structural framing and embed in masonry joints as masonry is laid, at spacing indicated on Structural Drawings.

3.8 LINTELS

- .1 Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
- .2 Maintain minimum 200 mm bearing on each side of opening.

3.9 GROUTED COMPONENTS

- .1 Reinforce bond beams as indicated on Structural Drawings.
- .2 Reinforce corners and adjacent to openings as indicated on Structural Drawings.
- .3 Support and secure reinforcing bars from displacement. Maintain position within 13 mm of dimensioned position.
- .4 Place and consolidate grout fill without displacing reinforcing.

3.10 CONTROL AND EXPANSION JOINTS

- .1 Do not continue horizontal joint reinforcement through control or expansion joints.

- .2 Size control joints as indicated on Drawings; if not indicated, 19 mm wide and deep.

3.11 BUILT-IN WORK

- .1 As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and provided under other sections.
- .2 Install built-in items plumb, level, and true to line.
- .3 Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - .1 Fill adjacent masonry cores with grout minimum 300 mm from framed openings.
- .4 Do not build into masonry construction organic materials that are subject to deterioration.

3.12 TOLERANCES

- .1 Install masonry within site tolerances listed in CAN/CSA A371.

3.13 CUTTING AND FITTING

- .1 Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items penetrating partitions. Coordinate with other sections of work to provide correct size, shape, and location.
- .2 Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

- .1 Remove excess mortar and mortar droppings.
- .2 Clean soiled surfaces with cleaning solution.

3.15 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 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based exterior wall and soffit sheathing.
- .2 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).

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 for both exterior wall and soffit assemblies.
 - .1 Indicate stud and soffit framing layout at attachments.
 - .2 Describe method for securing studs to tracks and for bolted framing connections.

- .3 Show temporary bracing required for erection purposes.
- .4 Indicate required bracing of the soffit framing as part of the supplier's scope of work. If a cold-formed metal bracing system cannot be provided, notify Contract Administrator immediately.
- .5 Design data:
 - .1 Shop Drawings signed and sealed by a professional structural engineer licensed in the location of the Project.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .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: In accordance with applicable codes., or as indicated on Drawings
 - .4 Live load deflection meeting the following, unless otherwise indicated:
 - .1 Exterior walls: Maximum horizontal deflection under wind load of 1/240 of span.
 - .2 Design non-axial loadbearing framing to accommodate not less than 25 mm vertical deflection.
 - .3 Soffits: Maximum vertical deflection under live load of 1/240 of span.

- .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 Stud depths are shown on the Drawings. Adjust stud material thicknesses and spacing, as required by the design criteria. Use greater or lesser stud depths only if approved by the Contract Administrator.
- .3 Soffit framing: Design steel framing system including size and spacing of members to suit soffit panels, and to accommodate dead loads, expansion, contraction, dynamic movements, and wind uplift, and other applicable forces required as by the Manitoba Building Code (latest edition).

2.3 FRAMING MATERIALS

- .1 Steel: Conforming to CSA S136; identified as to specification, type grade and mechanical properties.
- .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, G90/Z275 coating for framing components outside the exterior weather 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 G90/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 25 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 25 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; corrosion-resistant.
- .3 Threaded rod fasteners: Provide non-corrosive anchorage devices and fasteners of type, diameter and spacing for securing soffit framing to in-place construction in accordance with reviewed Shop Drawings.

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, bottom 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 concrete.
- .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 400 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.
 - .1 Two-piece telescoping top track: Nest top track into deflection channel 40 mm. Do not fasten tracks together. Stagger joints.
 - .2 Slotted top track: Install slotted top track and accessories including deflection clips, in accordance with Shop Drawings and manufacturer’s instructions.
- .11 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on Shop Drawings.
- .12 Attach cross studs to studs for attachment of fixtures anchored to walls.
- .13 Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- .14 Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- .15 Touch-up site welds and damaged galvanized surfaces with primer.

3.3 CUTOUTS

- .1 Maximum size of unreinforced cutouts for services as follows:

Member Depth (mm)	Perpendicular to Member Length (mm)	Parallel to Member Length (mm)	Centre-to-Centre Spacing (mm)
92	40 max.	114 max.	600 min.
102	40 max.	114 max.	600 min.
equal or greater than 152	64 max.	114 max.	600 min.

- .2 Limit distance from centreline of last unreinforced cutout to end of member to less than 300 mm.

3.4 INSTALLATION OF SOFFITS

- .1 Space framing and furring members as indicated on Shop Drawings.
 - .1 Level soffit system to a tolerance of 1/1200.
 - .2 Securely fasten framing to structural members. Space framing as required to limit deflection, and to support for expected soffit loads and layout.
 - .3 Securely fix carrying channels to furring to prevent turning or twisting and to transmit full load to framing.
 - .4 Place furring channels perpendicular to carrying channels, not more than 50 mm from perimeter walls, and rigidly secure. Lap splices securely.

.5 Install bracing as required to resist wind uplift.

3.5 TOLERANCES

- .1 Plumb: Not to exceed 1/500th of member length.
- .2 Spacing: Not more than plus or minus 3.0 mm from design spacing.
- .3 Gap between end of stud and track web: Not more than 3.2 mm.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by structural metal stud installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Shop fabricated steel items.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Placement of metal fabrications in concrete.
- .2 Section 03 41 00 - Precast Structural Concrete: Placement of metal fabrications in precast structural concrete.
- .3 Section 05 51 00 - Metal Stairs.
- .4 Section 05 75 00 - Decorative Formed Metal: Closures, trims, exposed bench arm rests and supports
- .5 Section 11 66 23 - Gymnasium Equipment: Badminton/pickleball posts and sleeve cover cap.

1.3 REFERENCE STANDARDS

- .1 ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- .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 A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- .5 ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reaffirmed 2021).
- .6 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel; 2013 (Reaffirmed 2018).
- .7 CSA W47.1 - Certification of Companies for Fusion Welding of Steel; 2019.
- .8 CSA W59 - Welded Steel Construction; 2018.
- .9 CWB 112E - Welding Symbols Study Guide; 2004.
- .10 SAFE Manitoba - Manitoba Workplace Safety and Health; current edition.
- .11 SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- .12 SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- .13 SSPC-SP 2 - Hand Tool Cleaning; 1982, with Editorial Revision (2004).
- .14 SSPC-SP 5 - White Metal Blast Cleaning; 2007.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate supports for benches and countertops with Section 06 40 00.
 - .2 Coordinate installation of anchorages for dance barre posts, floor sleeves for badminton/pickleball posts, and sump pit cover and frame. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or grouted in place. Deliver such items to Project site in time for installation.
 - .3 Coordinate floor sleeve depth with resilient athletic flooring specified in Section 09 65 66, and badminton/pickleball posts and cover cap specified in Section 11 66 23 to ensure cover cap is flush with finished flooring.

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 Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .4 Certificate: Provide documentation that ladder safety system products of this section meet or exceed requirements of the Occupational Health and Safety Act of the province in which the work will take place.
- .5 Welder qualifications: Submit evidence of CWB certification and welder qualifications indicating specific welding competencies associated with the type of work being performed by welders.
- .6 Designer's qualification statement.
- .7 Fabricator's qualification statement.

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 Steel sections: CSA G40.20/G40.21.
- .2 Steel tubing: ASTM A501/A501M hot-formed structural tubing.
- .3 Steel floor plate: ASTM A786/A786M, hot-rolled commercial grade; raised pattern.
- .4 Bolts, nuts, and washers: ASTM A307, Grade A, plain.
- .5 Welding materials: CSA W59; type required for materials being welded.
- .6 Shop and touch-up primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- .7 Touch-up primer for galvanized surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

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 continuous welds.
- .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; galvanized finish.
 - .1 Design to SAFE Manitoba and ANSI A14.3, and as indicated on Drawings.
- .2 Sump pit cover and frame:
 - .1 Cover: 6 mm thick steel floor plate with raised pattern. Provide cover in two pieces with recessed lift rings for each piece; complete with gasket.

- .2 Frame: Steel angle continuous around perimeter of pit. Mitre and weld frame corners. Provide with steel strap anchors welded to underside of angles for setting in concrete.
- .3 Finish: Galvanized.
- .3 Concealed bench supports: Steel; with attachments; prime paint finish.
- .4 Concealed architectural woodwork supports: Steel; with attachments; prime paint finish.
- .5 Dance barre supports: Steel; with welded fittings and attachments; powder coat finish.
 - .1 Welded fittings: Shop-welded from matching pipe or tube; joints and seams ground smooth.
 - .2 Dimensions: See Drawings for configurations and heights.
 - .3 Post sleeve: Fabricate sleeves from steel tube or pipe whose ID is sized for a close fit with posts to limit movement of post, complete with baseplate for fastening to hollow core slab.
 - .4 Dance barre saddle: To support wood rail, pre-drilled for fasteners
- .6 Floor sleeve for badminton/pickleball posts: Steel; machined to suit posts and drop-in cover cap, complete with plate for bolting to underside of existing structural floor slab.
- .7 Toilet partition support members: Steel channel sections; prime paint finish.
- .8 Steel plate head and jambs at openings: Steel plate; prime paint finish. Pre-drill for countersunk stainless steel fasteners.
- .9 Steel angle at sill (Pool Viewing 1:07): Steel angle; prime paint finish. Pre-drill for countersunk stainless steel fasteners.

2.4 FINISHES - STEEL

- .1 Prime paint steel items unless otherwise indicated.
 - .1 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-SP2.
 - .3 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
 - .4 Prime painting: One coat.
- .2 Galvanizing of non-structural items: Galvanize after fabrication to ASTM A123/A123M requirements.
- .3 Powder-coat finish: Prepare, treat, and coat non-galvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
 - .1 Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 5.
 - .2 Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.
 - .3 Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 0.04 mm.
 - .4 Colour and gloss: As selected by Contract Administrator from manufacturer's full ranges.

2.5 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 Isolate dissimilar materials with bituminous coating to prevent electrolytic corrosion.

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 Anchor metal fabrications securely to structure.
- .6 Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- .7 Obtain approval prior to site cutting or making adjustments not scheduled.
- .8 After erection, prime welds, abrasions, and surfaces not shop primed or shop finished , except surfaces to be in contact with concrete.

3.4 TOLERANCES

- .1 Maximum offset from true alignment: 6 mm.
- .2 Maximum out-of-position: 6 mm.

3.5 CLEANING

- .1 Remove protective film from exposed metal surfaces.

3.6 PROTECTION

- .1 Protect installed components and finishes from damage after installation.
- .2 Repair damage to exposed finishes to be indistinguishable from undamaged areas.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Placement of metal anchors in concrete.
- .2 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 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate installation of anchorages for guard rail posts. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, that are to be embedded in concrete or grouted in place. Deliver such items to Project site in time for installation.

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.
 - .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 Design data: As required by authorities having jurisdiction.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Welders' certificates: Comply with applicable CWB standards for classification of work being performed.
- .6 Designer's qualification statement.
- .7 Fabricator's qualification statement.

1.6 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 Fabricator qualifications: 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 AND RAILINGS - 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 stair assemblies: Provide stairs and railings of the design specified, complete with vertical and horizontal supports, railings, and guards, tied accurately for anchorage to each other and to building structure.
 - .1 Structural design: Provide complete stair and railing assemblies complying with the applicable local code.
 - .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: Galvanized steel bar grating.
 - .1 Grating type: Welded.
 - .2 Bearing bar depth: 19 mm, minimum.
 - .3 Top surface: Standard.
 - .4 Nosing: Checkered plate.

- .5 Nosing width: 32 mm, minimum.
- .6 Anchorage to stringers: End plates welded to grating, bolted to stringers.
- .4 Stringers: Rolled steel channels.
 - .1 Stringer depth: 250 mm.
 - .2 End closure: Sheet steel of same thickness as risers welded across ends.
 - .3 Stringer support rods: As indicated on Drawings.
- .5 Finish: Galvanized after fabrication.

2.3 HANDRAILS AND GUARDS

- .1 Wall-mounted rails in MPR Storage 1:06.1: Round steel pipe or tube rails, unless otherwise indicated.
 - .1 Outside diameter: As indicated.
 - .2 Handrail bracket, flanges and anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated, pre-drilled holes for exposed anchorage.
 - .3 Jointing: Welded and ground smooth and flush.
 - .4 Finish: Shop- or factory-prime painted.
- .2 Floor mounted guardrail in MPR Storage 1:06.1:
 - .1 Top rails: Round steel pipe or tube rails unless otherwise indicated.
 - .1 Outside diameter: As indicated.
 - .2 Intermediate rail: Round steel pipe or tube rails parallel to floor.
 - .1 Outside diameter: 25 mm.
 - .2 Height: As indicated.
 - .3 Provide 100 mm high toe board at bottom between vertical posts.
 - .3 End posts: Same material and size as top rails.
 - .4 End post sleeve: Fabricate sleeves from steel tube or pipe whose ID is sized for a close fit with posts to limit movement of post, complete with baseplate for fastening to hollow core slab.
 - .5 Jointing: Welded and ground smooth and flush.
 - .6 Finish: Shop- or factory-prime painted.
- .3 Stair guards and handrail in Crawlspace 1:118:
 - .1 Handrail: Round steel pipe or tube rails, unless otherwise indicated.
 - .1 Outside diameter: As indicated on Drawings.
 - .2 Mounting: On vertical stair stringer support rods; provide handrail continuously graspable.
 - .2 Guard: Formed by vertical rods supporting stair stringer.
 - .1 Top mounting: Fastened to underside of hollow core floor structure.
 - .2 Bottom mounting: Welded to top surface of stringer.
 - .3 Jointing: Welded and ground smooth and flush.
 - .4 Finish: Galvanized after fabrication.

2.4 MATERIALS

- .1 Steel sections, and plate: CSA G40.20/G40.21.

- .2 Steel tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- .3 Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- .4 Gratings: Bar gratings complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

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 limitations of authorities having jurisdiction.
- .4 Touch-up primer for galvanized surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.6 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.

2.7 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.
 - .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 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, and struts 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 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 Attach wall-mounted railings to wall with wall brackets. Provide brackets with 45 to 60 mm clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - .1 For steel-framed partitions, use hanger or lag bolts set into plywood backing between studs. Coordinate with stud installation to locate backing members.
- .8 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 Interior fabrications made of formed metal sheet, secondary supports, and anchors to structure, including:
 - .1 Closures, trim, and filler panels.
 - .2 Coiling counter door opening trim.
- .2 Interior fabrications made of formed metal bars, secondary supports, and anchors to structure, including:
 - .1 Support brackets with arm rests for X Lobby benches.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Nondecorative metal fabrications.
- .2 Section 06 40 00 - Architectural Woodwork: Wood dance barre, wood bench seats.
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim: Formed metal flashings and trim.

1.3 REFERENCE STANDARDS

- .1 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- .2 ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.
- .3 ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.
- .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 ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- .6 AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017.
- .7 CSA W59 - Welded Steel Construction; 2018.
- .8 NAAMM AMP 500-06 - Metal Finishes Manual; 2006.
- .9 SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- .10 SSPC-SP 5 - White Metal Blast Cleaning; 2007.

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 Indicate location of exposed fasteners, if any.
- .3 Verification samples: For each finish product specified, minimum size 150 mm square or 150 mm long, representing actual product in colour and texture; and one full size sample of each type of bench support bracket with arm rest.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .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.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Protect finishes during transportation and storage.
- .2 Provide markings to identify components consistently with Drawings.
- .3 Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- .4 Store products indoors protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - .1 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: Weld 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.
 - .2 Welded joints:
 - .1 Carbon steel: Perform welding in accordance with CSA W59.
 - .2 Stainless steel: Perform welding in accordance with AWS D1.6/D1.6M.
- .8 Performance requirements:
 - .1 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 Closures, trim and fill panels:
 - .1 Form closures, trim and fill panels from type and thickness of metal indicated.
 - .1 Interior closures, trim and fill panels associated with curtain wall: Aluminum, black anodized.
 - .2 Elsewhere: Formed steel; powder-coat finish.
 - .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 corners. Form tight joints.

2.3 FORMED METAL FABRICATIONS - BAR STOCK

- .1 X Lobby bench support bracket and arm rests:
 - .1 Material: Stainless steel bar; ASTM A276/A276M, Type 304; size indicated.
 - .2 Welded joints.
 - .3 Bend to radius indicated at front and back ends of arm rest.
 - .4 Stainless steel finish: Manufacturer's standard No.4 brushed mechanical finish.
 - .5 Fasteners: Stainless steel.
 - .6 Provide anchors and other components as required to attach to structure, made of same materials as bench support brackets unless otherwise indicated.

2.4 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: ASTM B209M, 5005-H32 minimum; alloy and temper recommended by aluminum producer and finisher for use and finish indicated.
 - .1 Thickness: Minimum 1.0 mm.
- .3 Steel sheet: ASTM A1008/A1008M uncoated, cold rolled, Type CS (commercial steel), exposed or ASTM A879/A879M electrolytic zinc coating over ASTM A1008/A1008M steel sheet substrate.
 - .1 Thickness: Minimum 1.5 mm.
- .4 Stainless steel plate or bar: ASTM A276/A276M.
- .5 Fasteners, general: Same basic metal and alloy as formed metal sheet unless indicated otherwise. Do not use metals incompatible with the materials joined.
- .6 Laminating adhesive: Recommended by metal fabricator; fully bond metal to metal, prevent telegraphing and oil canning; compatible with substrate; non-combustible after curing.
- .7 Isolation coating: Manufacturer's standard alkali-resistant coating.

2.5 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 Class I Colour Anodized Finish: AAMA 611 AA-M12C22A42 Integrally coloured anodic coating not less than 0.018 mm thick, black to match curtain wall framing.
- .3 Steel finishes:
 - .1 Surface preparation: Comply with SSPC-SP 1; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust from uncoated steel; comply with SSPC-SP 5.
 - .2 Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.
 - .3 Factory prime: Apply shop primer to prepared surfaces of items where site painting after installation indicated, unless indicated otherwise..
 - .4 Powder-coat finish: Manufacturer's standard thermosetting polyester or acrylic urethane powder coating; minimum cured-film thickness of 0.038 mm.
- .4 Stainless steel finishes:
 - .1 Surface preparation: Remove tool and die marks and stretch lines, or blend into finish.

- .2 Polished finishes: Comply with NAAMM AMP 500-06; grind and polish surfaces to uniform finish free of cross scratches. Run grain of directional finishes with long dimension of each item.
 - .1 Directional satin: No. 4.
- .3 When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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

- .1 Locate and place decorative formed 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 Anchor bench supports securely to structure.
- .5 Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers indicated.
- .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 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.

3.5 PROTECTION

- .1 Protect installed products from damage during construction.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Roofing nailers.
- .2 Preservative treated wood materials.
- .3 Fire retardant treated wood materials.
- .4 Miscellaneous framing and sheathing.
- .5 Communications and electrical room mounting boards.
- .6 Concealed wood blocking, nailers, and supports.
- .7 Miscellaneous wood nailers, furring, and grounds.

1.2 REFERENCE STANDARDS

- .1 ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- .2 CAN/CSA O80 Series - Wood Preservation; 2015.
- .3 CAN/CSA O121 - Douglas Fir Plywood; 2017 (Reaffirmed 2022).
- .4 CAN/CSA O141 - Softwood Lumber; 2005 (Reaffirmed 2019).
- .5 CAN/CSA O151 - Canadian Softwood Plywood; 2017 (Reaffirmed 2022).
- .6 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies; 2018.
- .7 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- .8 CSA O325 - Construction Sheathing (Adopted NIST PS 2-18 , with Canadian Deviations); 2021.
- .9 NLGA (SGRNL) - Standard Grading Rules for Canadian Lumber; 2017.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide technical data on wood preservative materials, application instructions, and fire-retardant materials.
- .3 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

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

- .2 Fire retardant treated wood: Prevent exposure to precipitation during shipping, storage, or installation.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all composite wood, by cost or surface area, shall have low-formaldehyde emissions that meet the Composite Wood Products Regulations CARB (ATCM) for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or contain no added formaldehyde resins. Composite wood and agrifibre products include:
 - .1 Particleboard
 - .2 Medium Density Fiberboard (MDF)
 - .3 Plywood
 - .4 Wheatboard
 - .5 Strawboard
 - .6 Panel substrates
 - .7 Door cores

2.2 GENERAL REQUIREMENTS

- .1 Dimension lumber: Comply with CAN/CSA O141 and requirements of specified grading agencies.
 - .1 Species: Spruce-Pine-Fir, unless otherwise indicated.
 - .2 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.

2.3 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 Miscellaneous framing, blocking, nailers, grounds, and furring:
 - .1 Lumber: S4S, No. 2 or Standard Grade.
 - .2 Boards: Standard or No. 3.

2.4 CONSTRUCTION PANELS

- .1 Wall sheathing: Meeting requirements of CSA O325.
 - .1 Material: Canadian Softwood CAN/CSA O151
 - .2 Bond Classification: Exterior.
 - .3 Grade: SHG.
 - .4 End use mark: W
 - .5 Edges: Square edged.

- .6 Flame spread: Maximum FS25 in accordance with CAN/ULC S102 clearly labelled on face of sheathing panel.
- .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.
- .3 Other applications:
 - .1 Plywood concealed from view, located within exterior enclosure: Douglas Fir Plywood, CAN/CSA O121, Grade SHG, Exterior.

2.5 ACCESSORIES

- .1 Fasteners and anchors:
 - .1 Metal and finish: Hot-dipped galvanized steel complying with ASTM A153/A153M.

2.6 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 Fire-retardant treated wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - .2 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 Fire retardant treatment:
 - .1 Interior type: CAN/CSA O80 Series, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with CAN/ULC S102, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - .1 Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - .2 Interior rough carpentry items are to be fire retardant treated.
- .3 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 Treat lumber exposed to weather.
 - .2 Treat lumber in contact with roofing, flashing, or waterproofing.
 - .3 Treat lumber in contact with masonry or concrete.
 - .4 Treat lumber less than 450 mm above grade.
 - .5 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.

Part 3 Execution

3.1 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.

3.2 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 framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- .3 In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- .4 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.
- .5 Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- .6 Provide non-structural framing and blocking for the following:
 - .1 Cabinets and shelf supports.
 - .2 Wall brackets.
 - .3 Handrails.
 - .4 Grab bars.
 - .5 Towel and bath accessories.
 - .6 Wall-mounted door stops.
 - .7 Visual display boards.
 - .8 Wall paneling and trim.
 - .9 Joints of rigid wall coverings that occur between studs.

3.3 ROOF-RELATED CARPENTRY

- .1 Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

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 centre 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.

3.6 CLEANING

- .1 Waste disposal: Comply with the requirements of Section 01 74 19 - Construction and Demolition Waste Management.
 - .1 Comply with applicable regulations.
 - .2 Do not burn scrap on project site.
 - .3 Do not burn scraps that have been pressure treated.
 - .4 Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- .2 Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- .3 Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Specially fabricated cabinet units.
- .2 Plastic laminate clad wall panels.
- .3 Countertops.
- .4 Cabinet hardware.
- .5 Wood benches.
- .6 Solid surfacing window sills, wall panels, and wall base.
- .7 Wood dance barre.
- .8 Upholstered bench seat.
- .9 Shop finishing.
- .10 Modification to existing architectural woodwork/solid surfacing to accommodate renovation work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 64 00 - City-Furnished Products: Appliances.
- .2 Section 05 50 00 - Metal Fabrications: Support framing for dance barre, countertops, vanities, and benches.

1.3 REFERENCE STANDARDS

- .1 ANSI A208.1 - American National Standard for Particleboard; 2016.
- .2 ANSI/BHMA A156.11 - Cabinet Locks; 2019.
- .3 ASTM D3453 - Standard Specification for Flexible Cellular Materials-Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications; 2020.
- .4 ASTM D3574 - Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams; 2017.
- .5 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.
- .6 AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, Canada Version 4.0; 2021.
- .7 BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- .8 BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems; 2013.
- .9 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.

- .10 CAN/CSA O121 - Douglas Fir Plywood; 2017 (Reaffirmed 2022).
- .11 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies; 2018.
- .12 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- .13 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .14 ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- .15 ISO 4586 - High-pressure decorative laminates (HPL, HPDL); 2018.
- .16 NFPA 260 - Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture; 2024.
- .17 SCS (CPD) - SCS Certified Products; Current Edition.
- .18 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate work to permit installation of adjacent affected plumbing and electrical rough-ins, and City-furnished appliances.
 - .2 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.
 - .3 Coordinate countertops, benches and vanities with brackets specified in Section 05 50 00.
 - .4 Coordinate toe base finishes with Section 09 65 00. Provide toe base substrate suitable for rubber base or integral cove base where indicated.
- .2 Sequencing:
 - .1 Install solid-surfacing wall panel and wall base after walls have been primed and painted, and paint has been allowed to cure.

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 sample prior to fabrication as follows; accepted samples will form the standard of acceptance for the remainder of the work.

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- .1 Lumber with transparent finish: 150 mm by 300 mm long for each species and cut, finished on one side and one edge.
 - .2 High pressure decorative laminate (HPL) clad panel products: Laid-up on specified core material, 300 mm by 300 mm for each type, colour, pattern, and surface finish, with specified edge banding on two adjacent edges. Identify high wear HPL on samples.
 - .3 Thermally fused laminate (TFL) panel products: Laid-up on specified core material, 300 mm by 300 mm for each type, colour, pattern, and surface finish, with specified edge banding on two adjacent edges.
 - .4 Solid surfacing materials: 150 mm square for each type, colour, pattern, edge treatment, and surface finish.
 - .5 Upholstery materials: 300 by 300 mm square size sample of foam, batting, and each type, colour, and pattern of fabric, illustrating specified seam in centre of fabric sample.
 - .6 Exposed cabinet fasteners, hardware and accessories: One unit for each type.
 - .4 Product data: Provide data for hardware accessories.
 - .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
 - .6 Fabricator qualification statement.
 - .7 Warranty documentation.

1.6 QUALITY ASSURANCE

- .1 Regulatory requirements: Provide materials that have fire test response characteristics acceptable to the Authority Having Jurisdiction and as follows:
 - .1 Provide materials and products with specified fire test response characteristics where fire retardant materials or products are indicated.
 - .2 Confirm fire test response characteristics as determined by testing for identical products and test methods indicated by CSA, ULC, ITS, or another testing and inspecting agency acceptable to Authority Having Jurisdiction.
 - .3 Identify casework materials with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- .2 Perform work of this Section to specified standards for quality of workmanship, materials, installation and execution of the design intent in accordance with NAAWS.
 - .1 Notify Contract Administrator of conflicts between NAAWS and this Section.
- .3 Fabricator and installer qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience in similar types of projects and adequate facilities and personnel required to perform on this project.
 - .1 Fabricator to perform installation. Any installer other than fabricator is prohibited, unless pre-approved by the City and Contract Administrator.

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 architectural woodwork items are 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.

1.9 WARRANTY

- .1 Provide an extended warranty for Work of this Section for a period of three years from date of Substantial Performance of the Work. Contractor hereby warrants that architectural woodwork will not warp, twist, show core lines, split, delaminate, sag, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the City and Contract Administrator, and at no expense to the City.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all composite wood, by cost or surface area, shall have low-formaldehyde emissions that meet the Composite Wood Products Regulations CARB (ATCM) for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or contain no added formaldehyde resins. Composite wood and agrifibre products include:
 - .1 Particleboard
 - .2 Medium density fibreboard (MDF)
 - .3 Plywood
 - .4 Wheatboard
 - .5 Strawboard
 - .6 Panel substrates
 - .7 Door cores

- .2 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the CAL (CDPH SM) or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)

2.2 CABINETS

- .1 Quality standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.
- .2 Cabinets:
 - .1 Finish - Exposed exterior surfaces: Decorative laminate (HPL), except solid surfacing material (SSM) on SJ55+ Reception and Concierge Desk where indicated.
 - .2 Finish - Exposed interior surfaces: Decorative laminate (HPL).
 - .3 Finish - Semi-exposed surfaces: Thermally fused laminate (TFL)
 - .4 Finish - Concealed surfaces: Manufacturer's option.
 - .5 Door and drawer front edge profiles: Square edge with thin applied band.
 - .6 Casework construction type: Type A - Frameless.
 - .7 Interface style for cabinet and door: Style 1 - Overlay; flush overlay.
 - .8 Shelf thickness: 25 mm.
 - .9 Cabinet style: Flush overlay.
 - .10 Cabinet doors and drawer fronts: Flush style.

2.3 WOOD-BASED COMPONENTS

- .1 Wood fabricated from old growth timber is not permitted.

2.4 LUMBER MATERIALS

- .1 Hardwood lumber: White Maple species, plain sawn, moisture content of 4 to 9 percent, Premium grade, no mineral streaks or black flecks permitted, consistent grain and colour suitable for clear finish.

2.5 SHEET MATERIALS

- .1 Particleboard: ANSI A208.1, Grade M-2; no-added formaldehyde (NAF) and ultra-low emitting formaldehyde (ULEF), and complying with CARB (ATCM) Phase 2, and certified as a flame retardant panel in accordance with CAN/ULC S102 with a flame-spread rating

(FSR) of 25 or less and smoke developed classification (SDC) of 50 or less where indicated.

- .2 Plywood: Douglas Fir Plywood, CAN/CSA O121, Grade G1S, Exterior.
- .3 Acrylic sheet: Cell-cast, clear with minimum 92 percent transparency, 3 mm thick.

2.6 LAMINATE MATERIALS

- .1 Thermally fused laminate (TFL): Melamine resin, Type VGL laminate panels to ISO 4586.
- .2 High pressure decorative laminate (HPL): to ISO 4586.
 - .1 Vertical surfaces: VGS, 0.71 mm nominal thickness, colours as indicated, finish as indicated.
 - .2 Horizontal surfaces: HGS, 1.2 mm nominal thickness, colours as indicated, finish as indicated.
 - .3 Basis-of-Design Products:
 - .1 PL1 - Woodgrain: Wilsonart Kensington Maple 10776-60.
 - .2 PL2 - Solid colour: Wilsonart Midnight D505. Provide high wear type plastic laminate for all PL2 surfaces.
 - .3 For plastic laminate clad wall panels (PLP): PL1 - Woodgrain.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.7 SOLID SURFACING MATERIALS - SSM#

- .1 Solid surfacing for countertops, window sills and wall base: Solid surfacing sheet and plastic resin castings complying with ISFA 2-01; acrylic or polyester 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 Flat sheet thickness: 12 mm, minimum, unless otherwise indicated.
 - .2 Finish on exposed surfaces: Semi-gloss, gloss rating of 25 to 50.
 - .3 Basis-of-Design Products:
 - .1 SSM-1: Corian; colour and pattern Jasmine White, based on Group 3 colour as selected by Contract Administrator.
 - .2 SSM-2: Corian; colour and pattern Willow, based on Group 3 as selected by Contract Administrator.
 - .3 SSM-3: Corian; colour and pattern Deep Titanium, based on Group 3 as selected by Contract Administrator.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Solid surfacing wall panels (backsplash at hand dryers): As specified for solid surfacing for countertops, except as follows:
 - .1 Flat sheet thickness: 6 mm, minimum.
 - .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 Basis-of-Design Products:
 - .1 SSM-4: Corian; colour and pattern Glacier White, based on Group 1 as selected by Contract Administrator.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.8 COUNTERTOPS

- .1 Solid surfacing countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - .1 Exposed edge treatment: Built up to thickness indicated; eased edges.
 - .2 Back and end splashes: Same sheet material, square top; minimum 100 mm high. Align top of backsplash at CWAD stations with top of backsplash elsewhere.
 - .3 Fabricate in accordance with manufacturer's standard requirements.
- .2 Supporting substrates:
 - .1 Vanities: Douglas Fir Plywood; minimum 19 mm thick; join lengths using metal splines.
 - .2 Countertops/work surfaces without sinks: Particleboard ANSI A208.1; minimum 19 mm thick; join lengths using metal splines.

2.9 WINDOW SILLS

- .1 Solid surfacing window sills: Solid surfacing sheet SSM-3.
 - .1 Exposed edge treatment: Drop edge build up with eased edge.

2.10 WALL BASE

- .1 Solid surfacing wall base: Solid surfacing sheet SSM-3.
 - .1 Exposed edge treatment: 3 mm radius at top edge.
 - .2 Fabricate in maximum size equal length pieces. Minimize joints.
 - .3 Seams: Hard seamed joint adhesive.

2.11 ACCESSORIES

- .1 Adhesive: Chemical-resistant and waterproof type recommended by AWMAC/WI (NAAWS) to suit application.
- .2 Adhesive sealant: Chemical-resistant and waterproof type recommended by solid surfacing manufacturer for joining solid surfacing materials, or for mounting countertops, window sills, wall base, and wall panels to suit application.
- .3 Joint adhesive:
- .4 Plastic edge banding: Extruded PVC, flat shaped; smooth finish; hot-glue application; 1 mm thick by width to match component thickness.
 - .1 Basis-of-Design Product:
 - .1 Teknaform.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding*

Procedures.

- .2 Colour: As selected by Contract Administrator from manufacturer's full range, and as follows:
 - .1 At cabinet doors, drawer, and decorative wall mounted panels: Black.
 - .2 At box panels with PL1 finish: Wood grain to match PL1.
 - .3 At box panels and door panels with PL2 finish: Solid to match PL2.
- .3 Use at edges of HPL-clad panels, and TFL panels.
- .4 Use at all four edges of adjustable shelves.
- .5 Fasteners: Size and type to suit application.
- .6 Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- .7 Concealed joint fasteners: Threaded steel.
- .8 Grommets: Standard painted metal grommets for cut-outs, in colour as selected by Contract Administrator.
- .9 Cable management system: Large J-shape underdesk wiremold cable manager with flange.
 - .1 Basis-of-Design Product:
 - .1 Doug Mockett; WM22A.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .10 Hanger rod: 30 mm dia. heavy duty stainless steel, 2.2 mm wall thickness, complete with end flanges.

2.12 UPHOLSTERED BENCH MATERIALS

- .1 Fabric:
 - .1 Composition: 100 percent vinyl.
 - .2 Backing: Knit, polyester.
 - .3 Weight: 946 g per linear metre.
 - .4 Finish: BeautyGard Supreme.
 - .5 Width: 1370 mm.
 - .6 Repeat: 476 mm vertical, and 457 mm horizontal.
 - .7 Flammability: In accordance with NFPA 260.
 - .8 Basis-of-Design Product:
 - .1 DesignTex Catalyst 3352, colour to be selected from manufacturer's entire selection.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Batting: 100 percent polyester Dacron wrap.
- .3 Foam: Polyurethane to ASTM D3453 and ASTM D3574, fire-retardant, non-hardening, non-oxidizing, and with high resistance to moisture, mildew, and tearing. Indentation

load deflection not to exceed 25% for 50 mm thickness under load of 172.5 kPa.

2.13 HARDWARE

- .1 Adjustable shelf supports: Standard side-mounted system using multiple holes for anti-tip L-shape pin supports with integrated shelf rests, nickel plate finish, for nominal spacing indicated.
 - .1 Basis-of-Design Products:
 - .1 Richelieu; 5834-180.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Fixed island countertop support brackets:
 - .1 Material: Steel.
 - .2 Manufacturer's standard, factory-applied, textured powder coat.
 - .3 Colour: Black.
 - .4 Basis-of-Design Products:
 - .1 Centerline Brackets; Forward L Granite Countertop Support Bracket.
 - .2 The Original Granite; Industrial L Countertop Support Bracket.
 - .3 Kolossus; Hidden Counter Bracket.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Fixed specialty vanity brackets:
 - .1 Material: Steel.
 - .2 Manufacturer's standard, factory-applied, textured powder coat.
 - .3 Basis-of-Design Products:
 - .1 Centerline Brackets; Floating Wall Mount.
 - .2 The Original Granite; Free Floating Vanity Brackets.
 - .3 Kolossus; Floating Countertop Brackets.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Drawer and door pulls: to BHMA A156.9. Wire D-pull, brushed/matt nickel with antimicrobial finish; 96 mm centres. Provide bolts of sufficient length to pass through total thickness of drawer front and sub-front.
 - .1 Basis-of-Design Products:
 - .1 Richelieu, 93896195AB.
 - .2 Häfele, 116.07.664.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .5 Drawer pull at Members' Lounge bench drawers: Metal edge pull; 436 mm long; colour black.
 - .1 Basis-of-Design Products:
 - .1 Richelieu; Modern Aluminum Edge Pull – 9898, black.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .6 Cabinet locks: to ANSI/BHMA A156.11, keying to BHMA A156.28.
 - .1 Typical lock: Matte nickel finish, flush mounted, with appropriate strike plate and opposite door elbow catches.
 - .1 Basis-of-Design Product:
 - .1 Häfele Modular Removable Core Locking System – SYMO 3000 Deadbolt Locks 232.25.6XX c/w angle strike 239.61.39, elbow catch 245.74.200 and cylinder rosette 219.19.676.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Locking core: Matte nickel finish, keyed differently or alike in accordance with keying schedule.
 - .1 Basis-of-Design Product:
 - .1 Häfele STW Pin-Tumbler Cylinder Removable Core 210.45.6XX.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .7 Catches: Mechanical elbow type; steel, bright zinc finish. Where pairs of solid doors are indicated for locking, provide lock on one door and mechanical catch on other door.
 - .8 Drawer slides: to BHMA A156.9.
 - .1 Pencil and small box drawer (up to 140 mm high, maximum 406 mm wide) slides: Medium-duty, 100 lb. load capacity.
 - .1 Side-mounted, full-extension, steel ball bearing, finish to be selected by Contract Administrator.
 - .2 Basis-of-Design Product:
 - .1 Accuride 3832E – Light-Duty & Full Extension Slide with Lever-Disconnect (no over travel – only full extension).
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Standard box drawer (141 to 260 mm high, maximum 610 mm wide) slides: Medium-duty, 100 lb. load capacity.
 - .1 Side-mounted, full-extension, steel ball bearing, finish to be selected by Contract Administrator.
 - .2 Basis-of-Design Product:
 - .1 Accuride 7434 – Light-Duty Over-Travel Slice with Rail-Mounting and Progressive Movement.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Large box and file drawer (over 260 mm high, maximum 610 mm wide) slides: Heavy-duty, 150 lb. load capacity.

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- .1 Side-mounted, full-extension, two-tier drawer slides, steel ball bearing with overtravel, finish to be selected by Contract Administrator.
 - .2 Basis-of-Design Product:
 - .1 Accuride 4034 – Medium-Duty & Over-Travel Slide with Progressive Movement.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Extra large box and file drawer (over 260 mm high, maximum 1066 mm wide) slides: Heavy-duty, 180 lb. load capacity.
 - .1 Side-mounted, full-extension, ball bearing with over-travel, gang locking system, finish to be selected by Contract Administrator.
 - .2 Basis-of-Design Product:
 - .1 Accuride 3641 – Heavy-Duty Interlock Slide.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .9 Hinges: to BHMA A156.9. Semi-concealed (European) institutional type, self-closing hinge with 3-dimensional adjustment, attached with height adjustable mounting plate, nickel finish, 180 degree opening angle. Provide hinge limiters for cabinet doors that are adjacent to a perpendicular wall or millwork. Finish selected by Contract Administrator. Provide four hinges per door 1220 mm and taller.
 - .1 Basis-of-Design Products:
 - .1 Hettich Selekt Pro 2000.
 - .2 Häfele Aximat, 344.06.XXX.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .10 Door and drawer bumpers: 7 mm diameter (nominal) install in pairs, clear.
 - .1 Basis-of-Design Products:
 - .1 3M model SJ5302.
 - .2 Bumper Specialties BS-27.
 - .3 Knape & Vogt 2680 CL.
 - .4 Mepla-Alfit 630.000.03.07.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.14 FINISHING MATERIALS

- .1 Finishing materials: In compliance with AWMAC/WI (NAAWS), unless noted otherwise.

2.15 FABRICATION - GENERAL

- .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. Slightly bevel arises.
 - .1 Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - .2 Cap exposed plastic laminate finish edges with plastic trim.
- .5 Provide removable access panels in millwork for servicing, installation or maintenance of mechanical and electrical services concealed behind cabinets, such as valves, traps, and junction boxes.
- .6 Provide cutouts for plumbing fixtures, inserts, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

2.16 FABRICATION - COUNTERS/VANITIES

- .1 Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
- .2 Solid surfacing: Fabricate tops up to 3650 mm long in one piece; join pieces with joint adhesive in accordance with manufacturer's recommendations and instructions.
 - .1 Fabricate to overhang fronts and ends of cabinets 25 mm except where top butts against cabinet or wall.
 - .2 Prepare cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- .3 Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - .1 Secure to countertop with contact surfaces set in waterproof adhesive.
 - .2 Height: 100 mm, unless otherwise indicated.
- .4 Wall-mounted counters/vanities: Provide skirts, aprons, brackets, and braces as indicated on Drawings, finished to match.

2.17 FABRICATION - PLASTIC LAMINATE CLAD WALL PANELS - PLP

- .1 Fabricate plastic laminate clad wall panels to sizes indicated; balanced construction.
 - .1 Core: 19 mm thick fire-retardant treated particleboard, single piece per panel.
 - .2 Face: HPL, Grade VGS.
 - .3 Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - .4 Cap exposed plastic laminate finish edges with black plastic trim.
- .2 Mounting method: Two-part aluminum Z-clips, minimizing projection from wall surface; size and length to suit weight of panel; mechanically fastened to back of panel, and mechanically fastened to partition studs, or blocking within partition.

2.18 FABRICATION - UPHOLSTERED BENCHES

- .1 Fabricate benches to details indicated.
- .2 Back pitch and seat depth: As indicated.
- .3 Cushions:
 - .1 Fabricate bench cushion in five equal size sections.
 - .2 Wrap foam with bonded Dacron pad.
 - .3 Cushion edges: Boxed, with no piping or welts. No knife edge or butterfly corners. Side edges to be seamless. Seam only acceptable in the back.
 - .4 Provide two full width strips of hook and loop fasteners (Velcro) on bottom of each cushion, and high-quality matching zipper to allow for removal of cushion cover for cleaning.
 - .5 Provide concealed air vents on underside of seat cushions.

2.19 FABRICATION - WOOD BENCHES

- .1 Shop-assemble and finish benches for delivery to site.
- .2 Bench seats: Provide Custom quality hardwood; Maple, plain sawn; exposed edge grain; seats laminated with waterproof adhesives; single length per board (no joints); size as indicated; suitable for transparent finish.
 - .1 Provide 3 mm radius on front edge of seats.
- .3 Bench back: Provide Custom quality hardwood; Maple, quartersawn; single length per plank (no joints); size as indicated; suitable for transparent finish.
 - .1 Provide 3 mm radius on top front edge of back.
- .4 Lobby Bench:
 - .1 Fasten bench seats to stainless steel support brackets from underside using stainless steel lag screws, as indicated on Drawings. Fasten stainless steel support bracket/arm rest to floor with stainless steel expansion anchors, head type as selected by Contract Administrator.
 - .2 Fasten planks forming seat back with two rows of countersunk fasteners per plank. Align fasteners vertically and horizontally. Cap with matching wood plugs sanded smooth.
- .5 Lobby-2 Bench: Fasten laminated bench seats to plywood substrate from underside using stainless steel fasteners. Fasten plywood substrate to steel angle supports.
- .6 Finish: Shop-finished, transparent varnish.

2.20 FABRICATION - WOOD DANCE BARRE

- .1 Dance barre: 50 mm diameter, solid clear Maple; sanded smooth; flat cut ends; transparent finish.
 - .1 Minimize joints in dance barre. Join straight sections using purpose-made concealed railing connectors; plug boreholes on underside of barre with matching wood plugs sanded smooth.
 - .2 Where barre saddles are not continuous, make railing joints only at vertical support post locations.

2.21 SHOP FINISHING

- .1 Sand work smooth and set exposed nails.
- .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 - 5, Varnish, Conversion.
 - .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 Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

- .1 Clean bonding surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - CABINETS

- .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 Secure counter bases to floor using appropriate angles and anchorages.
- .7 Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.4 INSTALLATION - COUNTERTOPS

- .1 Securely attach countertops to cabinets using concealed fastening methods. Make flat surfaces level; shim where required.

- .2 Attach plastic laminate countertops using screws with minimum penetration into substrate board of 16 mm.
- .3 Attach solid surfacing countertops without continuous substrate using compatible adhesive.
- .4 Attach solid surfacing countertops fabricated with continuous substrate using screws with minimum penetration into substrate board of 16 mm.
- .5 Seal joint between countertop and vertical surfaces.
- .6 Seal joint between back/end splashes and vertical surfaces.
- .7 Tolerances:
 - .1 Variation from horizontal: 3 mm in 3 m, maximum.
 - .2 Offset from wall, countertops: 3 mm maximum; 1.5 mm minimum.

3.5 INSTALLATION - PLASTIC LAMINATE CLAD WALL PANELS AND BROCHURE HOLDER

- .1 Install panels in accordance with AWMAC/WI (NAAWS), using Z-clip hanging system.

3.6 INSTALLATION - SOLID SURFACING WALL PANELS AND WALL BASE

- .1 Verify that substrate surfaces for adhered items are clean and smooth.
 - .1 Test painted surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations or application conditions where adhesion test's results are unsatisfactory.
- .2 Clean bonding surfaces and back of solid surfacing of bond-inhibiting before installation
- .3 Wall panels - SSM-4:
 - .1 Install wall panels at hand dryers in single piece section per location using manufacturer's recommended silicone adhesive applied in accordance with manufacturer's silicone adhesive bonding guidelines.
 - .2 Seal joint between wall panel and wall substrate with silicone sealant.
- .4 Wall base - SSM-3:
 - .1 Acclimate wall base materials minimum 48 hours in area of installation before installing.
 - .2 Install wall base where indicated using manufacturer's recommended silicone adhesive applied in accordance with manufacturer's silicone adhesive bonding guidelines.
 - .3 Hard-seam butt joints between wall base lengths with manufacturer's recommended joint adhesive, in accordance with manufacturer's instructions for length limitations.
 - .4 Seal joint between wall base and wall substrate with silicone sealant.

3.7 INSTALLATION - WINDOW SILLS

- .1 Adhere solid surfacing in place using full bed of compatible adhesive in accordance with manufacturer's instructions.

- .2 Allow for 1.3 mm of movement per metre of sill length for expansion and contraction at each end of sill.
- .3 Seal joint between solid surfacing window sill and vertical surfaces with silicone sealant.

3.8 INSTALLATION - BENCHES

- .1 Install benches as indicated on Drawings, and reviewed Shop Drawings.

3.9 INSTALLATION - DANCE BARRE

- .1 Fasten dance barre to post-mounted saddles using countersunk fasteners.

3.10 ADJUSTING

- .1 Adjust installed work.
- .2 Adjust moving or operating parts to function smoothly and correctly.

3.11 CLEANING

- .1 Clean interior and exterior of casework, counters, shelves, hardware, fittings, and fixtures, window sills, wall paneling, benches and other architectural woodwork components.

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 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 21 00 - Thermal Insulation: Insulation installed within cladding support system
- .3 Section 07 42 13 - Metal Wall Panels
- .4 Section 07 42 33 - Solid Phenolic 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
- .2 CAN/ULC S134 Standard Method of Fire Test of Exterior Wall Assemblies, 2013
- .3 MBC - Manitoba Building Code; MBC - M.R. 78/2023; 2024

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meetings: Schedule pre-installation meeting with Contractor, installer, manufacturer, Contract Administrator, and necessary parties to review and discuss project conditions. Conduct pre-installation meeting minimum one week before starting cladding work and on-site installations to:
 - .1 Verify project requirements, and substrate conditions.
 - .2 Co-ordinate products, installation methods and techniques.
 - .3 Sequence work of related sections, including but not limited to structural-support framing, weather barriers, exterior cladding, curtain wall systems.
 - .4 Co-ordinate 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 special cladding details, wall penetrations, openings, and condition of other construction that will affect installation.
- .2 Coordination:
 - .1 Coordinate with work of other Sections making up the exterior building envelope, including solid phenolic 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 metal wall panels specified in Section 07 42 13, phenolic wall panels specified in 07 42 33, and standing seam metal wall panels 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 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Test reports.
- .8 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:
 - .1 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.
 - .2 Test reports indicating compliance with wall assembly testing in accordance with CAN/ULC S134.

1.7 MOCK-UP

- .1 Mock-up: Refer to Section 07 42 33.

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 MBC - Manitoba Building Code and applicable local regulations, to maximum allowable deflection of L/240.
 - .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.
 - .1 Temperature change (Range): 85 deg C, ambient; 100 deg C, material surfaces.
- .3 Provide cladding support system using materials meeting requirements of MBC - Manitoba Building Code when used in non-combustible construction and meeting requirements of wall assembly testing in accordance with CAN/ULC S134.
- .4 Cladding accommodation: Design cladding support system configuration, size, spacing, fastening details, and make adjustments as needed to accommodate support for each cladding type, including:
 - .1 Metal wall panels.
 - .2 Solid phenolic wall panels.
 - .3 Standing seam metal wall panels.
- .5 Tolerances:
 - .1 Accommodate deflection of structural members.
 - .2 Maintain clearances at adjacent construction.
 - .3 Prevent load transfer to non-structural elements.
- .6 Accommodate substructure tolerance of +/- 9.5 mm.
- .7 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.
- .8 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 MANUFACTURERS

- .1 Basis-of-Design Product:
 - .1 Cascadia Windows; Cascadia Clip.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 MATERIALS

- .1 Field-installed thermal insulation: Semi-rigid mineral wool, specified in Section 07 21 00.
- .2 Thermally broken clip: Pultruded fibreglass and thermoset polyester resin; depth to suit insulation thickness, for structural attachment to building frame.
- .3 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 or where required for drainage.
- .4 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.
- .5 Fasteners: Heat-treated stainless 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.
 - .2 CMU and cast-in-place concrete substrates: Concrete screw with hex head; 38 mm embedment.
- .6 Galvanic protection: Provide tapes and other methods as necessary to separate and prevent contact between dissimilar metals.
- .7 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.
- .8 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 stainless steel screws at metal stud framed walls.
 - .1 Apply compatible sealant at fasteners penetrating through air/vapour barrier membrane.
 - .2 Pre-drill CMU and concrete substrates in accordance with fastener manufacturer's written recommendations
 - .2 Tighten fasteners in accordance with fastener manufacturer instructions.
 - .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

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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.

1.3 SITE CONDITIONS

- .1 Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.

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.
- .3 Languages: Provide markings in English.

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

Part 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 07 05 43 – Cladding Support Systems
- .2 Section 07 13 00 – Sheet Waterproofing
- .3 Section 07 21 00 – Thermal Insulation
- .4 Section 07 25 00 – Weather Barriers
- .5 Section 07 26 16 – Below Grade Vapour Retarders
- .6 Section 07 42 33 – Solid Phenolic Wall Panels
- .7 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .8 Section 07 62 00 – Sheet Metal Flashing and Trim
- .9 Section 07 64 00 – Sheet Metal Wall Cladding
- .10 Section 07 92 00 – Joint Sealants
- .11 Section 07 95 13 – Expansion Joint Cover Assemblies

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Building Envelope Commissioning Authority, on behalf of The City.
- .3 Co-ordinate visual review and testing frequency and locations with Building Envelope Commissioning Authority to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .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 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 General Requirements.
- .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 thermal and moisture protection 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 07 05 43 – Cladding Support Systems
 - .2 Section 07 13 00 – Sheet Waterproofing
 - .3 Section 07 21 00 – Thermal Insulation
 - .4 Section 07 25 00 – Weather Barriers
 - .5 Section 07 26 16 – Below Grade Vapour Retarders
 - .6 Section 07 42 33 – Solid Phenolic Wall Panels
 - .7 Section 07 52 00 – Modified Bituminous Membrane Roofing
 - .8 Section 07 62 00 – Sheet Metal Flashing and Trim
 - .9 Section 07 64 00 – Sheet Metal Wall Cladding
 - .10 Section 07 92 00 – Joint Sealants
 - .11 Section 07 95 13 – Expansion Joint Cover Assemblies
- .5 Shop Drawings

- .1 Provide shop drawings for:
 - .1 Section 07 05 43 – Cladding Support Systems
 - .2 Section 07 42 33 – Solid Phenolic Wall Panels
 - .3 Section 07 52 00 – Modified Bituminous Membrane Roofing
 - .4 Section 07 62 00 – Sheet Metal Flashing and Trim
 - .5 Section 07 64 00 – Sheet Metal Wall Cladding

1.7 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 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:
 - .2 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the thermal and moisture protection components.
 - .3 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.
- .3 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 Building Envelope 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.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 CLADDING SUPPORT SYSTEMS

- .1 Provide mock-ups of cladding support systems 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 SHEET WATERPROOFING

- .1 Provide a mock-up of the sheet waterproofing at a location 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.
- .3 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 THERMAL INSULATION

- .1 Provide mock-ups of thermal insulation at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each type of thermal insulation.
- .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.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.4 WEATHER BARRIERS

- .1 Provide mock-ups of the weather barriers at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each combination of membrane and substrate.
- .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.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.

- .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .4 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 five 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.
- .5 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.

3.5 BELOW GRADE VAPOUR RETARDERS

- .1 Provide mock-ups of the below grade vapour retarders 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 METAL WALL PANELS

- .1 Provide a mock-up of the metal wall panels at a location 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 SOLID PHENOLIC WALL PANELS

- .1 Provide a mock-up of the solid phenolic wall panels at a location 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.

3.8 MODIFIED BITUMINOUS MEMBRANE ROOFING

- .1 Provide a mock-up of the modified bituminous membrane roofing at a location 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 vapour barrier membrane seams and overlaps and at 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 Performance of the Work.

3.9 SHEET METAL FLASHING AND TRIM

- .1 Provide a mock-up of the sheet metal flashing and trim at a location 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.

3.10 JOINT SEALANTS

- .1 Provide a mock-up of the joint sealants at a location 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.

3.11 EXPANSION JOINT COVER ASSEMBLIES

- .1 Provide a mock-up of the expansion joint cover assemblies at a location 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.

3.12 THERMOGRAPHIC SCAN

- .1 Thermographic scan shall be completed by the Building Envelope Commissioning Authority in general accordance with ASTM E1186 prior to Substantial Performance.
 - .1 Minimum temperature differential shall be 20°C, or as otherwise directed by the Contract Administrator.
 - .2 Building shall be under positive pressurization to 50 Pa, or as otherwise directed by the Contract Administrator.
- .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.

3.13 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.

3.14 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports withing 5 working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Sheet waterproofing:
 - .1 Self-adhered modified bituminous sheet membrane.
 - .2 Galvanized steel sheet.

1.2 RELATED REQUIREMENTS

- .1 Section 07 21 00 - Thermal Insulation: Insulation used for protective cover.

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 CSA A123.23 - Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced; 2015 (Reaffirmed 2020).

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data for membrane, flexible flashings, joint cover sheet, and joint and crack sealants.
- .3 Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- .4 Manufacturer's installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.
- .5 Installer's qualification statement.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to project site in original packages with seals unbroken, labelled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing.
- .2 Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- .3 Store rolls according to manufacturer's written instructions.

1.7 SITE CONDITIONS

- .1 Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

Part 2 Products

2.1 MEMBRANE MATERIALS

- .1 Self-adhered modified bituminous sheet membrane, having cross-laminated high-density polyethylene film laminated to top face and meeting requirements of CSA A123.23, Type B, Grade 3 and as follows:
 - .1 Thickness: 1.5 mm, minimum.
 - .2 Adhesives, sealants, tapes, and accessories: As recommended by membrane manufacturer.
 - .3 Provide low temperature versions of the listed Products when installation conditions warrant use of cold temperature products.
 - .4 Basis-of-Design Products:
 - .1 GCP Applied Technologies; Bituthene 3000.
 - .2 Soprema; Colphene 3000.
 - .3 W.R. Meadows, Inc; Mel-Rol.
 - .4 Henry; Blueskin WP200.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Seaming materials: As recommended by membrane manufacturer.
- .3 Membrane sealant: As recommended by membrane manufacturer.
- .4 Flexible flashings: As recommended by membrane manufacturer.
- .5 Termination bars: Stainless steel; compatible with membrane and adhesives.
- .6 Surface conditioner: Type, compatible with membrane.

2.2 ACCESSORIES

- .1 General: Provide accessories and auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- .2 Sealant for cracks and joints In substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- .3 Protection board: Rigid insulation specified in Section 07 21 00.
- .4 Drainage board: Drainage layer with geotextile filter fabric on earth side.
 - .1 Composition: 10 mm thick dimpled polypropylene core; non-woven filter fabric.
 - .2 Basis-of-Design Products:
 - .1 Henry; DB 2000.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .5 Galvanized sheet steel (at column pockets in grade beams): 0.71 mm thick, zinc-coated cold rolled sheet steel, with Z275 designation coating to ASTM A653/A653M. Form in single piece per location.

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 waterproofing system.
- .3 Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

- .1 Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- .2 Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- .3 Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- .4 Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- .5 Surfaces for self-adhesive bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.3 INSTALLATION - MEMBRANE

- .1 Install membrane waterproofing in accordance with manufacturer's instructions.
- .2 Roll out membrane, and minimize wrinkles and bubbles.
- .3 Self-adhering membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
- .4 Overlap edges and ends, minimum 75 mm, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- .5 Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- .6 Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- .7 Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

- .8 Seal items watertight that penetrate through waterproofing membrane with flexible flashing and mastic.
- .9 Seal membrane and flashings to adjoining surfaces.
- .10 Column pockets:
 - .1 Fasten galvanized sheet steel material to grade beam where and to extents indicated using mechanical fasteners.
 - .2 Clean and prime sheet steel substrate to receive membrane materials in accordance with membrane manufacturer's instructions.
 - .3 Apply membrane waterproofing over galvanized steel sheet extending 150 mm edges of steel sheet.
- .11 Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or non-conforming area extending 150 mm beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.4 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

- .1 Mechanically fasten insulation directly against membrane as specified in Section 07 21 00; butt joints.
- .2 Place drainage panel directly against insulation and mechanically fasten. Lap joints in accordance with manufacturer's instructions. Place to encourage drainage downward. Scribe and cut drainage panel around projections, penetrations, and interruptions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Crystalline waterproofing.
- .2 Surface preparation.

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 Test data showing hydraulic permeability.
 - .2 Preparation instructions and recommendations.
 - .3 Storage and handling requirements and recommendations.
 - .4 Installation methods.
 - .5 Details for waterproofing at joints, intersections, and other special conditions.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Store products in manufacturer's unopened packaging until ready for installation.
- .2 Take necessary precautions to keep cementitious materials dry.

1.4 SITE CONDITIONS

- .1 Maintain temperature, humidity, and ventilation within limits recommended by manufacturer for acceptable results; do not install products under environmental conditions outside manufacturer's indicated limits.

Part 2 Products

2.1 APPLICATIONS

- .1 Waterproofing for precast concrete sump pits.

2.2 MATERIALS

- .1 Crystalline waterproofing: Portland cement, quartz or silica sand, and other active chemicals that, when applied to surface of concrete, form insoluble crystals in capillary pores preventing passage of liquids while having no adverse effect on normal properties of concrete.
 - .1 Basis-of-Design Products:
 - .1 Kryton International Inc.; Krystol T1/T2 Slurry.
 - .2 Euclid; Vandex Super/Super White.
 - .3 W.R. Meadows, Inc.; Cem-Kote CW Plus.
 - .4 Xypex Chemical Corporation; Xypex Concentrate.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

- .2 Accessory materials: Compatible with primary waterproofing materials, including but not limited to:
 - .1 Plugging compound: Cementitious compound meeting requirements specified for waterproofing, with additional characteristic of rapid set under water, recommended or approved by waterproofing manufacturer.
 - .2 Patching compound: Single component, fast-setting, non-shrink, high bond strength hydraulic cement recommended or approved by waterproofing manufacturer. With admixture where required for increased bond strength to existing concrete.
 - .3 Reinforcing fabric: non-woven, for crack treatment.
 - .4 Water: Potable, clean, free from salt.

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 best result for substrate under project conditions, and use sand blasting, water blasting, or acid etching as recommended.
- .3 Plug water leaks.
- .4 Patch holes, construction joints, and cracks; remove defective concrete.
- .5 Obtain approval of manufacturer's site representative before beginning installation.

3.3 INSTALLATION

- .1 Install in strict accordance with manufacturer's instructions, maintain environmental conditions required and recommended by manufacturer, and keep a copy of manufacturer's instructions on site.
- .2 Coordinate installation with installation of products that must penetrate waterproofed surfaces.
- .3 Prevent excessive drying of surface.
 - .1 Cure waterproofing for at least three days, or length of time required by manufacturer, with water spray and adequate air circulation.
 - .2 Do not use chemical curing agents unless explicitly approved by waterproofing manufacturer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Board insulation at cavity wall construction, perimeter foundation wall, exterior wall behind solid phenolic panel, and standing seam metal wall finish, and below grade extending beyond foundation.
- .2 Batt insulation in exterior parapet construction.

1.2 RELATED REQUIREMENTS

- .1 Section 07 05 43 - Cladding Support System
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .3 Section 07 13 00 - Sheet Waterproofing: Below grade drainage board.
- .4 Section 07 52 00 - Modified Bituminous Membrane Roofing: Insulation specified as part of roofing system.
- .5 Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.
- .6 Section 09 81 29 - Sprayed Acoustic Insulation: Acoustic insulation at underside of structure in Hall

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 Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED

Requirements.

- .4 Installer's qualification statement.

1.5 QUALITY ASSURANCE

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

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 APPLICATIONS

- .1 Insulation at perimeter of foundation on face of grade beams: Type 4 extruded polystyrene (XPS).
- .2 Insulation below grade extending at an angle outward from perimeter of grade beams: Type 4 extruded polystyrene (XPS), graphite polystyrene (GPS) board, or Type 3 expanded polystyrene (EPS) board, at option of Contractor.
- .3 Cavity wall insulation: Fibrous mineral wool insulation board.

2.2 BOARD INSULATION MATERIALS

- .1 Extruded polystyrene (XPS): Complies with CAN/ULC S701.1 with either natural skin or cut cell surfaces; HCFC-free, and with zero ozone depletion potential.
 - .1 Application: Perimeter of foundation on face of grade beams, and loose laid below grade extending outward from perimeter of grade beams.
 - .2 Type and compressive strength: Type 4, 207 kPa, minimum, in accordance with ASTM D1621.
 - .3 Water absorption: 0.3 percent by volume, maximum, in accordance with ASTM D2842.
 - .4 Board edges: Square.
 - .5 Basis-of-Design Product:
 - .1 Dupont; Styrofoam SM.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .6 Provide complete with grooves and Insulok Thermostud Channel System for mechanical attachment to grade beams.
- .2 Expanded polystyrene (EPS) board insulation: Complies with CAN/ULC S701.1.
 - .1 Application: Horizontally below grade extending outward from perimeter of grade beams.
 - .2 Type and compressive resistance: Type 3, 207 kPa, minimum, in accordance with ASTM D1621.

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- .3 Water absorption: 2 percent by volume, maximum, in accordance with ASTM D2842.
 - .4 Basis-of-Design Product:
 - .1 Quik-Therm; Sub-Grade Insulation SGI30.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Graphite-enhanced expanded polystyrene (GPS) board insulation: Complying with CAN/ULC S701.1 and as follows:
 - .1 Application: Horizontally below grade extending outward from perimeter of grade beams.
 - .2 Water absorption: 2.0 percent by volume, maximum, in accordance with ASTM D2842
 - .3 Type and compressive strength: Type 3, 210 kPa, minimum.
 - .4 Basis-of-Design Product:
 - .1 Beaver Plastics; Halo Subterra 30.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Fibrous mineral wool insulation: Preformed semi-rigid mineral fibre board insulation manufactured in accordance with CAN/ULC S702.1.
 - .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 to 25 and smoke developed classification (SDC) of 0 to 50 in accordance with CAN/ULC S102.
 - .4 Board edges: Square.
 - .5 Board size: 610 mm by 1220 mm.
 - .6 Board thickness: Thickness required to achieve insulation value indicated on Drawings, installed in two layers.
 - .7 Basis-of-Design Products:
 - .1 ROCKWOOL; CavityRock Dual Density.
 - .2 Owens Corning; Thermafiber RainBarrier HD.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .5 Fibrous mineral wool insulation: Preformed semi-rigid mineral fibre board insulation manufactured in accordance with CAN/ULC S702.1.
 - .1 Type: 2, permeable facing on one side.
 - .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 to 25 and smoke developed classification (SDC) of 0 to 50 in accordance with CAN/ULC S102.
 - .4 Board edges: Square.

- .5 Board size: 610 mm by 1220 mm.
- .6 Board thickness: Thickness required to achieve insulation value indicated on Drawings, used as second layer in open joint (reveal) cladding.
- .7 Basis-of-Design Products:
 - .1 ROCKWOOL; CavityRock Black.
 - .2 Owens Corning; Thermafiber RainBarrier Dark.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 BATT INSULATION MATERIALS

- .1 Mineral fibre batt insulation: Flexible or semi-rigid preformed batt or blanket, complying with CAN/ULC S702.1; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with CAN/ULC S102.

2.4 ACCESSORIES

- .1 Insulation fasteners: Insulation pin fastener system specifically designed for installation of board insulation materials into cold-formed steel framing, CMU or cast-in-place concrete; shaft length to suit sheathing and insulation thickness.
 - .1 Pin: Heat-treated carbon zinc-plated steel.
 - .2 Washer: HDPE, minimum 60 mm dia.
 - .3 Basis-of-Design Products:
 - .1 Ramset; InsulFast System.
 - .2 Hilti; X-IE Fastening System.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Insulation coating: Fibrous mineral wool insulation manufacturer's recommended black coating for joints and unfaced portions of black faced board that may be exposed in reveals.
- .3 Adhesive: Type recommended by insulation manufacturer for application.
- .4 Insulating foam sealant: One-component, quick-cure flexible polyurethane foam; HFC-free; with zero ozone depletion potential, low-expansion.
 - .1 Basis-of-Design Products:
 - .1 Dupont; Enerfoam Professional Foam Sealant.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

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 INSTALLATION - GENERAL

- .1 Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- .2 Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- .3 Extend insulation to envelop entire area to be insulated. Cut and fit tightly around protrusions and obstructions. Remove projections that interfere with placement.
- .4 Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths.

3.3 BOARD INSTALLATION AT FOUNDATION PERIMETER

- .1 Mechanically fasten boards on foundation perimeter using channel fastening system at minimum 610 mm o.c. Install fasteners through insulation to substrate.
 - .1 Install in running bond pattern.
 - .2 Apply continuous bead of insulation adhesive to edge before fastening.
 - .3 Butt edges and ends tightly to adjacent boards and to protrusions. Fill voids with insulating foam sealant.
- .2 Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- .3 Immediately following application of board insulation, place drainage panel over exposed insulation surfaces.
 - .1 Apply adhesive to back of panels with notched trowel.
 - .2 Install boards in vertical or horizontal orientation, and in accordance with manufacturer's instructions, to ensure proper drainage.
 - .3 Install boards with fabric facing outward.
 - .4 Butt boards tightly, with joints staggered from insulation joints.
 - .5 Lap fabric, and make corners, in accordance with manufacturer's instructions.
- .4 Extend horizontal below grade insulation boards outward from perimeter of foundation grade beams to extent indicated. Lay boards tight to one another on smoothed compacted fill.

3.4 BOARD INSTALLATION AT EXTERIOR WALLS

- .1 Install boards to fit snugly between thermal clips.
- .2 Install boards vertically or horizontally on walls, in two layers.
 - .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, and to suit project requirements.
 - .4 Use black faced insulation as second layer in open joint (reveal) cladding. Treat unfaced ends and joints with black coating.

- .3 Cut and fit insulation tightly to protrusions or interruptions to the insulation plane. Fill voids with insulating foam sealant.

3.5 BATT INSTALLATION

- .1 Install insulation and vapor retarder in accordance with manufacturer's instructions.
- .2 Install in exterior parapet 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 Where structural steel penetrates building envelope into overhang.

1.2 REFERENCE STANDARDS

- .1 ASTM D6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics; 2021.
- .2 ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- .3 CAN/ULC S705.1 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification; 2018.
- .4 CAN/ULC S705.2 - Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application; 2020.
- .5 CAN/ULC S741 - Standard for Air Barrier Materials - Specification; 2008 (R2016).
- .6 CAN/ULC S770 - Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams; 2015.
- .7 MBC - Manitoba Building Code - MBC - M.R. 78/2023; 2024.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- .3 Manufacturer's certificates: Certify that products of this section meet or exceed specified requirements. Submit CCMC evaluation report.
- .4 Manufacturer's installation instructions: Indicate special procedures, information on special environmental conditions required for installation and perimeter conditions requiring special attention.
- .5 Installer's qualification statement.

1.4 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.

- .3 Statement of compatibility: Letter from foamed-in-place insulation manufacturer stating that foamed-in-place insulation materials are compatible with materials onto which insulation is applied.

1.5 SITE CONDITIONS

- .1 Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- .2 Maintain required temperature during 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 Air leakage rate: Maximum 0.02 L/sec·sq m at 75 Pa when tested in accordance with CAN/ULC S741 or ASTM E2178.
 - .2 Long term thermal resistance: Nominal RSI-value 0.9/25 mm in accordance with CAN/ULC S770.
 - .3 Density: Nominal 35 kg/cu m plus or minus 10 percent.
 - .4 Closed cell content: Minimum 95 percent in accordance with ASTM D6226.
 - .5 Ozone depletion potential: Zero.
 - .6 Global warming potential: Low.
 - .7 Free from toxic, flammable blowing agents.

2.2 ACCESSORIES

- .1 Primer: As required by insulation manufacturer.

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 or protective coating adhesion.

3.2 PREPARATION

- .1 Mask and protect adjacent surfaces from over spray or dusting.
- .2 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 to a minimum cured thickness as indicated.

3.4 SITE QUALITY CONTROL

- .1 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

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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 water barriers: Materials that form a system to stop passage of air but allow water vapour to pass through.

1.2 RELATED REQUIREMENTS

- .1 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 52 00 - Modified Bituminous Membrane Roofing: Air/vapour barrier membrane installed as part of roofing systems.
- .3 Section 09 24 00 - Cement Plastering: Water-resistive barrier under cement plastering.

1.3 DEFINITIONS

- .1 Weather barrier: Assemblies that form either, air barriers, or air/vapour barrier.
- .2 Air water barrier: Air tight 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: Air tight 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 permeance: 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 ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.
- .5 CAN/CGSB 51.34 - Polyethylene Sheet for Use in Building Construction - Material Specification; 2022.
- .6 CAN/ULC S134 - Standard Method of Fire Test of Exterior Wall Assemblies; 2013 (Reaffirmed 2018).

- .7 CAN/ULC S741 - Standard for Air Barrier Materials - Specification; 2008 (R2016).
- .8 CAN/ULC S742 - Standard for Air Barrier Assemblies - Specification; 2011 (R2016).

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 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Installer: 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-UPS

- .1 Install air barrier and vapour retarder materials in integrated exterior mock-up specified in Section 07 42 33.

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 water barrier:
 - .1 On outside surface of sheathing of parapets use vapour permeable air water barrier sheet, self-adhesive type.
- .2 Interior vapour barrier:
 - .1 Between existing and new construction at Pool Viewing where indicated, use mechanically fastened polyethylene vapour barrier sheet.
- .3 Exterior air/vapour barrier:
 - .1 On outside surface of sheathing use air/vapour barrier sheet, self-adhesive type.

2.2 AIR WATER BARRIER MATERIALS (VAPOUR PERMEABLE)

- .1 Air water barrier sheet, self-adhered: Provide primer on substrate material as required by manufacturer and application conditions.

- .1 Air permeance: 0.02 L/s/sq m, maximum, when tested in accordance with ASTM E2178.
- .2 Water vapour permeance: 572 ng/(Pa s sq m), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
- .3 Ultraviolet (UV) and weathering resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
- .4 Seam and perimeter tape: As recommended by sheet manufacturer.
- .5 Basis-of-Design Products:
 - .1 GCP Applied Technologies; Perm-A-Barrier VPS.
 - .2 Henry Company; Blueskin VP160.
 - .3 Soprema; Sopraseal Stick VP.
 - .4 W.R. Meadows; Air-Shield SMP.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 AIR/VAPOUR BARRIER MATERIALS

- .1 Air/vapour barrier sheet, self-adhered:
 - .1 Type: SBS rubberized asphalt bonded to release film, self-adhesive.
 - .2 Thickness: 1.0 mm.
 - .3 Air permeance: 0.02 L/s/sq m, maximum, when tested in accordance with CAN/ULC S741.
 - .4 Air barrier assemblies: Conform to CAN/ULC S742, and meeting or exceeding Performance Class 1.
 - .5 Water vapour permeance: 2.5 ng/(Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.
 - .6 Low temperature flexibility: Less than -20 degrees Celsius.
 - .7 Complies with CAN/ULC S134 wall assembly requirements.
 - .8 Seam and perimeter tape: As recommended by sheet manufacturer.
 - .9 Basis-of-Design Products:
 - .1 GCP Applied Technologies; Perm-A-Barrier NPS.
 - .2 Soprema; Sopraseal Stick 1100 T.
 - .3 Henry Company; Blueskin SA LT.
 - .4 W.R. Meadows; AirShield Low Temp.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 INTERIOR VAPOUR BARRIER MATERIALS

- .1 Polyethylene vapour barrier: CAN/CGSB 51.34, Type 1 - 150 micrometre (6 mil) thick, and Type 2 - 250 micrometre (10 mil) as indicated.
- .2 Vapour barrier sealant for concealed joints: Lightweight low trigger resistance, non-drying, non-hardening, non-skinning, gunnable, synthetic rubber sealant recommended for sealing joints in polyethylene vapour barriers.

2.5 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.
- .2 Flexible flashing: Self-adhesive sheet flashing compatible with weather barrier membrane.
- .3 Pre-formed transition membrane: Pre-engineered system comprised of ribbed translucent silicone rubber extrusion, and silicone sealant.
- .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 transitions strips to allow for 25 mm deflection.
- .5 Primers, thinners and cleaners: As recommended by material manufacturer.
- .6 Staples: ASTM F1667/F1667M.

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 as required in accordance with manufacturer's instructions.

3.3 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- .3 Interior polyethylene vapour barriers: Install continuous over surfaces indicated.
 - .1 Fasten vapour retarders at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space staples 400 mm o.c.
 - .2 Seal perimeter with continuous bead of vapour barrier sealant.
 - .3 Lap edges and ends 150 mm, and seal with continuous bead of vapour barrier sealant.
 - .4 Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapour barrier with vapour-barrier tape to create an airtight seal between penetrating objects and vapour barriers.
 - .5 Repair tears or punctures in vapour barriers immediately before concealment by other work. Cover with vapour-barrier tape or another layer of vapour barrier.

- .4 Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- .5 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 airtight.
 - .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.
- .6 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 50 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.

3.4 TRANSITION STRIPS

- .1 Provide 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. Leg length indicated.
- .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 of sheet steel transition strips. 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, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, 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 Sheet dampproofing membranes (referred to on the Drawings as "dampproofing membrane").
- .2 Underslab vapour barrier membrane.

1.2 RELATED REQUIREMENTS

- .1 Section 03 48 00 - Precast Concrete Specialties: Precast concrete crawlspace walkway pavers.

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.
- .3 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.

1.5 SITE CONDITIONS

- .1 Do not apply on frozen ground.

Part 2 Products

2.1 MATERIALS

- .1 Sheet dampproofing membrane (exposed in Crawlspace): Fire-retardant, cross-laminated puncture resistant polyethylene sheet.
 - .1 Basis-of-Design Products:
 - .1 Reef Industries; Permalon Ply X-200 FR Fire Retardant Sheet, and Griffolyn Griff Tape FR.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Joint sealing tape: Fire-retardant pressure sensitive tape.

- .3 Pointing mastic: Pre-mixed cold-applied single-component polymeric flexible sealing compound, designed for use with sheet dampproofing membrane.
- .2 Sheet dampproofing membrane (under void form):
 - .1 Basis-of-Design Products:
 - .1 Stego; Stego Wrap (15 mil) Vapor Barrier.
 - .2 W.R. Meadows; Perminator 15.
 - .3 Layfield; VaporFLEX 15.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Joint sealing tape: Air-resistant pressure sensitive adhesive tape, type recommended by membrane manufacturer, 100 mm wide.
- .3 Vapour barrier membrane (between void form and floor slab): As specified for sheet dampproofing under void form.

2.2 ACCESSORIES

- .1 Precast walkway pavers: As specified in Section 03 48 00.

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 sheet dampproofing membrane and underslab vapour barrier.
- .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 exposed sheet dampproofing membrane to foundation grade beams, piles, and piers using pointing mastic between concrete foundation and sheet dampproofing membrane. Fasten continuous pressure preservative treated wood nailing strip along top edge and secure to concrete grade beams.
- .4 Penetrations:
 - .1 Cut a slit in sheet membrane materials around concrete pile caps, mechanical piping, foundation drainage piping, and wire penetrations to place initial layer of

- sheet membrane materials.
- .2 Cut a second piece of sheet membrane materials minimum 610 mm wide with “fingers” cut half the width of the sheet. Wrap sheet membrane around penetration and securely strap with steel banding and completely tape fingers to bottom layer of sheet damproofing membrane.
- .5 Inspect for continuity and repair in accordance with ASTM E1643 and as follows:
 - .1 Repair small punctures and tears with sealing tape before work is concealed.
 - .2 Where damage to sheet membrane materials exceeds tape width, repair with additional layer of sheet membrane material, minimum 150 mm overlap in all directions from edge of damage.
 - .1 Tape continuously around perimeter of patch.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Manufactured metal panels for exterior wall panels and subgirt framing assembly, with insulation, related flashings, and accessory components.

1.2 RELATED REQUIREMENTS

- .1 Section 05 40 00 - Cold-Formed Metal 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 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

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 Subcontractors.
- .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: Manufacturer's data sheets on each product to be used.
 - .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, and methods of anchorage.
 - .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 Provide Shop Drawings stamped or sealed by design engineer.
- .4 Samples: Submit two samples of wall panel, 305 mm by 305 mm in size illustrating finish colour, sheen, and texture.
- .5 Design data: Submit structural calculations stamped by design engineer, for Contract Administrator's review and project record.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Designer's qualification statement.
- .8 Installer's qualification statement.
- .9 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 Designer qualifications: Perform design by or 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 Installer qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- .2 Store prefabricated 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.

1.8 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

- .2 Correct defective work within a twenty year period after Date of Substantial Performance for degradation of panel finish, including colour fading caused by exposure to weather.

Part 2 Products

2.1 MANUFACTURED METAL PANELS

- .1 Wall panels: Factory fabricated prefinished metal panels, site assembled.
 - .1 Provide exterior wall panels and subgirt framing assembly.
 - .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/vapour barrier membrane at building enclosure elements in accordance with materials specified in Section 07 25 00.
- .2 Exterior wall panels:
 - .1 Profile: Vertical; style as indicated.
 - .2 Side seams: Double-interlocked, tight-fitting.
 - .3 Material: Precoated steel sheet, 0.76 mm minimum thickness.
 - .4 Panel depth: 38 mm.
 - .5 Panel coverage: 300 mm.
 - .6 Colour: As selected by Contract Administrator from manufacturer's standard line.
 - .7 Basis-of-Design Products:
 - .1 Agway Metals; HF-12-F.
 - .2 VicWest; AD-300.
 - .3 Centria; IW-14A.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Subgirt framing assembly:
 - .1 Minimum 1.9 mm thick formed non-precoated steel sheet.
 - .2 Profile as indicated; to attach panel system to building.

- .4 Internal and external corners: Same material, thickness, and finish as exterior sheets; profile to suit system; brake formed to required angles and profiles.
- .5 Trim, closure pieces, caps, flashing, and infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles, and as shown on Drawings.
- .6 Anchors: Galvanized steel.

2.2 MATERIALS

- .1 Precoated steel sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
- .2 Non-precoated steel sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, SS Grade 33/230, with Z275 coating.
- .3 Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.
- .4 Insulation: Mineral wool type specified in Section 07 21 00.

2.3 FINISHES

- .1 Exposed surface finish: Panel manufacturer's standard siliconized polyester coating, top coat over epoxy primer.
- .2 Panel backside finish: Panel manufacturer's standard siliconized polyester wash coat.

2.4 ACCESSORIES

- .1 Cladding support system: See Section 07 05 43.
- .2 Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- .3 Concealed sealants: Non-curing butyl sealant or tape sealant.
- .4 Exposed sealant: Exposed sealant: High performance hybrid as specified in Section 07 92 00.
- .5 Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized.
 - .1 Metal-to-metal fasteners: Self-drilling, self-tapping screws.
- .6 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 membrane has been installed over substrate.

3.2 PREPARATION

- .1 Install thermal clips securely fastened to substrates. Space at intervals indicated on reviewed Shop Drawings.
- .2 Install insulation between thermal clips in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 21 00.
- .3 Install subgirts, securely fastened to substrates and shimmed and leveled to uniform plane. Install in orientation and space at intervals indicated on reviewed Shop Drawings.

3.3 INSTALLATION

- .1 Install panels on walls in accordance with manufacturer's instructions, and reviewed Shop Drawings.
- .2 Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- .3 Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- .4 Fasten panels to supports; aligned, level, and plumb.
- .5 Flash and seal metal wall panels at perimeter of all openings. Install flashing and trim as metal wall panel work proceeds.
- .6 Use concealed fasteners unless otherwise approved by Contract Administrator.
- .7 Seal and place gaskets to prevent weather penetration. Maintain neat appearance.
- .8 Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- .9 Joint sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
- .10 Provide trim, closure pieces, and flashing to prevent water penetration and direct moisture to exterior.
- .11 Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

3.4 TOLERANCES

- .1 Maximum offset from true alignment between adjacent members butting or in line: 1.6 mm.
- .2 Maximum variation from plane or location indicated on Drawings: 6.4 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 Exterior solid phenolic, drained and back-ventilated rainscreen wall panel system, and soffit panels.

1.2 RELATED REQUIREMENTS

- .1 Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing, and wall panel substrate.
- .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: Insulation installed within cladding support system.
- .5 Section 07 25 00 - Weather Barriers: Weather barrier installed behind cladding support system.
- .6 Section 09 21 16 - Gypsum Board Assemblies: Wall panel substrate

1.3 REFERENCE STANDARDS

- .1 CAN/ULC S134, Standard Method of Fire Test of Exterior Wall Assemblies; 2013 (r2018).
- .2 FSC-STD-40-004, Chain of Custody Certification, v3-0.
- .3 MBC - Manitoba Building Code MBC - M.R. 78/2023, 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate work of this Section with cladding support system specified in Section 07 05 43.
 - .2 Coordinate work of this Section with rain drainage work, flashing, trim, and other adjoining work to provide secure and non-corrosive installation.
- .2 Pre-installation meeting: Convene minimum 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, and review manufacturers' installation instructions, and warranty requirements.
 - .1 Require attendance by the installer and relevant Subcontractors.
 - .2 Include panel manufacturer's representative to review storage and handling procedures.
 - .3 Review flashing, special panels details, wall penetrations, openings, and condition of other construction that affects solid phenolic wall panels.
 - .4 Review procedures for protection of work of this Section and other construction.

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: Show layout and elevations, dimensions and thickness of panels, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colours, patterns and textures.
 - .1 Combine with Shop Drawings of cladding support system specified in Section 07 05 43.
 - .2 Indicate panel numbering system.
 - .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 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: Representative size sample, including 4-way joint between phenolic wall panels, aluminum support structure, and panel fasteners for face-fastened panels.
- .5 Verification samples: For each finish product specified, two samples minimum 75 mm by 75 mm representing actual product in colour, and finish.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Certificate: Certify that the work results of this section meet or exceed specified requirements.
- .8 Design data: Submit structural calculations stamped by design engineer, for Contract Administrator's review and project record.
- .9 Manufacturer's site reports: Provide within 48 hours of site review. State what was observed and what changes, if any, were requested or required.
- .10 Designer's qualification statement.
- .11 Manufacturer's qualifications statement.
- .12 Installer's qualification statement.
- .13 Maintenance data: Care of finishes and warranty requirements.
- .14 Executed warranty: Submit warranty and ensure that forms have been completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Designer qualifications: Design cladding support system for wall assemblies 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 Manufacturer qualifications: Company specializing in manufacturing products for the work of this section with minimum 10 years documented experience.
- .3 Installer qualifications: Company specializing in fabricating and installing phenolic panel wall systems with minimum 5 years documented experience, approved by the manufacturer.

1.7 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for additional requirements.
- .2 Construct integrated exterior mock-up, 2 m long by 2 m high; include panel system, glazing, attachments to building frame, associated weather barrier materials, related insulation in mock-up.
- .3 Locate where directed by Contract Administrator.
- .4 Accepted mock-ups may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with site and environmental conditions, and in accordance with manufacturer's instructions.
- .2 Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Comply with manufacturer's written handling and storage guidelines.

1.9 PROJECT CONDITIONS

- .1 Field measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on Shop Drawings.
- .2 Ambient conditions: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer.

1.10 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- .2 Submit manufacturer's warranty covering defects in material or manufacturing quality. Warranty to include labour for removal, replacement and reinstallation of defective material.
 - .1 Failures include, but are not limited to structural failures including delamination, rupturing, cracking or puncturing, and deterioration of panels and other materials beyond normal weathering.

- .2 Correct defective work within a 10 year period after Date of Substantial Performance.

Part 2 Products

2.1 MANUFACTURED PHENOLIC PANELS

- .1 Wall panel system: Factory fabricated rainscreen phenolic panel system, site assembled.
 - .1 Provide exterior wall panels, soffit panels, and flashing, reveals, soffit vents, and accessories for a complete wall system.
 - .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.
 - .4 Fire performance:
 - .1 Exterior wall assembly: Tested to CAN/ULC S134 for compliance with MBC - Manitoba Building Code.
 - .5 Maximum allowable deflection of panel: $L/175$ for length (L) of span.
 - .6 Movement: Accommodate movement within system without damage to components, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - .7 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - .8 Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects.
- .2 Phenolic wall panels: Fire-retardant solid phenolic panels; impact-, scratch-, UV-, hail-, weather-, and graffiti-resistant.
 - .1 Material: Solid panel manufactured using a combination of high pressure and temperature to form a flat panel created from thermosetting resins, homogeneously reinforced with wood-based fibres, and an integrated decorative surface or printed decor; with UV protective layer on exterior panels.
 - .2 Panels: FSC-STD-40-004 certified.
 - .3 Basis-of-Design Products:
 - .1 FunderMax; Max Compact Exterior F-Quality.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Colour on primary face:
 - .1 Woodgrain.
 - .2 Finish: Standard NT - hammered embossed.
 - .5 Colour on back face: Manufacturer's standard.
 - .6 Core: Fire-retardant (FR) brown core.
 - .7 Panel thickness: 8 mm.
 - .8 Panel sizes: As indicated on Drawings.
 - .9 Mounting system: Exposed fastening on fixed depth aluminum sub-framing, with colour matched fasteners.

2.2 ACCESSORIES

- .1 Aluminum sub-structure: Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate in accordance with manufacturer's recommendations; designed to withstand structural loading.
- .2 Fasteners: Non-corrosive; type, size, and holding-power as recommended by panel manufacturer.as required to suit attachment to aluminum support structure. Provide colour-matched fasteners for face-fastened exterior panels.
- .3 Vent screen at base: Prefinished perforated aluminum angle, colour black.
- .4 Soffit insect screen: Woven aluminum, mesh count 18 x 16, 0.279 mm wire diameter; colour black.
- .5 Shadow reveal: Two-piece prefinished galvanized steel, colour black.

2.3 FABRICATION

- .1 Shop cut solid phenolic panels and accessory materials in accordance with panel manufacturer's written instructions and reviewed Shop Drawings. Comply with indicated profiles and dimensional requirements indicated.
- .2 Make panel lines, breaks, and angles sharp, true and with surfaces free from warp and buckle.
- .3 Panel bow: Maximum 2 mm per metre.
- .4 Minimize site fabrication.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine dimensions, tolerances, and interfaces with other work.
- .2 Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.
- .3 If substrate preparation is the 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, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- .2 Clean surfaces thoroughly before installation.

3.3 INSTALLATION - GENERAL

- .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 solid phenolic wall panel and aluminum sub-frame system manufacturer, and reviewed Shop Drawings.
- .3 Do not cut or trim panels 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.
- .4 Apply panels to walls and soffit with vertical joints straight and to pattern indicated on Drawings.
- .5 Replace damaged products.
 - .1 Exception: Site repairs of minor damage to finishes are permitted only when approved in writing by Contract Administrator, panel manufacturer, and fabricator.
 - .2 Site repairs to finishes: Use materials and methods sufficient that repairs are not discernible when viewed at distance of 1 m under all typical light conditions experienced at the project.

3.4 INSTALLATION - EXTERIOR PANELS

- .1 Install exterior wall and soffit system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation with exposed fasteners.
- .2 Install aluminum sub-framing system level and plumb and within tolerances of the completed system in accordance with reviewed Shop Drawings, using fasteners approved for use with supporting substrate.
- .3 Phenolic panels:
 - .1 Install solid phenolic panels plumb and level, except on angled soffits, with faces and edges aligned, and accurately spaced in accordance with reviewed Shop Drawings.
 - .2 Fasten solid phenolic panels with colour-matched fasteners approved for use with supporting substrate.
 - .3 Install accessories appropriate for use with adjoining construction as indicated on reviewed Shop Drawings and as recommended by manufacturer.
 - .4 Install exterior wall and soffit panels with end joints staggered as indicated.

3.5 ERECTION TOLERANCES

- .1 Maximum offset from true alignment between adjacent members butting or in line: 1.6 mm.
- .2 Adjust final panel installation so that joints are true and even throughout installation.
- .3 Maximum variation from plane or location indicated on Drawings: 3 mm.

3.6 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection, for independent site testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- .2 Wall system manufacturer's site services: Provide site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

3.7 ADJUSTING

- .1 Replace panels installed out of plumb or not aligned with adjacent panels or construction.

3.8 CLEANING

- .1 Remove masking or panel protection as soon as possible after installation.
- .2 Clean finished panel surfaces in accordance with manufacturer's recommendations.

3.9 PROTECTION

- .1 Protect installed panel system from subsequent construction operations.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Removal and replacement of existing BUR roofing system, flashing and counterflashing in designated areas to allow construction of new parapets.
- .2 Temporary roof protection.
- .3 Insulation, flat.
- .4 Vapour retarders.
- .5 Base flashings.
- .6 Roofing cant strips and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings and cap flashings.

1.3 REFERENCE STANDARDS

- .1 ASTM D1863/D1863M - Standard Specification for Mineral Aggregate Used on Built-Up Roofs; 2005 (Reapproved 2018).
- .2 ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- .3 ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).
- .4 CAN/ULC S704 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced; 2017.
- .5 CRCA Roofing Specifications Manual - Roofing Specifications Manual; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with installation of associated counterflashings as the work of this section proceeds.
- .2 Preinstallation meeting: Convene one week before starting work of this section.
 - .1 Attendees: Contractor, Contract Administrator, the City, Roofing Subcontractor, and City's building envelope commissioning agency (BECA).
 - .2 Review preparation and installation procedures, and coordinating and scheduling required with related work, including removal of existing BUR roofing.
 - .3 Discuss site storage, structural loading limitations of deck during removal and replacement of roofing, protection of existing roof deck and roofing materials, and cold weather restrictions for roofing work.
 - .4 Discuss base flashings, special roofing details, condition of other construction that will affect roofing, and transitions and connection to and with other work.

- .5 Discuss quality of workmanship expected, and ensure trades are fully aware of tie-in requirements as detailed, and roof inspections that will be undertaken by BECA to ensure that quality of workmanship is met.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data indicating vapour retarder, interply and base flashing membrane materials, insulation, adhesives, and aggregate.
- .3 Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and tie-in to existing roofing.
- .4 Samples of aggregate: Submit two 0.5 kg containers of roofing aggregate.
- .5 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention, and tie-in to existing roofing.
- .6 Manufacturer's certificate: Certify that products meet or exceed specified requirements.
- .7 Installer's qualification statement.
- .8 Manufacturer's site reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Use an installation company that is a member in good standing of the Roofing Contractors Association of Manitoba (RCAM) with minimum five years documented experience.
- .2 Comply with Roofing Specifications as published by Canadian Roofing Contractors Association CRCA Roofing Specifications Manual as a reference.
- .3 Installer must maintain a full time experienced journeyman roofer, and at least one apprentice on each crew on the Work at all times and as follows:
 - .1 Roofing Subcontractor and sub-Subcontractors must have "Approved Contractor" status by roofing product manufacturer. Only skilled and certified trade persons, officially employed by a Roofing Subcontractor operating adequate and necessary equipment, must be authorized to perform all roofing work.

1.7 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.
- .3 Place plywood runways over existing roof areas 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.

1.8 SITE CONDITIONS

- .1 Existing roofing system: Built-up asphalt roofing.
- .2 Do not remove existing roofing system when weather conditions threaten the integrity of building contents or intended continued occupancy.
- .3 Maintain continuous temporary protection prior to and during installation of new roofing system.
- .4 Do not apply roofing system during unsuitable weather.
- .5 Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions.
- .6 Do not apply roofing system to damp or frozen deck surface or when precipitation is expected or occurring.
- .7 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- .8 Schedule applications so that no partially completed sections of roof are left exposed at end of workday.
- .9 City will occupy building areas directly below re-roofing area.
 - .1 Provide City with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
 - .2 Do not disrupt City's operations or activities.
 - .3 Maintain existing mechanical, electrical, and security equipment operational unless otherwise indicated.

Part 2 Products

2.1 TEMPORARY ROOFING PROTECTION MATERIALS

- .1 Roofing Subcontractor is responsible to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.2 ROOFING

- .1 Built-up bituminous roofing: Cold-applied reinforced SBS-modified membrane, three ply plus base sheet, with vapour retarder and insulation.
- .2 Acceptable insulation types - Constant Thickness Application:
 - .1 Minimum 2 layers of polyisocyanurate board.
- .3 Surfacing: Aggregate, ASTM D1863/D1863M.

2.3 SHEET MATERIALS

- .1 Vapour retarder: Self-adhesive, fibreglass reinforced membrane composed of SBS rubberized asphalt laminated to slip-resistant, woven polyethylene surface film; comply with ASTM D1970/D1970M.
 - .1 Basis-of-Design Products:
 - .1 Tremco; AVC Max membrane.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Primer: Manufacturer's recommended primer used to enhance adhesion of self-adhesive membranes suitable for application temperatures.
- .2 Base sheet and ply sheets: ASTM D4601/D4601M Type II; SBS-modified asphalt-coated glass fibre; unperforated.
 - .1 Basis-of-Design Products:
 - .1 Tremco; BURmastic Composite Ply HT.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Flexible flashing material: Modified bitumen, SBS type.
 - .1 Thickness: 1.1 mm.
 - .2 Basis-of-Design Products:
 - .1 Tremco; TRA Elastomeric Sheeting.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 COVER BOARDS

- .1 Cover board: Multi-ply, semi-rigid, asphaltic board designed for use as a protection layer between the insulation and membrane.
 - .1 Thickness: 6.4 mm, or to match existing.
 - .2 Basis-of-Design Products:
 - .1 Tremco; Tremboard AC.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.5 INSULATION

- .1 Polyisocyanurate (ISO) board insulation: Rigid cellular foam, complying with CAN/ULC S704.
 - .1 Classifications:
 - .1 Class 2, Type II: 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: Applied in two equal layers; overall thickness to match existing.
- .4 Board edges: Square.

2.6 ACCESSORIES

- .1 Cant strips: Bitumen-impregnated wood fibreboard, compatible with roofing materials; cants formed to 45 degree angle.
- .2 Insulation adhesive: Bead-applied, low-rise, one-component or multi-component urethane as recommended by roofing manufacturer, compatible with roofing materials.
- .3 Membrane adhesive: Asbestos-free, fibrated cold process asphalt interply and surfacing adhesive.
 - .1 Basis-of-Design Products:
 - .1 Tremco; BURmastic Adhesive.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

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 cant strips are in place.

3.2 PROTECTION

- .1 Provide protection of existing roofing system that is not having work performed on it.
- .2 Provide temporary protection of uncovered deck surfaces.

3.3 PREPARATION

- .1 Coordinate with Contract Administrator or City to shut down air-intake equipment in the vicinity of the Work. Temporarily cover air-intake louvers before proceeding with re-roofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- .2 During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

3.4 MATERIAL REMOVAL

- .1 Remove only existing roofing materials that can be replaced with new materials as the weather will permit.
- .2 Scrape roofing gravel from membrane surface, and dispose of properly off-site.
- .3 Cut back and remove portions of existing roof membrane, insulation, and vapour retarder, flashing, cant strips where indicated, and as required, to allow for construction of new parapets.
- .4 Notify Contract Administrator and City's building envelope commissioning agency (BECA) before start of removals.

3.5 INSTALLATION

- .1 Prime existing deck covering surfaces to be covered.
- .2 Vapour retarder:
 - .1 Apply vapour retarder to deck surface, in accordance with roofing manufacturers' instructions.
 - .2 Extend vapour retarder under cant strips and blocking, and up vertical face of parapets.
- .3 Attachment of insulation:
 - .1 Adhere first layer of insulation in accordance with roofing manufacturer's instructions and to meet wind uplift requirements.
 - .2 Adhere subsequent layers of insulation with joints staggered minimum 150 mm from joints of preceding layer.
 - .3 Supplement adhesive with screw and plate fastening system if required at to meet wind uplift resistance requirements.
 - .4 Fill gaps between insulation boards and existing insulation with mineral wool insulation.
- .4 Adhere cover board to insulation to meet wind uplift resistance requirements.
- .5 Membrane application:
 - .1 Install built-up bituminous roofing system in accordance with manufacturer's recommendations and CRCA Roofing Specifications Manual requirements.
 - .2 Embed base sheet, coated side down in cold process adhesive squeegee-applied at recommended coverage rate. Lap sides 100 mm; lap ends 150 mm.
 - .3 Apply three membrane plies, weather lap edges and ends. Embed each ply in cold process adhesive squeegee-applied at manufacturer's recommended rate per ply.
 - .4 Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears.
 - .5 At intersections with vertical surfaces:
 - .1 Extend membranes and base sheet to top of cant strips.
 - .2 Adhere base flashing extending minimum 150 mm onto field of roof surface and to top of parapet.
 - .3 Secure base flashing to nailing strips at 200 mm on centre.

- .6 Apply flood coat of cold process adhesive at manufacturer's recommended rate and broadcast aggregate at rate of 20 to 24 kg per sq. m.

3.6 SITE QUALITY CONTROL

- .1 Independent agency inspection will be provided under provisions of Section 07 08 00.
- .2 City's building envelope commissioning agency (BECA) will identify the exact limits to material removal.

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

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Part 1 General

1.1 SECTION INCLUDES

- .1 Modified bituminous roofing membrane, conventional application.
- .2 Insulation, flat and tapered.
- .3 Air/vapour barrier.
- .4 Deck sheathing.
- .5 Base flashings.
- .6 Removal and replacement of existing SBS modified bituminous roofing system, flashing and counterflashing in designated areas to allow construction of new parapets.
- .7 Patching of existing SBS modified bituminous roofing system if required where existing roof drains are replaced with new.

1.2 RELATED REQUIREMENTS

- .1 Section 01 21 00 - Allowances: Investigation and remediation of existing roof/water leak at existing lobby desk.
- .2 Section 03 45 00 - Precast Architectural Concrete: Precast paver ballast.
- .3 Structural Drawings: Product requirements for acoustical insulation for deck flutes, for placement by this section.
- .4 Section 07 01 50.19 - Preparation for Re-Roofing.
- .5 Section 07 08 00 - Commissioning of Thermal and Moisture Protection
- .6 Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings and cap flashings, and scuppers.

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 C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- .3 CAN/CSA A123.21 - Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems; 2020.
- .4 CAN/ULC S107 - Methods of Fire Tests of Roof Coverings; 2010 (R2016).
- .5 CAN/ULC S704 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced; 2017.
- .6 CCOHS - Canadian Centre for Occupational Health and Safety - Fire Extinguisher Fact Sheet; Current Edition.
- .7 CRCA Roofing Specifications Manual - Roofing Specifications Manual; Current Edition.

- .8 CSA A123.23 - Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced; 2015 (Reaffirmed 2020).
- .9 FM (AG) - Factory Mutual, Approval Guide; current edition.
- .10 ITS (DIR) - Intertek Testing Services, Directory of Listed Products; current edition.
- .11 ULC (FRD) - Fire Resistance Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with installation of associated flashings and counterflashings installed by other sections.
- .2 Preinstallation meeting: Convene minimum one week before starting work of this section.
 - .1 Attendees: Contractor, Contract Administrator, the City, Roofing Subcontractor, Mechanical Subcontractor, and City's building envelope commissioning agency (BECA).
 - .2 Review preparation and installation procedures and coordinating and scheduling required with related work, including removal of existing roofing, construction of new parapets, and tie-in to existing roofing.
 - .3 Co-ordinate height of roof curbs to suit mechanical roof top units.
 - .4 Co-ordinate final roof drain locations and heights, and sloped insulation cricket layouts to ensure positive roof drainage without water ponding and without compromising thickness and thermal resistance of roof insulation.
 - .5 Discuss site storage, structural loading limitations of deck during removal and replacement of roofing, protection of existing roof deck and roofing materials, and cold weather restrictions for roofing work.
 - .6 Discuss base flashings, special roofing details, condition of other construction that will affect roofing, and transitions and connection to and with other work.
 - .7 Discuss preconditioning of membrane rolls, primers, and adhesives prior to application.
 - .8 Discuss dynamic wind uplift resistance requirements for this project, and in accordance with CAN/CSA A123.21. Confirm fastening and adhesive patterns required for all materials.
 - .9 Discuss quality of workmanship expected, and ensure trades are fully aware of tie-in requirements as detailed, and roof inspections that will be undertaken by building envelope commissioning agency (BECA) to ensure that quality of workmanship is met.
 - .10 Review Roof Asset Management Plan (RAMP).

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, and air/vapour barrier.
- .3 Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout,

- and adhesive layout, and tie-in to existing roofing.
- .4 Samples: Submit two samples 150 by 150 mm in size illustrating granule surfaced sheet.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .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, wind velocity during application, and supplementary instructions given.
- .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 Roofing Contractors Association of Manitoba (RCAM) with a minimum five 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 percent, 60 percent, 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.
- .3 Comply with Roofing Specifications as published by Canadian Roofing Contractors Association CRCA Roofing Specifications Manual as a reference.
- .4 Installer must maintain a full time experienced journeyman roofer, and at least one apprentice on each crew on the Work at all times and as follows:
 - .1 Roofing Subcontractor and sub-Subcontractors must have "Approved Contractor" status by roofing product manufacturer. Only skilled and certified trade persons, officially employed by a Roofing Subcontractor operating adequate and necessary equipment, must be authorized to perform all roofing work.
 - .2 Crew members using torches must be trained under a recognized training program and certified from the manufacturer of materials being installed.

1.7 MOCK-UP

- .1 Mock-up full roofing assembly in accordance with Section 01 45 00, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection. Locate mock-up on site as part of final installation.
- .2 Stagger mock-up to exposed all layers of roofing assembly as specified.
- .3 Mock-up will be reviewed for quality of workmanship including fastener and adhesive patterns to meet dynamic wind uplift resistance requirements.
- .4 Once approved, mock-up will set standard of acceptance for remaining installations.
- .5 Do not proceed with roofing installation until mock-up is complete and approved by BECA.

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 remove existing roofing system when weather conditions threaten the integrity of building contents or intended continued occupancy.
- .3 Maintain continuous temporary protection prior to and during installation of new roofing system.
- .4 Do not apply roofing membrane during unsuitable weather.
- .5 Do not apply roofing membrane when ambient temperature is below negative 10 degrees C.
- .6 Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- .7 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- .8 Schedule applications so that no partially completed sections of roof are left exposed at end of workday.
- .9 City will occupy building areas directly below re-roofing area.
 - .1 Provide City with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
 - .2 Do not disrupt City's operations or activities.
 - .3 Maintain existing mechanical, electrical, and security equipment operational unless otherwise indicated.

1.11 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- .2 Manufacturer's product warranty: Provide an extended warranty for work of this Section for a period of 10 years from date of Substantial Performance of the Work. Membrane manufacturer hereby agrees to repair any leaks in the roofing membrane to restore the roofing system to a dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. The warranty must cover for the entire cost of the repairs during the entire warranty period at no expense to the City.
- .3 Installer's warranty: Provide an extended warranty for work of this Section for a period of five years from date of Substantial Performance of the Work. Installer to provide written and signed Roofing Contractors Association of Manitoba (RCAM) document certifying work of this Section against failure and leakage, and these or other observed workmanship defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and City, and at no expense to the City.
- .4 Roof Asset Management Plan (RAMP): Roofing Subcontractor to establish RAMP to ensure RCAM and Roof Manufacturer's Warranty terms are followed. Roofing Subcontractor to include annual warranty follow-up roof inspections complete-with reports for the term of their warranty (five years).

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis-of-Design Products are based on Soprema products.
 - .1 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the 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 Uplift performance: Provide roofing systems that meet wind uplift performance requirements for conventional roofing assemblies in accordance with CAN/CSA A123.21 as follows:
 - .1 Wind loads: Based on 1/50 year occurrence, and as follows:
 - .1 Corners: -3.0 kPa.
 - .2 Edges: -1.6 kPa.
 - .3 Field: -1.2 kPa.
 - .4 End zone width: 2.1 m.
 - .2 Building geometry: Low rise, based on building height, width and length indicated on Drawings, and having parapets of height indicated.
 - .3 Building exposure: Rough terrain.
 - .4 Building openings: Category 2.
 - .5 Building importance: High.
- .4 For purposes of wind uplift assessment, designate roof membrane as plane of air tightness.
- .5 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 air/vapour barrier and insulation.
- .2 Roofing assembly requirements:
 - .1 External fire exposure classification: CAN/ULC S107 Class A, ULC (FRD) or ITS (DIR) listed.
 - .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:
 - .1 Roofing membrane with non-woven fleece reinforcement and elastomeric bitumen, top face covered with thermofusible plastic film.
 - .2 Components:
 - .1 Reinforcement: Non-woven polyester.
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
 - .3 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 Basis-of-Design Product:
 - .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 Components:
 - .1 Reinforcement: Non-woven polyester and glass grid.
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
 - .3 Mark top face with lines to ensure proper roll alignment.
 - .4 Characteristics:
 - .1 Membrane thickness: Minimum 3.0 mm.
 - .5 Basis-of-Design Product:
 - .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. 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: Non-woven polyester and glass grid.
 - .2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.

- .3 Protection: Coloured granules - colours selected by Contract Administrator. Allow for two colours. One field colour, and black at overflow scuppers.
- .2 Characteristics:
 - .1 Cold bending at minimum minus 18 degrees C: No cracking.
 - .2 Membrane thickness: Minimum 4 mm.
 - .3 ULC Class: A.
- .3 Basis-of-Design Product:
 - .1 Soprema; Sopraply Traffic Cap FR.
- .4 Vapour retarder: Self-adhesive membrane composed of SBS modified bitumen and a tri-laminated woven polyethylene facer; and release film on bottom.
 - .1 Basis-of-Design Product:
 - .1 Soprema; Soprapap'r.
- .5 Flexible flashing material: Same material as membrane.

2.5 DECK SHEATHING

- .1 Deck sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, 16 mm thick, Type X.

2.6 INSULATION

- .1 Polyisocyanurate (ISO) board insulation: Rigid cellular foam, complying with CAN/ULC S704.
 - .1 Classifications:
 - .1 Class 2, Type II: 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: 75 mm.
 - .4 Tapered board: Slope as indicated; minimum thickness 25 mm; fabricate of fewest layers possible.
 - .5 Board edges: Square.
 - .6 Basis-of-Design Product:
 - .1 Soprema; Sopra-Iso Plus.

2.7 ACCESSORIES

- .1 Complementary waterproofing products.
 - .1 Waterproofing mastic: Made of synthetic rubbers, plasticized with bitumen and solvents, aluminum pigments added to provide greater resistance to UV.
 - .1 Basis-of-Design Product:
 - .1 Soprema; Sopramastic ALU.
 - .2 Waterproofing sealant: Composed of a bitumen/polyurethane waterproofing mono-component and polyester reinforcements, designed to finish upstands

- and details.
- .1 Basis-of-Design Product:
 - .1 Soprema; Alsan Flashing.
- .2 Pre-cut tapered insulation for roof drains: Polyisocyanurate insulation with polymer-coated glass fibre facers for roof drains and sumps. Size: 2400 mm by 2400 mm.
 - .1 Basis-of-Design Products:
 - .1 Soprema; Sopra-Iso Plus Sump.
- .3 Base sheet panel joint tape: Manufacturer's recommended cover strip for sealing end joints in base sheet panels; 330 mm wide.
- .4 Deck sheathing fasteners: #14 Phillips head, self-tapping, cadmium plated, length for minimum 19 mm penetration through steel deck, with 50 mm dia. galvalume washers.
- .5 Insulation and base sheet panel adhesive: Bead-applied, low-rise, one-component or multicomponent urethane as recommended by roofing manufacturer, compatible with roofing materials.
- .6 Insulation fasteners: 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.
- .7 Sealants: As recommended by membrane manufacturer.
- .8 Galvanized sheet fastening bar: 25 mm high by 1.2 mm, continuous hot-dip Z275 zinc coated steel to ASTM A653/A653M, regular spangle surface.
- .9 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.
- .10 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 PROTECTION

- .1 Protect existing and completed portions of roof from traffic and damage. Place plywood runways over work to enable movement of material and other traffic.

3.3 METAL DECK PREPARATION

- .1 Install preformed acoustical glass fibre insulation strips in roof deck flutes. 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 wind uplift requirements.

3.4 VAPOUR RETARDER INSTALLATION - CONVENTIONAL APPLICATION

- .1 Self-adhesive air/vapour barrier: Apply to deck surface in accordance with roofing and air/vapour barrier manufacturers' instructions.
- .2 Extend air/vapour barrier over galvanized sheet transition strip and beyond edge of roof surface, and seal down exterior wall surface minimum 150 mm to tie into wall air/vapour barrier membrane.

3.5 INSULATION INSTALLATION - CONVENTIONAL APPLICATION

- .1 Ensure air/vapour barrier is clean and dry, continuous, and ready for application of roofing system.
- .2 Attachment of insulation:
 - .1 Adhere first layer of insulation in accordance with roofing manufacturer's instructions and to meet wind uplift requirements.
 - .2 Adhere subsequent layers of insulation with joints staggered minimum 150 mm from joints of preceding layer.
 - .3 Supplement adhesive with screw and plate fastening system if required at to meet wind uplift resistance requirements.
- .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 2400 mm.
- .6 Fill small gaps between roof insulation and roof parapets/curbs with compatible spray foam insulation. Apply spray foam to all layers of roof insulation, not just top layer. Trim spray foam flush with top of each roof insulation layer.

- .7 Do not apply more insulation than can be covered with membrane in same day.

3.6 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. Lap side joints. Tape end joints. Seal laps and ends in accordance with manufacturer's instructions.
 - .3 Install galvanized sheet fastening bar along perimeter at base of upstands, parapets, and curbs as detailed to continuously secure base sheet panel membrane. Fasten at 300 mm on-centre with galvanized fasteners.
 - .4 Install membrane gussets at every angle and on inside and outside corners after installing base sheet panel.
- .3 Apply base sheet stripping, cap sheet membrane, and cap sheet stripping. 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 over cant strips and 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 center.
- .7 Around roof penetrations, seal flanges and flashings with flexible flashing.
- .8 Install roofing expansion joints. Make joints watertight.
- .9 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.
- .10 Install cap sheet membrane on interior faces of prefinished metal scuppers. Colour of cap sheet to be selected by Contract Administrator to complement colour of prefinished metal scuppers.
- .11 Install complementary waterproofing products in accordance with manufacturer's written instructions and technical illustrations.

3.7 WORK ON EXISTING ROOFS

- .1 Protection:
 - .1 Provide protection of existing roofing system that is not having work performed on it.
 - .2 Provide temporary protection of uncovered deck surfaces.
- .2 Preparation:
 - .1 Coordinate with Contract Administrator or City to shut down air-intake equipment in the vicinity of the Work. Temporarily cover air-intake louvers before proceeding with re-roofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
 - .2 During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- .3 Material removal:
 - .1 Remove only existing roofing materials that can be replaced with new materials as the weather will permit.
 - .2 Cut back and remove portions of existing roof membrane, insulation, and vapour retarder, and flashing, where indicated, and as required, to allow for construction of new parapets.
 - .3 Notify Contract Administrator and City's building envelope commissioning agency (BECA) before start of removals.
- .4 Installation:
 - .1 Install vapour retarder, insulation, membranes and flashing as specified for new roof areas.

3.8 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, and Section 07 08 00 - Commissioning of Thermal and Moisture Protection for general requirements for site quality control and inspection.
- .2 Require site attendance of roofing material manufacturers daily during installation of the work.
- .3 Roof inspections will be carried out by a building envelope commissioning agency (BECA) retained and paid for by the City.
- .4 Inspections will be performed at start of work as well as periodically throughout duration of work to review material installation.
- .5 Co-ordinate and assist BECA with the performance of its duties by providing daily work schedule, and access to scaffolding, roof surfaces, on-site material storage, etc.
- .6 Presence of BECA does not alleviate roofing trade of quality control obligations.

3.9 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.

3.10 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

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Part 1 General

1.1 SECTION INCLUDES

- .1 Fabricated sheet metal items, including flashings, counterflashings, scuppers, foundation protection, and other items indicated in Schedule.
- .2 Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry: Wood nailers and backers for sheet metal work.
- .2 Section 07 08 00 - Commissioning of Thermal and Moisture Protection: Mock-up requirements.
- .3 Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.3 REFERENCE STANDARDS

- .1 AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.
- .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 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Indicate material profile and thickness, jointing pattern, jointing details, fastening methods, flashings, terminations, installation details, special conditions, and materials and methods used to isolate and protect incompatible materials.
- .3 Samples: Submit two samples 50 by 50 mm in size illustrating metal finish colour.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Fabricator's qualification statement.
- .6 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
- .2 Fabricator and installer qualifications: Company specializing in sheet metal work with five years of documented experience.

1.6 MOCK-UPS

- .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 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 Galvanized steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.61 mm thick base metal.
- .2 Pre-finished galvanized steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.76 mm thick base metal, shop pre-coated with modified silicone coating.
 - .1 Modified silicone polyester coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 - .2 Colours: As selected by Contract Administrator from manufacturer's standard colours.

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 longest possible lengths up to 3000 mm.
- .5 Hem exposed edges on underside 13 mm; mitre and seam corners.
- .6 Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- .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.
- .9 Fabricate flashings to allow toe to extend 50 mm over roofing. Return and brake edges.

2.4 SCUPPER FABRICATION

- .1 Fabricate 4-sided waterproof welded sheet metal scuppers of size and to details indicated, with spillout extending 50 mm beyond outside face of wall
- .2 Seal 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 Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- .4 Apply plastic cement compound between metal flashings and felt flashings.
- .5 Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- .6 Seal metal joints watertight.
- .7 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.
- .8 Install scuppers where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, and under roofing membrane.
 - .1 Waterproof scupper opening. Set flanges in bed of compatible sealant. Clean and prime tops of flanges to ensure proper adhesion of membrane flashing.
 - .2 Seal joints watertight.
- .9 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 Scuppers: Prefinished sheet steel, minimum 0.76 mm base steel thickness.
- .2 Coping, cap, parapet, sill, closure, and drip flashings: Prefinished sheet steel, minimum 0.76 mm base steel thickness.
- .3 Counterflashings at roofing terminations (over roofing base flashings), and curb-mounted roof items: Galvanized sheet steel, minimum 0.61 mm base steel thickness.
- .4 Roofing penetration flashings for pipes, structural steel, and equipment supports: Galvanized sheet steel, minimum 0.61 mm base steel thickness.
- .5 Foundation protection: Prefinished sheet steel flashing; 0.76 mm base steel thickness.
Colour: Black.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Manufactured standing seam metal panel system including exterior wall panels, panel support clips, and subgirt framing assembly, with related flashings and accessory components.

1.2 RELATED REQUIREMENTS

- .1 Section 05 40 00 - Cold Formed Metal 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 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, 2020

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 Subcontractors.
- .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, panel 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 Provide Shop Drawings stamped or sealed by design engineer.
- .4 Samples:
 - .1 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.
 - .2 Submit sample of parapet cap detail at top of wall illustrating connection to prefinished flashing.
- .5 Design data: Submit structural calculations stamped by design engineer, for Contract Administrator's review and project record.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Designer's qualification statement.
- .8 Installer's qualification statement.
- .9 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 Designer qualifications: Perform design by or 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 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, 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, and related insulation.
- .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 00 - Closeout Procedures and Submittals, for additional warranty requirements.
- .2 Correct defective work within a twenty year period after date of Substantial Performance for degradation of panel finish, including colour fading caused by exposure to weather.

Part 2 Products

2.1 STANDING SEAM METAL WALL PANELS

- .1 Wall panel system: Factory prefinished metal panel system, site assembled.
 - .1 Provide exterior wall panels, subgirt framing assembly, and panel support clips.
 - .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/vapour barrier membrane at building enclosure elements in accordance with materials specified in Section 07 25 00.

- .2 Exterior wall panels:
 - .1 Profile: Vertical; with two low ribs between standing seams.
 - .2 Side seams: Single-lock standing seam, integral, continuous overlapping suitable for continuous zipping or crimping by mechanical means.
 - .3 Material: Precoated steel sheet, 0.76 mm minimum base steel thickness.
 - .4 Panel depth: 38 mm.
 - .5 Panel width: 400 mm coverage.
 - .6 Panel height: Full length.
 - .7 Fabricate panels with hemmed top and bottom edges, and hemmed edges at openings, and penetrations through panels.
 - .8 Colour: Black.
 - .9 Basis-of-Design Products:
 - .1 Agway Metals; AR-38.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Panel support clips: Manufacturer's one- or two-piece reinforced polyamide, thermally-broken. Include both fixed clips, and clips allowing for movement.
- .4 Subgirt framing assembly:
 - .1 Minimum 1.9 mm thick, formed non-precoated steel sheet.
 - .2 Profile as indicated, perforated; to attach panel system to building framing.
- .5 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.
- .6 Expansion joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile to suit system.
- .7 Trim, closure pieces, caps, flashing, 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.

2.2 MATERIALS

- .1 Precoated steel sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
- .2 Non-precoated steel sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, SS Grade 33/230, with Z275 coating.
- .3 Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.
- .4 Insulation: Mineral wool type specified in Section 07 21 00.

2.3 FINISHES

- .1 Exposed surface finish: Panel manufacturer's standard siliconized polyester coating, top coat over epoxy primer.
- .2 Panel backside finish: Panel manufacturer's standard siliconized polyester wash coat.

2.4 ACCESSORIES

- .1 Cladding support system: See Section 07 05 43.
- .2 Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- .3 Exposed sealant: High performance hybrid as specified in Section 07 92 00.
- .4 Concealed sealants: Non-curing butyl sealant or tape sealant.
- .5 Fasteners: Manufacturer's standard type to suit application; steel, hot dip galvanized.
 - .1 Metal-to-metal fasteners: Self-drilling, self-tapping screws.
- .6 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 membrane has been installed over substrate.

3.2 PREPARATION

- .1 Install thermal clips securely fastened to substrates. Space at intervals indicated on reviewed Shop Drawings.
- .2 Install insulation between thermal clips in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 21 00.
- .3 Install subgirts, securely fastened to substrates and shimmed and leveled to uniform plane. Install in orientation and space at intervals indicated on reviewed Shop Drawings.

3.3 INSTALLATION

- .1 Install panels on walls in accordance with manufacturer's instructions, and reviewed Shop Drawings.
- .2 Anchor standing seam metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- .3 Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- .4 Fasten panels to supports; aligned, level, and plumb.

- .5 Flash and seal metal wall panels at perimeter of all openings. Install flashing and trim as metal wall panel work proceeds.
- .6 Use concealed fasteners unless otherwise approved by Contract Administrator.
- .7 Seal and place gaskets and closures to prevent weather penetration. Maintain neat appearance.
- .8 Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- .9 Joint sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
- .10 Provide trim, closure pieces, and flashing to prevent water penetration and direct moisture to exterior.
- .11 Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

3.4 TOLERANCES

- .1 Maximum offset from true alignment between adjacent members butting or in line: 1.6 mm.
- .2 Maximum variation from plane or location indicated on Drawings: 6.4 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 Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated or not, and other openings indicated, installed by a single firestop specialty subtrade for all firestopping in the Project.
- .2 Firestop devices.
- .3 Fill, void, and cavity materials.
- .4 Wall opening protective materials.
- .5 Packing materials.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Coordination for placement of cast-in-place firestop devices.
- .2 Section 04 20 00 - 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.
- .4 Division 21 - Fire Suppression.
- .5 Division 22 - Plumbing.
- .6 Division 23 - HVAC.
- .7 Division 25 - Integrated Automation.
- .8 Division 26 - Electrical.
- .9 Division 27 - Communications.
- .10 Division 28 - Electronic Safety and Security.

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 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .5 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials; 2014.
- .6 CAN/ULC S115 - Standard Method of Fire Tests of Firestop Systems; 2018.
- .7 CAN/ULC S702.1 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification; 2021.
- .8 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .9 FCIA - Firestop Contractors International Association; Current Edition.
- .10 IFC EJ Guidelines - Recommended International Firestop Council (IFC) Guidelines for Evaluating Firestop System Engineering Judgments; Current Edition.
- .11 SCS (CPD) - SCS Certified Products; Current Edition.
- .12 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- .13 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 instructions: Indicate preparation and installation instructions.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Warranty documentation.
- .8 Installer'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 (EFRR) from a firestopping manufacturer.
 - .2 EJ and EFRR 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 Trained by manufacturer.
 - .2 ULC (DIR) Qualified Firestop Contractor.
 - .3 FCIA Contractor Member in good standing for minimum two years.
 - .4 Documented to have completed not less than five comparable scale projects.
- .5 Firestopping material must have visibly labeled expiration or packaging date and must be within the manufacturer specified shelf life at time of installation. Installation of firestopping material past its specified shelf life is strictly prohibited and will be rejected. Contractor to verify shelf life with Contract Administrator prior to installation.

- .6 Verify on-site to Contract Administrator prior to firestopping installation on all phases of construction that firestopping material is not damaged or frozen or has not exceeded manufacturer's expiry date identified on product or packaging. All firestopping materials must be installed prior to expiration of shelf life.
- .7 Hold pre-installation meeting prior to commencement of firestop systems. Subcontractors that are affected, such as masonry, gypsum board/steel stud, mechanical and electrical Subcontractors to attend. Review standard installation procedures, scheduling/sequencing of other work around or that affects outcome of installation, precautions, annular opening sizes, wall/floor service single and multi - preparations, joints and perimeter joints to ensure that all Subcontractors and Contractor understand full complexity of firestop installation, based on reviewed Shop Drawings.

1.7 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control for additional requirements.
- .2 Mock-up a minimum of 25 percent of the proposed ULC or cUL system.
 - .1 If required, include work by other trades to provide required finish work, such as steel stud / gypsum board trade framing out multi-penetrations openings.
 - .2 Reviewed mock-ups become standard of workmanship and material against which installed work will be checked. Reviewed and approved mock-ups may be used in final construction.
 - .3 Once mock-ups have been completed and materials have had adequate time to properly cure, notify Contract Administrator to perform their review. Minimum 48 hours notice is required.

1.8 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.

1.9 SITE CONDITIONS

- .1 Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for minimum three days after installation of materials.
- .2 Provide ventilation in areas where solvent-cured materials are being installed.

1.10 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Manufacturer hereby warrants firestopping products to be free of manufacturing defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

- .2 Installation Subcontractor's Warranty: provide an extended warranty for Work of this Section for a period of two years from date of Substantial Performance of the Work. Contractor hereby warrants that firestopping will remain as installed, free from any defects and deficiencies, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the CAL (CDPH SM) or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 At least 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the equivalent programs listed above.
- .3 The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation. Insulation for HVAC ducts and plumbing piping are excluded.

2.2 MANUFACTURERS

- .1 Firestopping manufacturers:
 - .1 3M Fire Protection Products.
 - .2 HILTI, Inc..
 - .3 Specified Technologies, Inc.
 - .4 RectorSeal.
 - .5 Tremco Firestop Systems.
 - .6 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 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 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.

2.4 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.

2.5 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:
- .5 Intumescent composite sheet: Composite panel consisting of reinforced, intumescent laminate bonded to metallic sheet.
- .6 Intumescent spray mastics: Water-based, spray-in-place intumescent mastic sealant.
- .7 Wrap strip: Flexible intumescent strip.

2.6 WALL OPENING PROTECTIVE MATERIAL

- .1 Outlet box firestopping: Intumescent, mouldable putty pads, precut liners or gaskets designed to protect UL listed outlet boxes.

2.7 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 07 08 00 - Commissioning of Thermal and Moisture Protection
- .2 Section 07 25 00 - Weather Barriers: Sealants required in conjunction with air barriers and air/vapour barriers.
- .3 Section 07 26 16 - Below Grade Vapour Retarders: Sealants required in conjunction with crawlspace dampproofing membrane, and underslab vapour barriers.
- .4 Section 07 84 00 - Firestopping: Firestopping sealants.
- .5 Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
- .6 Section 08 80 00 - Glazing: Glazing sealants and accessories.
- .7 Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- .8 Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- .9 Section 23 31 00 - Duct Work: Duct sealants.

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 C1311 - Standard Specification for Solvent Release Sealants; 2022.
- .8 ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

- .9 ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2015 (Reapproved 2021).
- .10 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .11 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .12 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .13 SCS (CPD) - SCS Certified Products; Current Edition.
- .14 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

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.
 - .8 Certification by manufacturer indicating that product complies with specification requirements.
- .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 Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Preconstruction laboratory test reports: Submit at least four weeks prior to start of installation.
- .7 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 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 Allow sufficient time for testing to avoid delaying the work.
 - .4 Deliver to manufacturer sufficient samples for testing.
 - .5 Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 - .6 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.

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 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- .2 Correct defective work within a five year period after Date of Substantial Performance.
- .3 Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the CAL (CDPH SM) or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 Sealants: Complying with SCAQMD 1168.

2.2 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 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 Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - .2 Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - .3 Joints where installation of sealant is specified in another section.
 - .4 Joints between suspended panel ceilings/grid and walls.
- .2 Exterior joints: Use non-sag high-performance hybrid sealant, unless otherwise indicated.
 - .1 Lap joints in sheet metal fabrications: Butyl rubber, non-curing.
 - .2 Lap joints between manufactured metal panels: Butyl rubber, non-curing.
- .3 Interior joints: Use non-sag siliconized acrylic sealant, unless otherwise indicated.
 - .1 Joints between fixtures in wet areas and floors, walls, and ceilings: Mildew-resistant silicone sealant.
 - .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: Washrooms, kitchens, food service areas, and food preparation areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.3 JOINT SEALANTS - GENERAL

- .1 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.
- .2 Where sealants are qualified with primers use only those primers.
- .3 Colours: As indicated as selected by Contract Administrator.

2.4 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 Basis-of-Design Product:
 - .1 Sika; MasterSeal NP 100.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Mildew-resistant silicone sealant: ASTM C920, Grade NS, Uses M and A; single-component, mildew resistant; not expected to withstand continuous water immersion or traffic; low odour.
 - .1 Cure type: Single-component, neutral moisture curing.
 - .2 Basis-of-Design Product:
 - .1 Pecora; 898NST.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Siliconized acrylic latex: Water-based; ASTM C834, single-component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - .1 Basis-of-Design Products:
 - .1 Tremco Commercial Sealants & Waterproofing; Tremflex 834.
 - .2 Pecora; AC-20+ Silicone.
 - .3 Sika; MasterSeal NP 520.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the 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.

2.5 SELF-LEVELLING SEALANTS

- .1 Self-levelling polyurethane sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for 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: 12 mm.
- .4 Joint depth: Provide product suitable for joints from 3 mm to 51 mm in depth, or in accordance with manufacturer's instructions.

2.6 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 Joint cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- .4 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 Contract Administrator will perform field adhesion testing in the presence of and with the assistance of the Contractor in accordance with ASTM C1521. Testing will be completed throughout the course of the Work. The purpose of the field adhesion testing is to help detect application problems such as improper cleaning, use of improper primer, poor primer application, or improper joint configuration.
- .2 Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- .3 Repair destructive test location damage immediately after evaluation and recording of results by applying new sealant to test area. Assuming good adhesion was obtained, use the same application procedure to repair the area as was used originally for the joint. Ensure original sealant surface area is clean and new sealant is in contact with the original sealant.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Expansion joint cover assemblies for floor, wall, and ceiling surfaces.

1.2 RELATED REQUIREMENTS

- .1 Section 03 10 00 - Concrete Forming and Accessories: Block-out for joint cover assembly in formwork.
- .2 Section 09 21 16 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.3 REFERENCE STANDARDS

- .1 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- .2 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- .3 ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.
- .4 ITS (DIR) - Intertek Testing Services, Directory of Listed Products; current edition.
- .5 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Installation templates: For frames and anchors to be embedded in concrete or masonry, provide templates to relevant installers; include installation instructions and tolerances.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colours and finish.
- .3 Shop Drawings: Indicate joint and splice locations, mitres, layout of the work, affected adjacent construction and anchorage locations.
- .4 Samples: Submit two samples 75 mm long, illustrating colour of resilient gasket selected.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Manufacturer's installation instructions: Indicate rough-in sizes and required tolerances for item placement.

Part 2 Products

2.1 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

- .1 Interior floor joints subject to thermal movement:
 - .1 Basis-of-Design Products:
 - .1 Construction Specialties; GFT series.
 - .2 InPro Corporation; 101 Series.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Interior floor joints subject to high traffic:
 - .1 Basis-of-Design Products:
 - .1 Construction Specialties; APF series.
 - .2 InPro Corporation; 733 Series.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Interior wall/ceiling joints: Non-fire rated and fire-rated.
 - .1 Basis-of-Design Products:
 - .1 Construction Specialties; FWF-100 series.
 - .2 InPro Corporation; 101 Series.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.2 EXPANSION JOINT COVER ASSEMBLIES

- .1 Expansion joint cover assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - .1 Joint dimensions and configurations: As indicated on Drawings.
 - .2 Joint cover sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 - .3 Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 - .4 Anchors, fasteners, and fittings: Provided by cover manufacturer.
- .2 Floor joint covers: Coordinate with indicated floor coverings.
- .3 Floor joint covers with resilient seal: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering.
- .4 Sliding cover plate type covers: Provide plate with beveled edges and neat fit that does not collect dirt.

- .5 Covers in gypsum board assemblies: Provide style with anchoring wings that can be completely covered by joint compound.
- .6 Covers In fire rated assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
 - .1 Acceptable evaluation agencies: ULC (DIR) and ITS (DIR).

2.3 MATERIALS

- .1 Extruded aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
 - .1 Exposed finish at floors: Mill finish or natural anodized.
 - .2 Exposed finish at walls and ceilings: Mill finish or natural anodized.
- .2 Resilient seals:
 - .1 For walls: Thermoplastic rubber; flush.
 - .2 For pedestrian traffic applications: Thermoplastic rubber; no PVC; Shore A hardness of 60 to 65 Durometer.
 - .3 Colour: Selected by Contract Administrator from manufacturer's standard range.
- .3 Anchors and fasteners: As recommended by cover manufacturer.
- .4 Backing paint for aluminum components in contact with cementitious materials: Asphaltic type.
- .5 Fire barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.2 INSTALLATION

- .1 Install components and accessories in accordance with manufacturer's instructions.
- .2 Align work plumb and level, flush with adjacent surfaces.
- .3 Rigidly anchor to substrate to prevent misalignment.
- .4 Fire-resistance-rated assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
 - .1 Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.3 PROTECTION

- .1 Do not permit traffic over unprotected floor joint surfaces.
- .2 Provide strippable coating to protect finish surface.

END OF SECTION

DOOR & FRAME ABBREVIATIONS:					
ABBREV	DOOR & FRAME TYPE	SPEC NO	ABBREV	DOOR OPERATIONS	SPEC NO
AL	Aluminum Door	08 43 13	ADO	Automatic Door Operator - Surface Mount	08 71 13
AFS	Aluminum Framed Storefronts	08 43 13	CR	Card Reader (see Electrical)	
AES	Automatic Entrance System	08 42 29	DA	Double Acting	
CCD	Coiling Counter Door	08 33 13	DE	Double Egress	
CWS	Curtain Wall System	08 44 13	HO	Hold Open Device	08 71 00
FRRG	Fire Resistant Rated Glass	08 80 00	PR	Pair	
HM	Hollow Metal	08 11 13	RL	Relocated	
HMI	Hollow Metal, Insulated	08 11 13			
FAU	Floor Access Unit	08 31 00			
FPP-1	Folding Panel Partition	10 22 39			
FSG	Folding Security Grille (Sliding Metal Grilles)	08 11 74			
NFS	Non-Rated Fire Separation	-			
P	Paint	09 90 00			
PF	Prefinished				
WSPL	Wood Solid Plastic Laminate Finish (Flush Wood Doors)	08 41 16			
W	Wood				
X	Existing				
ABBREV	DOOR PROTECTION	SPEC NO			
KP-SS(A)	Stainless Kickplate, one side, 300 mm high.	08 71 00			
KP-SS(B)	Stainless Kickplate, two side, 300 mm high.	08 71 00			
KP-SS(C)	Stainless Kickplate, one side, 860 mm high.	08 71 00			

TYPICAL NOTES:	
1.	Typical levers to be Schlage ND with Everest cores Schlage C Keyway, and Von Duprin Panic bars, unless otherwise noted.
2.	Doors shall be 1000 mm wide unless otherwise noted.
3.	Doors shall be 2350 mm high unless otherwise noted.
4.	Doors shall be 45 mm thickness unless otherwise noted.
5.	Hollow Metal (HM / HMI) doors and frames shall receive paint finish unless otherwise noted. Interior door and frame to receive different paint colour.
6.	Colour to be determined by Contract Administrator.
7.	Door hardware shall be Black finish, unless otherwise noted.
8.	Install door frames 50 mm from adjacent perpendicular wall finish unless otherwise noted; for masonry walls install 100 mm unless otherwise noted.
9.	Kickplates, when indicated to be on one side of door, to be on push side, unless otherwise noted.
10.	Coordinate electrical requirements to door frames - refer to electrical drawings.
11.	HM frames shall wrap around wall type indicated (i.e. nominal throat dimension is equal to wall width, unless noted otherwise.)
12.	Set overhead door stop to maximum opening at all concealed door stops (verify with Contract Administrator before doors are prepared).
13.	Set overhead door stop to maximum opening at all concealed door stops (verify with Contract Administrator before doors are prepared).
13.	Refer to Drawing A4.4 for Door and Frame Styles. W# refers to aluminum frame assemblies.
14.	Where fire rating is identified for HM Doors and Frames, doors and frame to be Temperature Rise Rated, complete with Fire Resistant Rated Glass.

REMARKS:	
R1	Account for 5 additional card reader to be incorporated within existing doors.
R2	Frame and door height to match existing doors and frame heights along North wall in Hall.
R3	Site confirm existing door opening size.
R4	Confirm door can be operational with new floor finish in Hall.
R5	Door Frame sill to be at 300mm above crawlspace floor level.
R6	Door Frame height indicates full assembly height with operating mechanism, header, etc.
R7	Hardwood frame, painted. Refer to detail on A5.6.
R8	Salvage and reuse Card Reader and Automatic Door Operator. Reroute conduit runs to suit new work.
R9	Add kickplate to existing door. Contractor to confirm size, material, and rating of door.
R10	Door width expresses clear opening width when sliding doors are in open position, in normal sliding operation (not in breakaway mode).
R11	Modify door for temporary use as main entry to building. Add Automatic Door Operator. Confirm existing card reader functions.
R12	Door to receive 24" x 18" louver for ventilation.
R13	Existing Hollow Metal Door X115 to be salvaged and relocated to 1:06 Pool Storage, door to be painted. Provide new frame, painted.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
Drawing A1.1 Main Floor - Demolition Plan															
X - EAST CORRIDOR	X 1:00	X-900	X-2150	X	X-HMI	-	X-A		X-HMI	-	1		-	##	R11 Modify door for temporary main entry.
Drawing A2.0 Basement - Renovation Floor Plan															
CRAWLSPACE	0:01	1000	1200		HM	-	A		HM	-	2		45 MINS	01	R5 passage set
CRAWLSPACE	0:02	1000	1200		HM	-	A		HM	-	2		45 MINS	01	R5 passage set

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
Drawing A2.1 Main Floor - Renovation Floor Plan															
VESTIBULE 1:01 (Exterior)	1:01.1	PR1800	2350	-	AE	PF	G	-	AL	PF	W16	-	-	02	<p>R6, R10 Aluminum sliding door and hardware by supplier, proximity sensed for automatic operation, 2 way automatic during hours of operation / 1-way exit for after hours at reduced door opening, scheduled by access system for automated functions with building's hours of operation. On/Off key switch, recess mounted in jamb on interior side of frame to engage night mode which will disengage exterior motion sensors and engage lock. When switched off, unit reverts to free manual operation. Second key switch, recessed mounted in jamb on interior side of frame to override full open or half open operation. Door contacts to monitor if door is closed or if broken away. Exterior Card Reader provides signal to open the door half width for momentary access. Slider panel connected to Access Control to include an autolock to fail secure. No manual lock. All functions to be confirmed with City at time of programming. Includes locking devices for sidelites to prevent manual breakout from exterior.</p>

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
VESTIBULE 1:01 (Interior)	1:01.2	PR1800	2350	-	AE	PF	F	-	AL	PF	W20	-	-	02	R6, R10 Aluminum sliding door and hardware by supplier, proximity sensed for automatic operation, 2 way automatic during hours of operation / 1-way exit for after hours at reduced door opening, scheduled by access system for automated functions with building's hours of operation. On/Off key switch, recess mounted in jamb on interior side of frame to engage night mode which will disengage exterior motion sensors and engage lock. When switched off, unit reverts to free manual operation. Second key switch, recessed mounted in jamb on interior side of frame to override full open or half open operation. Door contacts to monitor if door is closed or if broken away.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
MULTIPURPOSE ROOM 1	1:03	1100	2350	45	HM	P	C		HM	P	3		45 MINS	03	Storeroom Lock with Exit Device, Card Reader, ADO with hold-open c/w separate toggle switch for hold-open. Hold-open on ADO to release upon fire alarm. Access Control Toggle switch near door to unlock/lock door. Actuator on Corridor side only electrified when door is unlocked via Access Control keyswitch or via valid credentials on Card Reader. Actuator on Room side always energized for egress. Always free egress.
MULTIPURPOSE ROOM 2	1:04	1100	2350	45	HM	P	C		HM	P	3		45 MINS	03	Storeroom Lock with Exit Device, Card Reader, ADO with hold-open c/w separate toggle switch for hold-open. Hold-open on ADO to release upon fire alarm. Access Control Toggle switch near door to unlock/lock door. Actuator on Corridor side only electrified when door is unlocked via Access Control keyswitch or via valid credentials on Card Reader. Actuator on Room side always energized for egress. Always free egress.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
STUDIO (Interior)	1:05	PR2000	2350	45	HM	P	C		HM	P	4		45 MINS	04	Storeroom Lock with Exit Devices, Card Reader, ADO with hold-open c/w separate toggle switch for hold-open. Hold-open on ADO to release upon fire alarm. Access Control Toggle switch near door to unlock/lock door. Actuator on Corridor side only electrified when door is unlocked via Access Control keyswitch or via valid credentials on Card Reader. Actuator on Room side always energized for egress. Always free egress.
STUDIO (Exterior)	1:05.1	1000	2350	45	AL	PF	G		CWS	PF	W8			35	Exit Device, emergency exit only. Free to egress at all times. Exit only, no entry.
POOL STORAGE	X1:06	X1100	X2150	X	XHM-RL	P	XA	X	HM	P	1			07	R13 New Hold Open Closer. Remainder of hardware to be salvaged from existing (storage room lock)
MPR STORAGE	1:06.1	1200	2350	45	HM	P	A	KP-SS(C)	HM	P	1			06	Storage Room Lock, Hold Open Closer

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
POOL VIEWING AREA (Corridor side)	1:07	1000	2350	45	HM	P	C		HM	P	6			08	Classroom Lock with Card Reader and ADO. Actuator on Corridor side only electrified when Classroom lock is retracted. Actuator on Room side always energized for egress. Always free egress.
POOL VIEWING AREA (Pool side)	1:07.1	1000	2350	45	AL	PF	F		AFS	PF	W19			36	Classroom lock with ADO. Door typically unlocked during hours of operation. Unlocked by Staff via key.
POOL DECK	1:08	1000	2150	45	HMI	P	A	KP-SS(A)	HMI	P	1			09	Emergency egress only, connected to fire alarm. Alarm will sound upon opening of door.
PUBLIC W/C	1:09	1000	2350	45	WSPL	PF	A	KP-SS(A)	HM	PF	1			10	ADO, passage set, Occupancy indicator light on corridor side, lit "push to lock" button on w/c side. Turning interior lever releases electric strike. Lock can be unlocked from outside, typically with a tool, if required. Fire Alarm releases power to strike: fail-safe.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
PUBLIC W/C	1:10	1000	2350	45	WSPL	PF	A	KP-SS(A)	HM	PF	1			10	ADO, passage set, Occupancy indicator light on corridor side, lit "push to lock" button on w/c side. Turning interior lever releases electric strike. Lock can be unlocked from outside, typically with a tool, if required. Fire Alarm releases power to strike: fail-safe.
SUPPORT SERVICES	1:12	1000	2350	45	WSPL	PF	D1	-	HM	P	7			11	Office Lock Lever Set, kick down hold-open.
ADMINISTRATION	1:13	1000	2350	45	WSPL	PF	D1	-	HM	P	8			11	Office Lock Lever Set, kick down hold-open.
RECEPTION	1:14	235	2350	45	WSPL	PF	A		WD	P	-			12	R7 Cylinder lock, keyed to building master system. Recessed D-pull (Black) and continuous hinge piano (Black) by Door Supplier.
RECEPTION	1.14.1	Refer to Floor Plan	2900	-	FSG	-	-	-	-	-	-			13	Cylinder lock, keyed both sides for main grille lock, keyed to building master system. Intermediate through bolts keyed on secured side. Allow for two.
COPY ROOM (Reception side)	1:15.1	1000	2350	45	WSPL	PF	D1	KP-SS(A)	HM	PF	1			14	Storeroom Lock with Card Reader.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
COPY ROOM (Lounge side)	1:15.2	1000	2350	45	WSPL	PF	B	KP-SS(A)	HM	PF	1			15	Passage set. Never locked.
EXECUTIVE DIRECTOR	1:16	1000	2350	45	WSPL	PF	D1	-	HM	P	8			16	Office Lock Lever Set
PROGRAM COORDINATOR	1:17	1000	2350	45	WSPL	PF	D1	-	HM	P	8			16	Office Lock Lever Set
SHARED OFFICE	1:18	1000	2350	45	WSPL	PF	D1	-	HM	P	8			16	Office Lock Lever Set
CLINIC	1:19	1000	2350	45	WSPL	PF	A		HM	PR	1			16	Office Lock Lever Set
CLINIC	1:20	1000	2350	45	WSPL	PF	A		HM	PF	1			16	Office Lock Lever Set
CORRIDOR	1:21	1000	2350	45	WSPL	PF	D1		HM	P	10			39	Classroom Lock with Card Reader.
IT CLOSET	1:21.1	900	2350	45	WSPL	PF	A		HM	P	1			37	R12 Storeroom Lever Set.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
MEMBERS LOUNGE	1:22	1000	2350	45	WSPL	PF	D1		HM	P	8			40	Classroom Lock with Card Reader and ADO with hold-open.
CLOSET	1:22.1	PR1200	2350	45	WSPL	PF	A		HM	PF	1			18	Passage set lever with roller latch on both doors
MULTI-PURPOSE ROOM 3	1:23.1	1100	2350	45	HM	P	G		HM	P	5	45 MINS	03	Storeroom Lock with Exit Device, Card Reader, ADO with hold-open c/w separate toggle switch for hold-open. Hold-open on ADO to release upon fire alarm. Access Control Toggle switch near door to unlock/lock door. Actuator on Corridor side only electrified when door is unlocked via Access Control keyswitch or via valid credentials on Card Reader. Actuator on Room side always energized for egress. Always free egress.	
MULTI-PURPOSE ROOM (to Hall)	1:23.2	1100	2150	45	HM	P	A		HM	P	1			17	Classroom Lock with ADO with hold open. ADO c/w keyswitch for activation. ADO hold open releases upon fire alarm. ADO Key switch to be located on Hall side.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
Accessible W/C	1:24	1000	2150	45	HM	PF	A	KP-SS(A)	HM	PF	1		10	ADO, passage set, Occupancy indicator light on corridor side, lit "push to lock" button on w/c side. Turning interior lever releases electric strike. Lock can be unlocked from outside, typically with a tool, if required. Fire Alarm releases power to strike: fail-safe.	
LAUNDRY	1:25	1000	2150	45	HM	PF	D	KP-SS(A)	HM	PF	1		14	Storeroom Lock with Card Reader.	
LAUNDRY FLOOR ACCESS HATCH DOOR	1:25.1	-	-	-	FAU	-	-	-					19	Coin Turn Latch by FAU	
STORAGE	1:26	1100	2150	45	HM	P	D	KP-SS(A)	HM	P	1		38	Storeroom Lever Set with Card Reader. Always access to exit, always keyed or Card Reader entry. Weather stripping required due to smudging activity in room.	
ELECTRICAL ROOM	1:27	1000	2150	45	HM	PF	A	KP-SS(A)	HM	P	1	45 MINS	14	Storeroom Lock with Card Reader.	

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
HALL	1:29	PR1800	2150	45	HM	P	C	KP-SS(A)	HM	P	1		45 MINS	22	R3, R8 Classroom Lock with Card Reader and ADO with hold-open. Card Reader and ADO to be salvaged from existing. Hold-open on ADO to release upon fire alarm. Card Reader swipe to unlock; swipe to lock. Corridor actuator only electrified when Classroom lock is retracted. Actuator on Room side always energized for egress. Always free egress. Card Reader and ADO to be salvaged from existing.
HALL	1:29.1	1000	2150	45	HMI	P	A	KP-SS(C)	HMI	P	1			09	Exit Device, emergency egress only, connected to fire alarm. Alarm will sound upon opening of door.
STORAGE 1:30A	X1:30.1	x	x	x	xHM	P	A	-	xHM	P	1			23	R4, existing storeroom lever set
STORAGE 1:30B	X1:30.2	x-PR	x	x	xHM	P	A	-	xHM	P	1			23	R4, existing storeroom lever set
CORRIDOR (from Hall)	1:31.1	PR1800	2150	45	HM	P	C	KP-SS(C)	HM	P	1			25	ADO both doors, hardware with push plate and D-pull

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
CORRIDOR (from Corridor 1:31 to Corridor 1:39)	1:31.2	1200	2150	45	HM	P	B	KP-SS(C)	HM	P	1		45 MINS	26	Storeroom Lever Set with Card Reader and ADO to access both sides. ADO with hold-open c/w separate toggle switch for hold-open on Corridor 1:39 side. Hold-open on ADO to release upon fire alarm. Door always locked, both sides. Card Reader energizes ADO actuators. Door releases upon fire alarm.
BARRIER-FREE WC STALL	1:32.2	1000	2150	45	HM	P	A	KP-SS(A)	HM	P	1			10	ADO, passage set, Occupancy indicator light on corridor side, lit "push to lock" button on w/c side. Turning interior lever releases electric strike. Lock can be unlocked from outside, typically with a tool, if required. Fire Alarm releases power to strike: fail-safe.
BARRIER-FREE WC STALL	1:32.3	1000	2150	45	HM	P	A	KP-SS(A)	HM	P	1			10	ADO, passage set, Occupancy indicator light on corridor side, lit "push to lock" button on w/c side. Turning interior lever releases electric strike. Lock can be unlocked from outside, typically with a tool, if required. Fire Alarm releases power to strike: fail-safe.
EQUIPMENT STORAGE	1:34	PR1800	2150	45	HM	P	A	KP-SS(C)	HM	P	1			05	Storeroom Lever Set with hold open closer.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
ELEC. ROOM	X1:34.1	X	X	X	X-HM	P	A	KP-SS(C)	HM	P	X		45 MINS	24	R9 No change to existing hardware set.
JANITORIAL ROOM	1:35	1200	2150	45	HM	P	A	KP-SS(C)	HM	P	1		0 MINS	28	R3 Storeroom Lever Set
STAFF ROOM	1:36	1000	2150	45	HM	P	B	KP-SS(A)	HM	P	1		45 MINS	29	Storeroom Lever Set with ADO and Card Reader. Always access to exit, always keyed or card reader entry. Card Reader energizes ADO actuator on corridor side. Room side actuator always enabled.
OFFICE	1:37	1000	2150	45	HM	P	B	KP-SS(A)	HM	P	1		45 MINS	30	Office lock with Card Reader.
CLASSROOM	X1:38	x	x	x	xHM	-	A	x	xHM	-	1		x-45min	31	Existing door and frame to be retrofitted with ADO. Hardware to be modified to maintain classroom lock function, with ADO complete with Hold Open. Hold Open releases upon fire alarm.
VESTIBULE (Interior)	1:40.1	1000	2400	45	HM	P	C	KP-SS(A)	HM	P	1			32	ADO with hold open, exit device with passage lever set on vestibule side. Always open.

ROOM NAME	DOOR NO	DOOR							FRAME				FIRE RATING	HDWR GROUP	REMARKS + FUNCTION
		WIDTH	HEIGHT	THICK	TYPE	FINISH	STYLE	PROT	TYPE	FINISH	STYLE	PROT			
VESTIBULE (Exterior)	1:40.2	1000	2400	45	HMI	P	E	KP-SS(A)	HMI	P	1			33	R16 Storeroom Lever Set with Exit Device. Free to egress at all times. Unlocked during hours of operation. Reinstall salvaged card access system. Card access, scheduled by facility. Door to remain locked after hours. ADO to be energized during hours of operation. After hours, card reader energizes exterior ADO. Interior ADO always energized.
CORRIDOR (East)	1:41	1000	2400	45	HMI	P	B	-	HMI	P	1			34	Exit Device, free to egress at all times. Exit only, no entry.
CORRIDOR (West)	1:42	1000	2400	45	HMI	P	B	-	HMI	P	1			34	Free to egress at all times. Exit only, no entry.

Part 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 42 29 – Automatic Entrances
- .3 Section 08 44 35 – Fire-Resistive Framed Glazing Assemblies
- .4 Section 08 44 13 – Glazed Aluminum Curtain Walls
- .5 Section 08 51 13 – Aluminum Windows
- .6 Section 08 80 00 – Glazing

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Building Envelope Commissioning Authority, on behalf of the The City.
- .3 Co-ordinate visual review and testing frequency and locations with Building Envelope Commissioning Authority to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .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 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.
- .2 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 General Requirements.
- .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 Construction Manager, 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 08 11 13 – Hollow Metal Doors and Frames
 - .2 Section 08 42 29 – Automatic Entrances
 - .3 Section 08 44 35 – Fire-Resistive Framed Glazing Assemblies
 - .4 Section 08 44 13 – Glazed Aluminum Curtain Walls
 - .5 Section 08 51 13 – Aluminum Windows
 - .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 42 29 – Automatic Entrances
 - .3 Section 08 44 35 – Fire-Resistive Framed Glazing Assemblies
 - .4 Section 08 44 13 – Glazed Aluminum Curtain Walls

- .5 Section 08 51 13 – Aluminum Windows
- .6 Section 08 80 00 – Glazing

.6 Qualification Statements:

- .1 Submit proof of Testing Agency qualifications for review and acceptance:
 - .1 Proof of ISO 17025:2005 accreditation.
 - .2 Minimum five projects completed in last five years demonstrating experience in air leakage testing and water penetration testing of glazed aluminum curtain walls and aluminum windows in accordance with standards specified in this section.

1.7 TESTING AGENCY

- .1 Testing Agency:
 - .1 Third-party accredited testing laboratory.
 - .2 Accredited to ISO 17025:2005, General requirements for the competence of testing and calibration laboratories.

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 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of openings:
 - .1 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the openings including thermal and moisture protection components.
 - .2 Provide a minimum seventy-two (72) hours' notice for openings 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 openings including thermal and moisture protection components may be periodically completed at the discretion of the Building Envelope Commissioning Authority.
Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 HOLLOW METAL DOORS AND FRAMES

- .1 Provide a mock-up of hollow metal doors and frames at a location 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.
 - .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 AUTOMATIC ENTRANCES

- .1 Provide a mock-up of automatic entrances at a location 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.
 - .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 FIRE-RESISTIVE FRAMED GLAZING ASSEMBLIES

- .1 Provide a mock-up of fire-resistive framed glazing assemblies at a location 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.
 - .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.

3.4 GLAZED ALUMINUM CURTAIN WALLS

- .1 Provide a mock-up of glazed aluminum curtain walls at a location identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-up to be at least two (2) bays wide, full-height, and capturing both vertical and horizontal mullions, jambs, head, and sill conditions.
- .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:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 ASTM E1105 or 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 Uniform method.
 - .3 Include the rough opening.
 - .2 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization or depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Test pressure in accordance with:
 - .1 Section 08 44 13.
 - .4 Frequency of Testing:
 - .1 One (1) during mock-ups.
 - .4 Testing: Functional performance:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under 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.
- .2 Test pressure in accordance with:
 - .1 Section 08 44 13.
- .3 Frequency of Testing:
 - .1 One (1) full day of testing covering as much area as possible.

3.5 ALUMINUM WINDOWS

- .1 Provide mock-ups of fiberglass windows at locations 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 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.
 - .2 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.
- .3 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization or depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .4 Test pressure in accordance with:
 - .1 Section 08 51 13.
 - .5 Frequency of Testing:
 - .1 One (1) during Mock-ups.
 - .2 One (1) additional unit randomly selected during remainder of installation.

3.6 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 The City for repairs or testing.

3.7 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports withing 5 working days following field observations and testing.

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 Hollow metal borrowed lites glazing frames.

1.2 RELATED REQUIREMENTS

- .1 Section 08 71 00 - Door Hardware.
- .2 Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- .3 Section 09 91 00 - Painting: Site painting.

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 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 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .5 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies; 2010.
- .6 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .7 CSDMA Commercial Steel Doors and Frames - Canadian Steel Door Manufacturers Association Commercial Steel Doors and Frames Recommended Specification; 2009.
- .8 CSDMA Storage and Installation Guide - Guide Specification for Installation and Storage of Hollow Metal Doors and Frames; 2012.
- .9 ITS (DIR) - Intertek Testing Services, Directory of Listed Products; current edition.
- .10 NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- .11 SCS (CPD) - SCS Certified Products; Current Edition.
- .12 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- .13 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.4 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 Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's qualification statement.
- .6 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- .2 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.
- .3 Installer qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- .4 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 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.
 - .2 At oversize openings: Unclassified as to fire rating.
- .5 Maintain at project site copies of reference standards relating to installation of products specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Provide protection during transit and site storage to prevent distortion or indentation, and additional protection required to prevent damage to finish of doors and frames and as follows:
 - .1 Minor damages may be repaired provided refinished items match new work and are acceptable to the Contract Administrator.
 - .2 Remove and replace damaged items that cannot be repaired as directed by the Contract Administrator, at no additional cost to the City.
- .2 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 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 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,

- .2 Commercial Steel (CS) Type B for each.
- .2 Exterior door top closures: Flush end closure channel, with top and door faces aligned.
- .3 Typical door face sheets: Flush.
- .4 Glazed lights: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings. Style: Manufacturers standard.
- .5 Zinc coating for typical interior and exterior locations: Provide metal components 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 crawlspace: 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.

2.3 HOLLOW METAL DOORS

- .1 Door finish: Factory galvannealed, and site painted.
- .2 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; 45 mm thickness of types and sizes indicated in Door, and Frame Schedule on Drawings, and as follows:
 - .1 Fabricate door faces of all 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.
- .3 Type HMI , Exterior doors: Thermally insulated.
 - .1 Face thickness: Minimum 1.30 mm.
 - .2 Insulation stiffened core: Insulated and sound deadened with polystyrene or polyisocyanurate at choice of manufacturer, 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 Door thermal resistance: RSI-Value of 1.94.
 - .5 Weatherstripping: Refer to Section 08 71 00.
- .4 Type HM , 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.
- .5 Type HM , 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 1.30 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.
 - .4 Fire rating: As indicated on Door Schedule, tested in accordance with CAN/ULC S104.
 - .5 Temperature-Rise Rating (TRR) across door thickness: In accordance with local building code and authorities having jurisdiction.
 - .6 Provide units listed and labeled by ULC (DIR) or ITS (DIR).
 - .1 Attach fire rating label to each fire rated unit.

2.4 HOLLOW METAL FRAMES

- .1 Comply with standards or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- .2 Frame finish: Same as hollow metal door.
- .3 Frame profile for interior openings:
 - .1 Gypsum board partitions: Double rabbet with backbend.
 - .2 Masonry partitions: Wrap around unless otherwise indicated.
- .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: Knock-down 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 Borrowed lites glazing frames: Construction and face dimensions to match door frames, and as indicated on Drawings.
- .9 Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- .10 Frames in masonry walls: Size to suit masonry coursing with head member 100 mm high to fill opening without cutting masonry units, unless otherwise indicated.

- .11 Frames wider than 1220 mm: Reinforce with steel channel fitted tightly into frame head, flush with top.
- .12 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.
- .13 Frames installed back-to-back: Reinforce with steel channels anchored to floor and overhead structure.

2.5 REINFORCEMENT

- .1 Hardware reinforcement: Cold or hot rolled steel, galvanized 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.

2.6 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.

2.7 ACCESSORIES

- .1 Glazing: As specified in Section 08 80 00.
- .2 Removable stops: Formed sheet steel, shape as indicated on Drawings, mitred or butted corners; prepared for countersink style tamper proof screws.
- .3 Grout for Frames: Portland cement grout with maximum 100 mm slump for hand troweling; thinner pumpable grout is prohibited.
- .4 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.

- .5 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 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.
 - .6 Securely attach floor anchors to inside of each jamb profile.
- .6 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 Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- .5 Install door hardware as specified in Section 08 71 00.
- .6 Comply with glazing installation requirements of Section 08 80 00.
- .7 Coordinate installation of electrical connections to electrical hardware items.
- .8 Touch up damaged galvanized 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 Sliding metal grilles, referred to on the Drawings as "FSG".

1.2 RELATED REQUIREMENTS

- .1 Section 08 14 16 - Flush Wood Doors: Pocket door.
- .2 Section 08 71 00 - Door Hardware: Cylinder cores and keys.
- .3 Section 09 21 16 - Gypsum Board Assemblies: Metal stud wall framing.

1.3 REFERENCE STANDARDS

- .1 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- .2 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide manufacturer's data sheets for specified project systems.
- .3 Shop Drawings: Indicate detailed plans, sections, elevations, required clearances and accessories, and installation instructions.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

Part 2 Products

2.1 COMPONENTS

- .1 Body style: Standard body.
- .2 Sliding grille panel material: Sliding open with staggered rod link grilles.
- .3 Sliding metal grilles:
 - .1 Grille panel width: 125 to 178 mm wide.
 - .2 Grille panel height: As indicated on Drawings.
 - .3 Top and bottom plates: Manufacturer's standard height top and bottom plate consisting of truss-like aluminum.

-
- .4 Grille in-fill panels: Open.
 - .5 Rod link grille panel connectors: Manufacturer's standard.
 - .6 Overhead track: Extruded aluminum, 35 mm wide by 44 mm high with flush seamed profile, and carrying 29 mm diameter nylon trolley wheels.
 - .1 Mounting: As indicated on Drawings.
 - .2 Layout: As indicated on Drawings.
 - .7 Basis-of-Design Products:
 - .1 Amstel; Classic AS600, brick pattern.
 - .2 Dynaflair Corporation; S-126.
 - .3 MobilFlex; S-126 System Brick Pattern.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Pockets:
 - .1 Provide for at least 25 mm up or down height adjustment in pocket assembly.
 - .2 Pocket door: Solid core flush wood door specified in Section 08 14 16.
 - .5 Wall channels: Provide full-height extruded aluminum channel permanently anchored to wall that lead post will fit and lock into.
 - .6 Lead posts: First post of sliding metal grille that extends across the opening and into wall channel.
 - .1 Hardware: Provide with hook-bolt latch that secures post into wall channel with interior and exterior keyed cylinder lock.
 - .7 Intermediate posts: Provide for full-height grilles located at least 3 m on centre, and located on or near centre of curves.
 - .1 Hardware: Provide with spring-loaded drop-bolt and floor socket with keyed cylinder lock on secure side.
 - .8 Traveling end posts: Last post of grille that travels to the front of the pocket when grille is fully extended across opening. Top of post self-locks into track header stopper, and bottom of post engages "V" Stop on inside of pocket.
 - .9 Top and bottom locking posts: Provide the following on "Lead Posts".
 - .1 Spring-loaded bottom drop-bolt and floor socket, and top-lift bolt that protrudes into track, with interior and exterior keyed cylinder lock.
 - .10 Operation:
 - .1 Manual push-pull operation.
 - .11 Lock hardware:
 - .1 Cylindrical locking mechanism: Keyed lock cylinder, specified in Section 08 71 00.
 - .2 Drop-bolt and floor sockets: Manufacturer's standard, 45 mm long.

2.2 MATERIALS

- .1 Extruded aluminum: ASTM B221M.

2.3 FINISHES

- .1 Natural anodized finish: Clear anodic coating; AAMA 611 AA-M12C22A31 Class II, minimum thickness 0.0102 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

- .1 Install sliding metal grille unit assembly in accordance with manufacturer's instructions.
- .2 Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- .3 Securely and rigidly brace components suspended from structure.
- .4 Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- .5 Interface with other related work as necessary for proper installation of this Work.

3.3 TOLERANCES

- .1 Maintain dimensional tolerances and alignment with adjacent work.
- .2 Maximum variation from plumb: 1.5 mm.
- .3 Maximum variation from level: 1.5 mm.
- .4 Longitudinal or diagonal warp: Plus or minus 3 mm per 3 m straight edge.

3.4 ADJUSTING

- .1 Adjust grille, hardware and operating assemblies for smooth and proper operation.

3.5 CLEANING

- .1 Clean grille and components with materials as recommended by manufacturer.
- .2 Remove labels and visible markings.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Flush wood doors; flush and flush glazed configuration; non-rated.

1.2 RELATED REQUIREMENTS

- .1 Section 08 11 13 - Hollow Metal Doors and Frames.
- .2 Section 08 71 01 - Door Hardware Sets.
- .3 Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

- .1 AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, Canada Version 4.0; 2021.
- .2 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- .3 NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- .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 face, core and edge materials, and construction.
- .3 Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - .1 Provide information as required by AWMAC/WI (NAAWS).
- .4 Samples: Submit two samples of door construction, 300 by 300 mm in size cut from top corner of door, complete with specified face finish, and edge construction.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Manufacturer's qualification statement.
- .7 Installer's qualification statement.
- .8 Specimen warranty.
- .9 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 specified quality standard.
- .2 Accept doors on site in manufacturer's packaging. Inspect for damage.
- .3 Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.7 WARRANTY

- .1 See Section 01 78 00 - 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 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all composite wood, by cost or surface area, shall have low-formaldehyde emissions that meet the Composite Wood Products Regulations CARB (ATCM) for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or contain no added formaldehyde resins. Composite wood and agrifibre products include:
 - .1 Particleboard
 - .2 Medium density fibreboard (MDF)
 - .3 Plywood
 - .4 Wheatboard
 - .5 Strawboard
 - .6 Panel substrate
 - .7 Door cores

2.2 DOORS

- .1 Doors: Refer to Drawings for locations and additional requirements.
 - .1 Quality standard: Custom Grade, Heavy Duty performance, in accordance with AWMAC/WI (NAAWS) or WDMA I.S. 1A.
 - .2 High pressure decorative laminate faced doors: 5-ply unless otherwise indicated.
- .2 Interior doors: 44 mm thick unless otherwise indicated; flush construction.
 - .1 Provide solid core doors at each location.
 - .2 High pressure decorative laminate finish.

2.3 DOOR AND PANEL CORES

- .1 General:
 - .1 Provide wood products and laminating adhesives containing no added urea-formaldehyde or resins containing urea-formaldehyde.
- .2 Non-rated solid core doors: Type particleboard core (PC), plies and faces as indicated.

2.4 DOOR FACINGS

- .1 High pressure decorative laminate facing for non-fire-rated doors: NEMA LD 3, HGS; colour as selected; finish as selected by Contract Administrator from manufacturer's full range.
- .2 Cross banding behind high pressure laminate finish: 1 ply; of manufacturer's standard composite material.
- .3 Facing adhesive: Type I - waterproof.

2.5 DOOR CONSTRUCTION

- .1 Fabricate doors in accordance with door quality standard specified.
- .2 Cores constructed with stiles and rails:
 - .1 Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - .2 Provide solid blocking for other through-bolted hardware.
 - .3 Door edge: Type A AWMAC/WI (NAAWS).
- .3 Glazed openings: Non-removable stops on non-secure side; sizes and configurations as indicated on Drawings.
- .4 Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- .5 Factory fit doors for frame opening dimensions identified on Shop Drawings, with edge clearances in accordance with specified quality standard.
- .6 Provide edge clearances in accordance with the quality standard specified.

2.6 FACTORY FINISHING - DOOR EDGES

- .1 Factory finish door edges in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - .1 Transparent:
 - .1 System - 5, Varnish, Conversion.
 - .2 Stain: As selected by Contract Administrator to match door face.
 - .3 Sheen: Flat.

2.7 ACCESSORIES

- .1 Hollow metal door frames: As specified in Section 08 11 13.
- .2 Glazing: As specified in Section 08 80 00.

- .3 Glazing stops: Flush wood stained to match high pressure laminate, mitered corners.
- .4 Door hardware: As specified in Section 08 71 01 - Door Hardware Sets.

Part 3 Execution

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.
- .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.
- .5 Coordinate installation of glazing.

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 Adjust closers for full closure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Wall and ceiling access door and frame units.
- .2 Floor access door and frame units, interior.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Openings in precast concrete.
- .2 Section 07 05 53 - Fire and Smoke Assembly Identification.
- .3 Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions.
- .4 Section 09 91 00 - Painting: Site paint finish.

1.3 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 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies; 2010.
- .3 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .4 ITS (DIR) - Intertek Testing Services, Directory of Listed Products; current edition.
- .5 NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- .6 SCS (CPD) - SCS Certified Products; Current Edition.
- .7 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- .8 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 floor access door.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's installation instructions: Indicate installation requirements and rough-in dimensions.
- .6 Manufacturer's qualification statement.

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 and Section 07 05 53.
- .2 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

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.
 - .2 Size:
 - .1 Hand entry: 305 mm by 305 mm.
 - .2 Body entry: 610 mm by 610 mm.

- .3 Style: Exposed frame with door surface flush with frame surface.
 - .1 Gypsum board mounting criteria: Use drywall bead type frame.
- .4 Door style: Single thickness with rolled or turned in edges.
- .5 Frames: 1.52 mm, minimum thickness.
- .6 Single steel sheet door panels: 1.6 mm, minimum thickness.
- .7 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.
- .8 Steel finish: Primed, for site painting.
- .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 Latch/lock: Screw driver slot for quarter turn cam latch.
 - .4 Number of locks/latches required: As recommended by manufacturer for size of unit.

2.3 FLOOR ACCESS UNITS

- .1 Interior floor access unit - Door 1:06.1: Aluminum, minimum 6 mm thick, single-leaf.
 - .1 Design load: Design to support minimum live load of 14 kPa with deflection not to exceed 1/150 of span.
 - .2 Operation: Manual opening, and manual closing.
 - .3 Size: 915 mm by 3000 mm, nominal. Confirm exact size with Contract Administrator.
 - .4 Cover pattern: Diamond tread plate.
 - .5 Frame: Extruded aluminum, with coating applied to exterior of frame that comes in contact with concrete.
 - .6 Latch: Stainless steel slam latch with inside lever handle, and screw driver slot for quarter turn cam lock on outside.
 - .7 Finish: Mill finish.
 - .8 Drain coupling: 38 mm dia.
 - .9 Hardware:
 - .1 Hinges: Heavy forged Type 316 stainless steel hinges, each having a minimum 6 mm diameter Type 316 stainless steel hinge pins.
 - .2 Hold-open arm: Automatic hold open arm that automatically locks the cover in the open position.
 - .3 Compression spring operators: Type 316 stainless steel, designed to provide lift assistance; cover fitted with required number and size of operators.
 - .4 Slam latch: Type 316 stainless steel slam latch with fixed handle mounted on the underside of cover.
- .10 Basis-of-Design Products:
 - .1 Acudor Products Inc; Acudor FC-300.
 - .2 The Bilco Company; J-AL.
 - .3 Babcock Davis; BFDDP Drainable Floor Door.

-
- .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Interior floor access unit - Door 1:25.1: Aluminum, minimum 6 mm thick, single-leaf.
 - .1 Design load: Design to support minimum live load of 7.2 kPa with deflection not to exceed 1/180 of span.
 - .2 Operation: Manual opening, and manual closing, with automatic hold open arm to allow panel to open to 90 degrees, locking door in open position, and allowing for easy control when closing door panel.
 - .3 Size: 915 mm by 915 mm, nominal.
 - .4 Cover: 3 mm deep recess for finish flooring, with edge moulding.
 - .5 Frame: Extruded aluminum, with coating applied to exterior of frame that comes in contact with concrete.
 - .6 Hardware:
 - .1 Hinges: Heavy forged Type 316 stainless steel hinges, each having a minimum 6 mm diameter Type 316 stainless steel hinge pins.
 - .2 Hold-open arm: Automatic hold open arm that automatically locks the cover in the open position.
 - .3 Compression spring operators: Type 316 stainless steel, designed to provide lift assistance; cover fitted with required number and size of operators.
 - .4 Slam latch: Type 316 stainless steel slam latch with fixed handle mounted on the underside of cover.
 - .7 Finish: Mill finish.
 - .8 Safety accessories: Telescoping safety post.
 - .9 Basis-of-Design Products:
 - .1 Acudor Products Inc; Acudor FT-8040, with telescoping safety post.
 - .2 The Bilco Company; Type T Floor Access Door, with telescoping safety post.
 - .3 Babcock Davis; BFDRPA 1/8 inch Pan Architectural Floor Door, with telescoping safety post.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 SAFETY ACCESSORIES

- .1 Telescoping safety post: Floor hatch manufacturer's standard device for attachment to 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 floor.
 - .3 Material: Aluminum.
 - .4 Post: Square tubing.
 - .5 Finish: Mill.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that rough openings are correctly sized and located.

3.2 PREPARATION

- .1 Clean surfaces thoroughly prior to proceeding with this work.
- .2 Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 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

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Part 1 General

1.1 SECTION INCLUDES

- .1 Non-fire-rated coiling counter doors and operating hardware.
- .2 Fire-rated coiling counter doors and operating hardware.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Rough openings.
- .2 Section 26 05 33 - Conduit: Conduit from fire alarm system.
- .3 Section 28 46 00 - Fire Alarm: Fire alarm interconnection.

1.3 REFERENCE STANDARDS

- .1 ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- .2 ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- .3 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- .4 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- .5 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .6 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .7 NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- .8 SCS (CPD) - SCS Certified Products; Current Edition.
- .9 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Submit manufacturer's standard literature showing materials and details of construction and finish; include data on fire and smoke protection, and connection to fire alarm system.
- .3 Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.
- .4 Samples: Submit two slats, 100 mm long, illustrating shape, colour and finish texture.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.

- .6 Manufacturer's instructions: Indicate installation sequence and installation, adjustment, and alignment procedures, and fire alarm system connection requirements.
- .7 Installer's qualification statement.
- .8 Warranty documentation.
- .9 Operation and maintenance data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.
- .10 Project Record Documents: Include as-built electrical diagrams for connection to fire alarm system.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

- .1 Manufacturer's Product Warranty: Provide an extended warranty for Work of this Section for a period of two years from date of Substantial Performance of the Work. Manufacturer hereby warrants overhead coiling counter doors to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.

- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 COILING COUNTER DOORS

- .1 Coiling counter doors, non-fire-rated: Aluminum slat curtain.
 - .1 Mounting: As indicated on Drawings.
 - .2 Nominal slat size: 38 mm wide.
 - .3 Slat profile: Flat.
 - .4 Finish, aluminum: Powder-coated.
 - .5 Colour: As selected by Contract Administrator from manufacturer's full range.
 - .6 Guides: Formed track; same material and finish unless otherwise indicated.
 - .7 Hood enclosure: Square; aluminum, powder-coated to match slats.
 - .8 Manual hand crank lift operation, with removable pole, and hook.
 - .9 Locking devices: Slide bolt on coil side of bottom bar at each jamb extending into slots in guides; padlockable.
 - .10 Basis-of-Design Products:
 - .1 Cookson; Model ESC10 with SpectraShield powder coat finish.
 - .2 Overhead Door Series 652, with PowderGuard Premium powder coat finish.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Coiling counter doors, fire-rated: Galvanized steel slat curtain.
 - .1 Mounting: As indicated on Drawings.
 - .2 Fire rating: As indicated on the Drawings; comply with NFPA 80.
 - .3 Nominal slat size: 38 mm wide.
 - .4 Slat profile: Flat.
 - .5 Finish, Galvanized steel: Factory powder coated.
 - .6 Colour: As selected by Contract Administrator from manufacturer's full colours.
 - .7 Guides: Formed track; same material and finish unless otherwise indicated.
 - .8 Hood enclosure: Square, galvanized steel; powder-coated to match slats.
 - .9 Smoke seals: Equip each fire-rated coiling counter door with smoke-seal perimeter gaskets and bottom bar seal for smoke and draft control as required for door listing and labeling by a qualified testing agency.
 - .10 Coiling door release mechanism: Fire alarm system activated with automatically governed closing speed.
 - .11 Manual hand crank lift operation, with removable pole, and hook.
 - .12 Locking devices: Slide bolt on coil side of bottom bar at each jamb extending into slots in guides; padlockable.
 - .13 Basis-of-Design Product:
 - .1 The Cookson Company; ERC11 SmokeShield Fire Doors with AlarmGard Door Closing System and SmokeShield UL leakage rated assembly label.

- .2 Overhead Door Series 640 with Fire Sentinel closing system, with PowderGuard Premium powder coat finish.
- .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 MATERIALS

- .1 Curtain construction: Interlocking, single thickness slats.
 - .1 Slat ends: Alternative slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - .2 Curtain bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 - .3 Steel slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 1.5 mm.
 - .4 Aluminum slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063; minimum thickness 1.3 mm.
- .2 Guide construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
 - .1 Guides for galvanized curtains: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A123/A123M.
 - .2 Aluminum guides: Extruded aluminum channel, with wool pile runners along inside; powder-coated to match slats.
- .3 Hood enclosure: Internally reinforced to maintain rigidity and shape.
- .4 Lock hardware:
 - .1 Slide bolt: Provide on both-jamb sides, extending into slot in guides.
- .5 Roller shaft counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 10 kg nominal force to operate.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

- .1 Install units in accordance with manufacturer's instructions.
- .2 Install fire-rated doors in accordance with NFPA 80.
- .3 Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- .4 Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

- .5 Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- .6 Complete wiring from fire alarm system .

3.3 TOLERANCES

- .1 Maintain dimensional tolerances and alignment with adjacent work.
- .2 Maximum variation from plumb: 1.5 mm.
- .3 Maximum variation from level: 1.5 mm.
- .4 Longitudinal or diagonal warp: Plus or minus 3 mm per 3 m straight edge.

3.4 MANUFACTURER SERVICES

- .1 Engage a factory-authorized service representative to perform start-up service.
 - .1 Perform installation and start-up checks according to manufacturer's written instructions.
 - .2 Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - .3 Drop test each fire rated coiling counter door closing. Reset door-closing mechanism after successful test.

3.5 ADJUSTING

- .1 Adjust operating assemblies for smooth and noiseless operation.

3.6 CLEANING

- .1 Clean installed components.
- .2 Remove labels and visible markings.

3.7 DEMONSTRATION

- .1 Engage a factory-authorized service representative to train the City's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Exterior and interior packaged power-operated door assemblies of following types:
 - .1 Bi-parting sliding type.
- .2 Controllers, actuators and safety devices.

1.2 RELATED REQUIREMENTS

- .1 Section 08 44 13 - Glazed Aluminum Curtain Wall.
- .2 Section 08 71 13 - Automatic Door Operators: Operators for swing doors.
- .3 Section 08 08 00 - Commissioning of Openings.
- .4 Section 08 80 00 - Glazing: Materials and installation requirements of glazing for automatic entrances.
- .5 Section 26 05 80 - Equipment Wiring: Power to disconnect.
- .6 Section 28 16 00 - Access Control and Intrusion Detection - Combined: Connection to access control system; access control devices.

1.3 DEFINITIONS

- .1 AAADM - American Association of Automatic Door Manufacturers.

1.4 REFERENCE STANDARDS

- .1 AAMA 701/702 - Combined Voluntary Specifications for Pile Weatherstrip and Replaceable Fenestration Weatherseals; 2011.
- .2 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).
- .3 BHMA A156.10 - American National Standard for Power Operated Pedestrian Doors; 2017.
- .4 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .5 CAN/CGSB 69.26 - Power-Operated Pedestrian Doors; 1996.
- .6 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .7 City of Winnipeg Accessibility Design Standards - City of Winnipeg Accessibility Design Standards; 2018.
- .8 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations; 2021.
- .9 MBC - Manitoba Building Code - MBC - M.R. 78/2023; 2024.

- .10 SCS (CPD) - SCS Certified Products; Current Edition.
- .11 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- .12 UL 305 - Standard for Panic Hardware; Current Edition, Including All Revisions.
- .13 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Electrical systems roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies, and access-control system.
 - .2 Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
 - .3 System integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.
 - .1 Provide electrical interface control capability for activation of sliding automatic entrances by security access system on doors with electric locking.
 - .2 Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.6 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
 - .2 Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.
 - .3 Indicate glazing materials and thickness.
- .3 Product data: Provide data on system components, sizes, features, and finishes.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.
- .6 Manufacturer's qualification statement.
- .7 Installer's qualification statement.
- .8 Warranty documentation.

- .9 Project record documents: Record actual locations of concealed equipment, services, and conduit.
- .10 Maintenance data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.
- .11 Site quality control submittals:
 - .1 Submit completed AAADM recommended inspection forms after installation of automatic door equipment.
 - .2 Provide AAADM 'Safety Information' sticker at inside face of mullion for doors operated by barrier free equipment and automatic door operators. Ensure sticker shows step by step safety check required at start-up.
- .12 Warranty: Submit manufacturer warranty and ensure that forms have been completed in City's name and registered with manufacturer.
- .13 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, for additional provisions.
 - .2 Wrenches and other tools required for maintenance of equipment.

1.7 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.
- .2 Installer qualifications: Company specializing in performing work of the type specified and with at least three years documented experience, and approved by manufacturer.
 - .1 Certified by AAADM.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Cover exposed metal surfaces with pressure sensitive heavy protection paper or strippable plastic coating. Do not use materials of the type which will become bonded when exposed to the sun, or leave residue.
- .2 Store inside building in dry protected area away from construction activity.
- .3 Protect finish surfaces from damage during handling, erection and at point of installation.

1.9 PROJECT CONDITIONS

- .1 Field measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication. Indicate measurements on Shop Drawings.

1.10 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- .2 Provide an extended warranty for Work of this Section for a period of two years from date of Substantial Performance of the Work. Contractor hereby warrants automatic entrance door systems against defects and malfunctions under normal usage, and these

or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

- .3 Warranty coverage to include repair or replacement of components or entire units which fail in materials or workmanship. Failures include but are not necessarily limited to, structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation of operators, speed control and hardware, deterioration of metals, metal finishes, and other materials beyond normal weathering.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.

2.2 MANUFACTURERS

- .1 Sliding automatic entrance door assemblies:
 - .1 Basis-of-Design Products:
 - .1 ASSA ABLOY Entrance Solutions; Besam SL500, configuration SO-SX-SX-SO.
 - .2 Stanley Access Technologies; DuraGlide 3000 series; configuration SO-SX-SX-SO.
 - .3 Horton Automatics; ProSlide Series 2003, Type 310, configuration SO-SX-SX-SO.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 REGULATOR

- .1 Emergency-exit door requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

- .2 Electrical components, devices, and accessories: Listed and labeled as defined in Canadian Electrical Code, by a qualified testing agency, and marked for intended location and application.

2.4 POWER OPERATED DOORS

- .1 Power operated doors: Provide products that comply with CAN/CGSB 69.26 or BHMA A156.10 and requirements of Authority Having Jurisdiction (AHJ); provide equipment selected for actual door weight and for moderate to high pedestrian traffic, unless otherwise indicated.
 - .1 Sliding door operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
 - .2 Packaged door assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties required for a complete installation.
 - .1 Finish exposed equipment components to match door and frame finish.
 - .3 Air leakage: Maximum of 5.0 L/s/sq m of wall area, when tested in accordance with ASTM E283 at 75 Pa pressure differential across assembly.
 - .4 Exterior and vestibule doors: Provide equipment suitable for operating temperature range of minus 35 to plus 50 degrees C ambient.
 - .5 Sliding automatic entrances specified with access control locking shall be designed to function as follows when set for secure operation:
 - .1 Entrances shall be normally closed and locked by access control locking system with exterior motion activation system disabled. Interior motion activation system to remain enabled; free egress.
 - .2 Upon signal from exterior secure activation device, sliding automatic entrances will unlock and open enabling motion activation system. Entrance will be held open as long as an object or pedestrian remains in the activation or safety zones.
 - .3 Once all activation and safety zones have cleared the entrance will close and re-lock, returning to normal state.
 - .4 At any time during the cycle emergency egress can be achieved by using emergency break-away feature.
 - .5 Confirm functions with the City at time of programming control system.
- .2 Sliding doors with full power operators: Comply with BHMA A156.10; safeties required; provide break-away operation; in the event of break-away operation, interrupt power operation.
 - .1 Acceptable evidence of compliance includes ULC (DIR) or ITS (DIR) listing or test report by testing agency acceptable to authorities having jurisdiction.
 - .2 Force required to swing break-away panel: 220 N, maximum, measured at 25 mm from the latch edge of the door at any point in the closing cycle.

2.5 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- .1 Comply with City of Winnipeg Accessibility Design Standards and MBC - Manitoba Building Code for egress requirements.

- .2 Framing members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.
 - .1 Nominal sizes:
 - .1 Bi-parting sliding doors: 44 mm wide by 114 mm deep.
 - .2 Concealed fastening: Provide concealed fastening pocket in framing, with continuous flush insert cover extending full length of each framing member.
- .3 Door and sidelight construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swing break-away panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
 - .1 Door thickness: 44 mm, nominal.
 - .2 Stile design:
 - .1 Narrow stile, 51 mm, nominal width.
 - .3 Top rail height: 150 to 200 mm, nominal.
 - .4 Centre rail height: 108 mm, nominal; exterior sliding panels.
 - .5 Bottom rail height: 305 mm, nominal.
 - .6 Header: Extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access
 - .7 Glazing stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.
 - .8 Glazing stop width: Manufacturers standard.
 - .9 Glazing thickness: 25 mm for exterior doors; 6 mm for interior doors. Refer to Section 08 80 00.
- .4 Sliding automatic door: Bi-parting double leaf track-mounted, electric operation, extruded aluminum glazed door, with frame, and operator concealed overhead.
 - .1 Traffic pattern: Two-way.
 - .2 Emergency breakaway capability: Full breakout of sliding panels and sidelights.
 - .3 Mounting: Between jambs.
 - .4 Sequence of operation/door function: Refer to 08 06 10 - Door Schedule.
 - .5 Operation: Power open, power close operation.
 - .6 Sliding door opening width control switch: Two position switch which in normal position permits sliding doors to open full width and in alternate position reduces opening to selected partial opening width.
 - .7 Exterior-side actuator/safety: Motion/proximity sensor, with after hours and emergency department access control.
 - .8 Interior-side actuator/safety: Motion/proximity sensor.
 - .9 Door and frame finish: Anodized, black.
- .5 Hardware:
 - .1 Threshold:
 - .1 Exterior: Continuous standard tapered extrusion double bevel, 12 mm high; full width.
 - .2 Interior: None in opening.

- .2 Panic exit device: UL 305, flush, recessed in horizontal centre rail of exterior sliding panels, with tamperproof concealed vertical rods that prevent breakout until rod is released by exit device, and prohibit manual breakout of doors from exterior.
- .3 Manual dead locks: None.
- .4 Weatherstripping: Manufacturer's standard replaceable components complying with AAMA 701/702; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing at perimeter of sliding panels and swing break-away panels.
- .5 Weather sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.6 CONTROLLERS, ACTUATORS, AND SAFETIES

- .1 Controller: Provide microprocessor operated controller for each door.
- .2 Comply with BHMA A156.10 for actuator and safety types and zones.
- .3 Motion sensoractuator/safety: Microwave, Active infrared to detection motion and presence Microwave or active infrared sensor to detect motion and presence in accordance with BHMA A156.10 , distance of control sensitivity adjustable.
 - .1 Exterior-side motion activation is secondary to secure activation device when set for secure operation.
- .4 Photoelectric beams: Minimum two infrared doorway holding beams; recess mounted in jambs or sidelight; monitored by electrical controls for faults and shall fail safe.
- .5 Security and access control locking system, exterior entrances:
 - .1 Include:
 - .1 Fail-secure electric solenoid locking device with a self-contained solid-state electronic control factory mounted inside header.
 - .2 Concealed vertical rod panic exit devices.
 - .2 When set for secure operation, automatic sliding entrance shall electrically latch in closed position preventing door panels from sliding manually, returning the system to its locked status.
 - .3 During a power interruption:
 - .1 Provide monitored power fail (battery back-up), so that if power fails, locks automatically engage (autolock fail-secure).
 - .2 Means of egress shall be accomplished by panic exit device.
- .6 Alarm contacts: Include factory installed integrated alarm contacts to provide closed-circuit dry contact for remote monitoring of sliding panel security. Alarm contacts shall be configured to signal forced entry, normal sliding, and emergency breakout conditions.
- .7 Control switch: Key switch and door position switch to allow for full control of automatic entrance doors; interior jamb mounted. Controls to include, but are not limited to:
 - .1 One-way traffic.
 - .2 Two-way traffic
 - .3 Reduced opening.
 - .4 Open/closed/automatic.

- .8 Power switch: Two position "On/Off" key switch to control power to door; interior jamb mounted.

2.7 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- .1 Electrical service to door:
 - .1 120 volts, single phase, 60 Hz.
 - .2 Refer to Section 26 05 83: Electrical connections.
- .2 Wiring terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to CSA C22.1.
- .3 Disconnect switch: Factory mount disconnect switch in control panel.

2.8 ACCESSORIES

- .1 Signage: Label or decal signage on both sides of each door and breakaway sidelight in accordance with MBC - Manitoba Building Code.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that openings and recesses are ready to receive work and dimensions are as indicated on Shop Drawings.
- .2 Verify that electric power is available and is of the correct characteristics.

3.2 PREPARATION

- .1 Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

3.3 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions, and reviewed Shop Drawings.
- .2 Set work plumb, square, level, free from warp, twist and superimposed loads.
- .3 Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment. Seal joints weathertight.
- .4 Provide for dimensional distortion of components during operation.
- .5 Coordinate installation of components with related and adjacent work; level and plumb.
- .6 Install surface-mounted hardware using concealed fasteners to greatest extent possible.
- .7 Apply signage on both sides of each door and breakaway sidelight.
- .8 Wiring within automatic entrance enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.4 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for independent site testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- .2 Inspection: Engage installer's certified inspector to test and inspect automatic entrances and prepare test and inspection reports.
 - .1 Certified inspector shall test and inspect each automatic entrance to determine compliance of installed systems with applicable BHMA standards.
 - .2 Inspection report: Certified inspector shall submit report in writing to the Contract Administrator and Contractor within 24 hours after inspection.

3.5 ADJUSTING

- .1 Adjust door equipment for correct function and smooth operation and in accordance with BHMA A156.10.

3.6 CLEANING

- .1 Remove temporary protection, clean exposed surfaces.

3.7 CLOSEOUT ACTIVITIES

- .1 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.8 MAINTENANCE SERVICE DURING WARRANTY PERIOD

- .1 Provide service and maintenance of operating equipment during the warranty period.
- .2 During the warranty period the City shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the City.
- .3 During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Interior aluminum-framed storefront, with vision glass.
- .2 Interior aluminum doors and frames.
- .3 Weatherstripping.

1.2 RELATED REQUIREMENTS

- .1 Section 08 71 01 - Door Hardware Sets: Hardware items other than specified in this section.
- .2 Section 08 80 00 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

- .1 AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- .2 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- .3 AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- .4 ANSI H35.1/H35.1M - American National Standard Alloy and Temper Designation Systems for Aluminum; 2017.
- .5 ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- .6 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- .7 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- .8 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .9 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .10 SCS (CPD) - SCS Certified Products; Current Edition.
- .11 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- .3 Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details,

and field welding required.

- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Hardware schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- .6 Installer's qualification statement.
- .7 Warranty documentation.

1.5 QUALITY ASSURANCE

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

1.6 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.

1.7 SITE CONDITIONS

- .1 Do not install sealants when ambient temperature is less than 5 degrees C. Maintain this minimum temperature during and 48 hours after installation.
- .2 Site measurements: Verify actual locations of structural supports for aluminum framed entrance and storefront systems by site measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- .2 Manufacturer's Product Warranty:
 - .1 Provide an extended warranty for Work of this Section for a period of five years from date of Substantial Performance of the Work. Manufacturer hereby warrants aluminum-framed storefronts to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.
 - .2 Provide five year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
- .3 Installation Subcontractor's Warranty: Provide an extended warranty for Work of this Section for a period of two years from date of Substantial Performance of the Work. Contractor hereby warrants that work of this Section will remain rigid and weathertight, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 BASIS OF DESIGN - FRAMING FOR MONOLITHIC GLAZING

- .1 Centre-set style, with vertical mullions except butt-glazed vertical joints where indicated:
 - .1 Alumicor; FlushGlaze TL 1800 Non-Thermally Broken.
 - .2 Kawneer; Trifab VG450 (centre plane) Non-Thermally Broken.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 BASIS OF DESIGN - SWINGING DOORS

- .1 Medium stile, monolithic glazing:
 - .1 Alumicor; Canadiana 500B.
 - .2 Kawneer; 350 series.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 STOREFRONT

- .1 Aluminum-framed storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - .1 Glazing rabbet: For 6 mm monolithic glazing.
 - .2 Finish: Class I colour anodized.
 - .1 Factory finish all 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.
 - .3 Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - .4 Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - .5 Installation method: Single span, storefront, butt-glazed vertical joints between glass lites; framed perimeter.
 - .6 Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - .7 Perimeter clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.5 COMPONENTS

- .1 Aluminum framing members: Tubular aluminum sections.
 - .1 Framing members for interior applications need not be thermally broken.
 - .2 Provide door sub-frame adapter to accommodate glazed aluminum doors.
 - .3 Glazing stops: Flush at perimeter.
 - .4 Cross-section: 44 by 114 mm nominal dimension.
- .2 Glazing: As specified in Section 08 80 00.
 - .1 For interior framing: Types as indicated on Drawings.
- .3 Swing doors: Glazed aluminum.
 - .1 Thickness: 43 mm.
 - .2 Top rail height: 100 mm, nominal.
 - .3 Stile width: 100 mm wide, nominal.
 - .4 Bottom rail height: Refer to Drawings.
 - .5 Mid rail: 200 mm high, where indicated on Drawings.
 - .6 Glazing stops: Manufacturer's standard shape.
 - .7 Finish: Same as storefront.

2.6 MATERIALS

- .1 Aluminum: Materials recommended by manufacturer for type of use and finish indicated, and as follows:
 - .1 Sheet and plate: Conform to ASTM B209/B209M, and ANSI H35.1/H35.1M, AA1100-H14, or AA5005-H32 or H34, anodizing quality.
 - .2 Extruded bars, rods, profiles, and tubes: Conform to ASTM B221/ASTM B221M, and ANSI H35.1/H35.1M, AA6063-T5 or T6, anodizing quality.

- .2 Brackets and reinforcements: Manufacturer's standard high strength aluminum and non-staining, non-ferrous shims for aligning system components.
- .3 Fasteners: Stainless steel.
- .4 Fasteners and accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials:
 - .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.
- .5 Glazing gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- .6 Glazing accessories: As specified in Section 08 80 00.

2.7 FINISHES

- .1 Class I Colour Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.018 mm thick.
- .2 Colour: Black.

2.8 HARDWARE

- .1 For each door, include weatherstripping and sill sweep strip.
- .2 Other door hardware: As specified in Section 08 71 01.
- .3 Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- .4 Sill sweep strips: Resilient seal type, retracting, of neoprene; provide on all doors.

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.

3.2 INSTALLATION

- .1 Install 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 Install glass in accordance with Section 08 80 00, using glazing method indicated.
- .6 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.
- .7 Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

- .1 Maximum variation from plumb: 1.5 mm per 1 m non-cumulative or 1.5 mm per 3 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Location and plane: Limit variation from true location and plane to 3 mm in 3660 mm; 6 mm over total length.
- .4 Diagonal measurements: Limit difference between diagonal measurements to 3 mm.

3.4 ADJUSTING

- .1 Adjust operating 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.

3.5 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.

3.6 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

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Part 1 General

1.1 SECTION INCLUDES

- .1 Aluminum-framed curtain wall, with vision glazing.
- .2 Associated glazed aluminum entrance doors.

1.2 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- .2 Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- .3 Section 08 08 00 - Commissioning of Openings: Testing requirements.
- .4 Section 08 42 29 - Automatic Entrances.
- .5 Section 08 71 01 - Door Hardware Sets: Hardware items other than specified in this Section.
- .6 Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

- .1 AAMA 501.4 - Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts; 2009.
- .2 AAMA 501.6 - Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from Window Wall, Curtain Wall and Storefront Systems; 2018.
- .3 AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- .4 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 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 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).

- .11 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).
- .12 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .13 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .14 MBC - Manitoba Building Code - MBC - M.R. 78/2023; 2024.
- .15 SCS (CPD) - SCS Certified Products; Current Edition.
- .16 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with installation of other components that comprise the exterior enclosure.
- .2 Preinstallation meeting: Schedule pre-installation meeting before start of glazed aluminum curtain wall assembly installation work with all building envelope Subcontractors in attendance. Discuss quality of workmanship expected, and ensure that all Subcontractors are fully aware of the mock-up required and testing procedures that will be undertaken on their work to ensure that the quality of workmanship is met.

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.
- .3 Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, method for achieving air and vapour barrier seal to adjacent construction, affected related Work, expansion and contraction joint location and details, and site welding required.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's certificate: Certify that the products supplied meet or exceed the specified requirements.
- .6 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.
- .7 Test reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.
- .8 Site quality control submittals: Report of site testing for water penetration and air leakage.
- .9 Designer's qualification statement.

- .10 Installer's qualification statement.
- .11 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 Full-size mock-up testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified thermal, structural, air infiltration, and water penetration criteria.
- .3 Installer qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for additional requirements.
- .2 Provide mock-up, size as specified in Section 08 08 00, and including each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, glass and air barrier and vapour retarder seal, and perimeter sealant.
- .3 Locate on-site where directed by Contract Administrator; mock-up may remain as part of the 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 Do not install sealants when ambient temperature is less than 5 degrees C. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- .2 Manufacturer's Product Warranty:
 - .1 Provide an extended warranty for Work of this Section for a period of five years from date of Substantial Performance of the Work. Manufacturer hereby warrants glazed aluminum curtain wall free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

- .2 Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
- .3 Installation Subcontractor's Warranty: Provide an extended warranty for Work of this Section for a period of two years from date of Substantial Performance of the. Contractor hereby warrants that work of this Section will remain rigid and weathertight, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 MANUFACTURERS

- .1 Glazed aluminum curtain walls:
 - .1 Alumicor; Thermawall 2600.
 - .2 Kawneer North America; 1600 UT System 1: www.kawneer.com/#sle.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Glazed aluminum entrance doors:
 - .1 Alumicor; ThermaPorte 7700.
 - .2 Kawneer North America; Insulpour.

- .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 CURTAIN WALL

- .1 Aluminum-framed curtain wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - .1 Outside glazed, with pressure plate and 19 mm deep mullion cover caps.
 - .2 Fabrication method: Site fabricated stick system.
 - .3 Glazing method: Site glazed system.
 - .4 Vertical mullion face width: 63 mm.
 - .5 Vertical mullion depth from face of glazing to back of frame: As indicated.
 - .6 Finish: Class I colour anodized.
 - .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.
 - .7 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.
 - .8 Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - .9 System internal drainage: 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.
 - .10 Air and vapour seal: Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.
 - .11 Perimeter clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- .2 Structural performance requirements: Design and size components to withstand the following load requirements without damage or permanent set.
 - .1 Design wind loads: Comply with the applicable code.
 - .1 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.
 - .2 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.
 - .2 Seismic loads: Design and size components to withstand seismic loads and sway displacement in accordance with MBC - Manitoba Building Code requirements, AAMA 501.4 and AAMA 501.6, and as indicated on Drawings.
 - .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: Negative 40 degrees C to positive 35 degrees C.
- .2 Interior ambient: Positive 16 degrees C to positive 29 degrees C.
- .3 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.
- .3 Water penetration resistance on manufactured assembly: No uncontrolled water on indoor face when tested as follows:
 - .1 Test pressure differential: 720 Pa.
 - .2 Test method: ASTM E331.
- .4 Air leakage laboratory test: Maximum of 0.2 L/sec sq m of wall area, when tested in accordance with ASTM E283 at 75 Pa pressure differential across assembly.
- .5 Thermal performance requirements:
 - .1 Overall USI-value including glazing: 1.4 W/(sq m K), maximum.

2.4 COMPONENTS

- .1 Aluminum framing members: Tubular aluminum sections, 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 Glazing: As specified in Section 08 80 00.

2.5 ENTRANCE DOORS

- .1 Glazed aluminum framed doors:
 - .1 Thickness: 57 mm.
 - .2 Top rail height: 100 mm, nominal.
 - .3 Stile width: 100 mm, nominal.
 - .4 Bottom rail height: As indicated.
 - .5 Mid rail: 200 mm, nominal, where indicated.
 - .6 Finish: Class I colour anodized.
 - .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.
- .2 Fabrication:
 - .1 Fabricate thermally-broken entrance door assemblies of extruded sections, designed for mechanical shear block fastening in combination with SIGMA deep penetration plug welds and fillet welds at stile/rail connections.
 - .2 Construct doors square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance, with accurately fitted and secure joints and corners.

- .3 Use only concealed or semi-concealed fasteners. Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used upon approval of Contract Administrator.
- .4 Install specified door hardware in accordance with manufacturer's templates.
- .3 Door hardware:
 - .1 Weatherstripping: Wool pile, continuous and replaceable; provide on each door.
 - .2 Sill sweep strips: Resilient seal type, of neoprene; provide on each door.+
 - .3 Other door hardware: As specified in Section 08 71 01.

2.6 MATERIALS

- .1 Extruded aluminum: ASTM B221 (ASTM B221M).
- .2 Sheet aluminum: ASTM B209 (ASTM B209M).
- .3 Brackets and reinforcements: Manufacturer's standard high strength aluminum and non-staining, non-ferrous shims for aligning system components.
- .4 Structural supporting anchors attached to structural steel: Design for bolted attachment.
- .5 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 Contract Administrator.
- .6 Exposed flashings: Aluminum sheet, 1.0 mm minimum thickness; finish to match framing members.
- .7 Concealed Flashings: Sheet aluminum, 0.43 mm minimum thickness.
- .8 Sill flashing sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.
- .9 Glazing gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- .10 Glazing accessories: As specified in Section 08 80 00.
- .11 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.
- .12 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.
- .13 Isolation coating: Manufacturer's standard alkali-resistant coating.

2.7 FINISHES

- .1 Class I colour anodized finish: AAMA 611 AA-M12C22A44 Electrolytically deposited coloured anodic coating not less than 0.018 mm thick.
- .2 Colour: Black.
- .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 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, and entrances 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 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .8 Pressure plate framing: Install glazing in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
- .9 Entrance doors:
 - .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 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 19 mm and minimum of 6 mm.

3.4 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for independent site testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- .2 Repair or replace curtain wall components that have failed designated site testing, and retest to verify performance conforms to specified requirements.

3.5 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.

3.6 PROTECTION

- .1 Protect installed products from damage until Date of Substantial Performance.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Exterior fire-rated curtain wall assembly.

1.2 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- .2 Section 07 84 00 - Firestopping: Firestop at exterior wall assembly junction with structure.
- .3 Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3 REFERENCE STANDARDS

- .1 AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2005.
- .2 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
- .3 AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- .4 ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- .5 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.
- .6 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.
- .7 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- .8 ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- .9 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).
- .10 ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- .11 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .12 CAN/CGSB 12.20 - Structural Design of Glass in Buildings; 1989.

- .13 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials; 2014.
- .14 CAN/ULC S106 - Standard Method for Fire Tests of Window and Glass Block Assemblies; 2015.
- .15 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .16 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel; 2013 (Reaffirmed 2018).
- .17 MBC - Manitoba Building Code - MBC - M.R. 78/2023; 2024.
- .18 NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- .19 SCS (CPD) - SCS Certified Products; Current Edition.
- .20 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- .21 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with installation of other components that comprise the exterior enclosure.
- .2 Preinstallation meeting: Schedule pre-installation meeting before start of the fire-resistive framed glazing assembly installation work with all building envelope Subcontractors in attendance. Discuss quality of workmanship expected, and ensure that all Subcontractors are fully aware of the mock-up required and testing procedures that will be undertaken on their work to ensure that the quality of workmanship is met.

1.5 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.
- .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 as follows illustrating each exposed metal finish of interior and exterior project-specific applications.
 - .1 For colour anodized aluminum, submit minimum of three samples illustrating expected range of colour in actual production.
 - .2 For factory-finished steel members, submit minimum of three colour selection samples.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Design data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

- .7 Manufacturer's certificate: Certification that products meet or exceed specified requirements.
- .8 Designer's qualification statement.
- .9 Manufacturer's qualification statement.
- .10 Installer's qualification statement.
- .11 Maintenance data: Include recommended cleaning methods and materials, and methods and materials to avoid that may harm glass surfaces or void warranty.
- .12 Warranty documentation: Submit manufacturer warranty and ensure forms have been completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Designer qualifications: Perform design under direct supervision of a Professional Structural 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 ten years documented experience.
- .3 Installer qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- .4 Source limitations: Obtain framing system, glazing and glazing accessories from one source for each product and installation method indicated.

1.7 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.

1.8 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.
- .2 Field measurements: Verify actual locations of walls, and other construction contiguous with framing assembly by field measurement before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- .2 Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- .3 Provide five year manufacturer warranty against excessive degradation of finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 EXTERIOR RESISTIVE FRAMED GLAZING ASSEMBLIES

- .1 Exterior curtain walls (punched openings):
 - .1 Technical Glass Products; FireFrames Curtainwall series with Pyrostop 45-360 IGU glazing with low e coating.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.
 - .1 Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" within internal spaces.
 - .2 System internal drainage: 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.
 - .3 Air and vapour seal: Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.

- .4 Perimeter clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- .3 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.
- .4 Structural performance: Design and size components to withstand the following loading without damage or permanent set.
 - .1 Design live loads: Comply with requirements of the MBC - Manitoba Building Code, and as indicated on the Drawings.
 - .2 Comply with CAN/CGSB 12.20 or ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - .3 Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths or 19 mm, whichever is less, under specified design load.
 - .4 Movement: Accommodate the following movement without damage to components or deterioration of seals:
 - .1 Expansion and contraction caused by 82 degrees C surface temperature.
 - .2 Expansion and contraction caused by cycling temperature range of 95 degrees C over a 12 hour period.
 - .3 Movement of wall relative to perimeter framing.
 - .4 Deflection of structural support framing, under permanent and dynamic loads.
- .5 Dynamic water penetration: No uncontrolled water on indoor face when tested as follows:
 - .1 Test pressure differential: 720 Pa.
 - .2 Test method: AAMA 501.1.
- .6 Air leakage: Maximum of 0.3 L/s/sq m of wall area, when tested in accordance with ASTM E283 at 300 Pa pressure differential across assembly.

2.3 COMPONENTS

- .1 Framing members: Formed steel members with or 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 Curtain wall pressure plates: Formed stainless steel, with dimensions to securely hold glazing materials in place.
 - .3 Curtain wall cover caps: Extruded aluminum, 15 mm deep.
 - .4 Glazing stops: Flush.
 - .5 Cross section:
 - .1 Exterior curtain wall framing: 45 mm wide by 114 mm deep back section, nominal dimension, plus cover caps.
 - .6 Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 - .7 Finish: Class I colour anodized or superior performing organic coating to match black anodized finish.

2.4 MATERIALS

- .1 Extruded aluminum: ASTM B221M, alloy and temper recommended by manufacturer for type of use and finish indicated.
- .2 Steel reinforcement: Shop-primed or galvanized.
 - .1 Structural shapes, plates and bar: ASTM A36/A36M or CSA G40.20/G40.21.
 - .2 Cold-rolled sheet and strip: ASTM A1008/A1008M.
 - .3 Hot-rolled sheet and strip: ASTM A1011/A1011M.
- .3 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.
 - .2 Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
- .4 Brackets and reinforcements: Manufacturer's standard high-strength materials with non-staining, non-ferrous shims for aligning system components.
- .5 Exposed flashings: 0.81 mm thick aluminum sheet; finish to match framing members.
- .6 Firestopping: As specified in Section 07 84 00.
- .7 Insulation: Mineral wool fire stop insulation, ASTM C612.
- .8 Sealants within fire-rated assembly: As required by fire-rating and manufacturer's assembly.
- .9 Sill flashing sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- .10 Refer to Section 07 92 00 for additional information on sealant requirements.
- .11 Fire-resistance rated glazing:
 - .1 Insulated glass unit Type IGU3 for exterior curtain walls (punched windows):

- .1 Overall thickness: 33 mm.
 - .2 Outer lite: 6 mm thick fully tempered glass; low e coating on surface 2.
 - .3 Interspace: 8 mm, air-filled.
 - .4 Inner lite: 25 mm thick composed of multiple sheets of low-iron high visible light transmission glass laminated with an intumescent interlayer
- .12 Glazing gaskets: Type to suit application to achieve fire-rating, weather, moisture, and air infiltration requirements.
 - .13 Intumescent tape: As supplied by frame manufacturer.
 - .14 Setting blocks: Calcium silicate.
 - .15 Intumescent sealant: Single-component, latex-based, intumescent sealant designed to stop passage of fire, smoke, and fumes through fire-rated separations; permanently flexible after cure; will not support mold growth; flame spread/smoke developed 10/10.

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: Class I colour anodized.
 - .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.
- .3 Steel finish: Superior performing organic coatings AAMA 2605; multiple coats, thermally cured polyvinylidene fluoride system; colour and gloss to match "black anodized aluminum" aesthetic.
- .4 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.
 - .1 Refer to Section 07 25 00 for requirements on weather barriers.
- .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 Provide thermal isolation where components penetrate or disrupt building insulation.
- .7 Install sill flashings at exterior framing. Turn up ends and edges; seal to adjacent work to form water tight dam.
- .8 Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- .9 Apply insulating foam sealant in shim spaces at perimeter of exterior assembly to maintain continuity of thermal barrier.
- .10 Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

- .1 Maximum variation from plumb: 1.75 mm every 1.0 m non-cumulative or 12.5 mm per 30 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Sealant space between mullions and adjacent construction: Maximum of 19 mm and minimum of 6.4 mm.

3.4 SITE QUALITY CONTROL

- .1 Provide services of manufacturer's site representative to observe installation and submit report.

3.5 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.

3.6 PROTECTION

- .1 Protect installed products from damage until Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Extruded aluminum windows with fixed sash, factory-assembled.
- .2 Site glazing.

1.2 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Weather Barriers: Sealing frame to weather barrier installed on adjacent construction.
- .2 Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- .3 Section 08 08 00 - Commissioning of Openings: Testing requirements.
- .4 Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

- .1 AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- .2 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- .3 AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- .4 AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2017.
- .5 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .6 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .7 SCS (CPD) - SCS Certified Products; Current Edition.
- .8 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Schedule pre-installation meeting before start of the aluminum windows installation work with all building envelope Subcontractors in attendance. Discuss the quality of workmanship expected, and ensure that all Subcontractors are fully aware of the mock-up required and testing procedures that will be undertaken on their work to ensure that the quality of workmanship is met.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide component dimensions, information on glass and glazing, and internal drainage details.

- .3 Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapour barrier seal to adjacent construction, anchorage locations, and installation requirements.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Grade substantiation: Prior to submitting Shop Drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - .1 Evidence of AAMA Certification.
 - .2 Evidence of WDMA Certification.
 - .3 Evidence of CSA Certification.
 - .4 Test reports by independent testing agency itemizing compliance and acceptable to Authority Having Jurisdiction.
- .6 Manufacturer's installation instructions: Include complete preparation, installation, and cleaning requirements.
- .7 Site quality control submittals: Report of Site testing for water penetration and air leakage.
- .8 Installer's qualification statement.
- .9 Warranty: Submit manufacturer warranty and ensure that forms have been completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

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

1.7 MOCK-UPS

- .1 Provide mock-up of aluminum window in location identified by Contract Administrator and Commissioning Authority and in accordance with Sections 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings.
- .2 Mock-up aluminum window assembly on site as part of initial installation. Mock-up will be reviewed for rough opening condition, preparation, quality of fabrication and installation including tie-in between aluminum window and air/vapour barrier membrane, sealant and flashing installation, and co-ordination with work of other Sections.
- .3 Once approved, mock-up will set a standard of acceptance for remaining installations.
- .4 Do not proceed with aluminum window installation until mock-up area is complete and reviewed by Contract Administrator and Commissioning Authority.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Comply with requirements of AAMA CW-10.

- .2 Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.9 SITE CONDITIONS

- .1 Do not install sealants when ambient temperature is less than 5 degrees C.
- .2 Maintain this minimum temperature during and 24 hours after installation of sealants.

1.10 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- .2 Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- .3 Provide five 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 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 MANUFACTURERS

- .1 Basis-of-Design Products:
 - .1 Alumicor; RainBlade 1970 Series with 50 mm nose.
 - .2 Kawneer; AA6600 Thermal Window.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 WINDOWS

- .1 Aluminum windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with related flashings, and anchorage and attachment devices.
 - .1 Frame depth: 150 mm nominal.
 - .2 Provide units triple assembled for site glazing.
 - .3 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.
 - .4 Perimeter clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - .5 Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - .6 System internal drainage: 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.
 - .7 Thermal movement: Design to accommodate thermal movement caused by 85 degrees C surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.
- .2 Fixed, non-operable type:
 - .1 Construction: Thermally broken.
 - .2 Glazing: Triple; clear; low-e.
 - .3 Exterior finish: Class I colour anodized.
 - .4 Interior finish: Class I colour anodized.

2.4 COMPONENTS

- .1 Frames: Extruded aluminum; thermally broken with interior portion of frame insulated from exterior portion; applied glass stops of snap-on type; with continuous leg flange with mitred corners for air/vapour barrier continuity.
- .2 Glazing: As specified in Section 08 80 00.
- .3 Sill: Extruded aluminum; sloped for positive wash.
- .4 Interior trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings; clip and snap-on trim for concealed attachment; finish to match window framing.
- .5 Fasteners: Stainless steel.

- .6 Glazing materials: As specified in Section 08 80 00.
- .7 Sealant for setting sills and sill flashing: Non-curing butyl type.
 - .1 Refer to Section 07 92 00 for additional requirements.

2.5 MATERIALS

- .1 Extruded aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.6 FINISHES

- .1 Class I Colour Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited coloured anodic coating not less than 0.018 mm thick.
- .2 Finish colour: Black.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that wall openings and adjoining air and vapour seal materials are ready to receive aluminum windows.

3.2 INSTALLATION

- .1 Install windows in accordance with manufacturer's instructions.
- .2 Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- .3 Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- .4 Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- .5 Install sill.
- .6 Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .7 Install glass in accordance with requirements specified in Section 08 80 00.

3.3 TOLERANCES

- .1 Maximum variation from level or plumb: 1.5 mm/m non-cumulative or 3 mm/3 m, whichever is less.

3.4 SITE QUALITY CONTROL

- .1 See Section 01 45 00 - Quality Control, and Section 08 08 00 - Commissioning of Openings, for independent site testing and inspection requirements, and requirements for monitoring quality of specified product installations.

- .2 Repair or replace fenestration components that have failed designated site testing, and retest to verify performance complies with specified requirements.

3.5 CLEANING

- .1 Remove protective material from factory finished aluminum surfaces.
- .2 Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Hardware for wood, aluminum, and hollow metal doors.
- .2 Hardware for fire-rated doors.
- .3 Electrically operated and controlled hardware.
- .4 Lock cylinders for doors that hardware is specified in other sections.
- .5 Thresholds.
- .6 Weatherstripping and gasketing.

1.2 RELATED REQUIREMENTS

- .1 Section 08 11 13 - Hollow Metal Doors and Frames.
- .2 Section 08 14 16 - Flush Wood Doors.
- .3 Section 08 43 13 - Aluminum-Framed Storefronts: Door hardware, except as noted in Section 08 71 01 - Door Hardware Sets.
- .4 Section 08 44 13 - Glazed Aluminum Curtain Walls: Door hardware, except as noted in Section 08 71 01 - Door Hardware Sets.
- .5 Section 08 71 01 - Door Hardware Sets.
- .6 Section 08 71 13 - Automatic Door Operators
- .7 Section 26 05 80 - Equipment Wiring: Power supply to electric hardware devices.
- .8 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 BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- .3 BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.
- .4 CAN/ULC S104 - Standard Method for Fire Tests of Door Assemblies; 2010.
- .5 City of Winnipeg Accessibility Design Standards - City of Winnipeg Accessibility Design Standards; 2018.
- .6 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations; 2021.
- .7 CSDMA Recommended Dimensional Standards - Recommended Dimensional Standards; 2000.

- .8 DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.
- .9 DHI (KSN) - Keying Systems and Nomenclature; 1989.
- .10 ITS (DIR) - Intertek Testing Services, Directory of Listed Products; current edition.
- .11 NFC - National Fire Code of Canada; 2015, with Errata (2018).
- .12 NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- .13 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), and electrified hardware consultant (EHC).
 - .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.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's catalogue 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 Samples for verification:
 - .1 Submit minimum size of 50 by 100 mm for sheet samples, and minimum length of 102 mm for other products.
 - .2 Submit one sample of hinge, latchset, lockset, and closer illustrating style, colour, and finish upon request by Contract Administrator.
 - .3 Returned full-size samples to be incorporated into this Work.
 - .4 Submit product description with samples.
- .6 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .7 Maintenance data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - .1 Submit manufacturer's parts lists and templates.
- .8 Installer's qualification statement.
- .9 Warranty: Submit manufacturer's warranty and ensure that forms have been completed in City's name and registered with manufacturer.
- .10 Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- .11 Maintenance materials and tools: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, for additional provisions.
 - .2 Lock cylinders: Ten for each master keyed group.
 - .3 Tools: Two sets 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 Installer qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

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.
- .2 Deliver hardware to site in manufacturer's original packaging. Packaging to contain manufacturer's name, product name and identification number and other related

information.

- .3 Provide and maintain dry, off-ground weatherproof storage. Protect hardware in accordance with manufacturer's recommendations. Remove only in quantities required for same day use.

1.8 WARRANTY

- .1 See Section 01 78 00 - 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 MANUFACTURERS

- .1 Hardware manufacturers and Basis of Design Products are as specified in Section 08 71 01 - Door Hardware Sets.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Auto operators as specified in Section 08 71 13 to be supplied by this Section.

2.2 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 Accessibility: City of Winnipeg Accessibility Design Standards. Maximum operating force for pushing or pulling open a door:
 - .1 Exterior hinged doors: 38 N.
 - .2 Interior hinged doors: 22 N.
 - .3 Sliding or folding doors: 22 N.
 - .2 Applicable provisions of the NFC.
 - .3 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.
 - .4 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.
 - .5 Hardware preparation for steel doors and steel frames: BHMA A156.115.
 - .6 Hardware preparation for wood doors with steel frames: BHMA A156.115W.

- .7 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 71 01 - Door Hardware Sets.
- .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.
 - .3 Compatible with material through which they pass.
 - .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 wood or 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.

2.3 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 Door locks to be keyed to facility approved Best cores for exterior locks and Schlage cores for interior locks. Prepare detailed keying schedule in conjunction with the City.
 - .3 Keying: Master keyed.
 - .4 Include construction keying for lock cylinders.
 - .5 Key to existing keying system.
 - .6 Supply keys in following quantities:
 - .1 Seven Master keys for each MK group.
 - .2 Three keys for each lock.

- .3 6 each Construction keys.
- .7 Deliver keys, permanent cylinder cores, and key records to City by registered delivery shipment direct from hardware supplier.

2.4 FIRE DEPARTMENT LOCK BOX

- .1 Fire department lock box:
 - .1 Heavy-duty, recessed, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
 - .2 Capacity: Holds 10 key cards.
 - .3 Finish: Manufacturer's standard black.

2.5 FINISHES

- .1 Finishes: Identified in Section 08 71 01 - Door Hardware Sets.

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 Install hardware for smoke and draft control doors in accordance with CAN/ULC S104.
- .4 Use templates provided by hardware item manufacturer.
- .5 Do not install surface mounted items until application of finishes to substrate are fully completed.
- .6 Install hardware to standard hardware location dimensions in accordance with CSDMA Recommended Dimensional Standards, except as otherwise required by City of Winnipeg Accessibility Design Standards.
- .7 Use of "Lock-tite" or other sealants during hardware installation is not permitted.
- .8 Remove construction cores when directed by Contract Administrator. Permanent cores to be installed by others.
- .9 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 Perform site inspection and testing under provisions of Section 01 45 00 - Quality Control.
- .2 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 Clean adjacent surfaces soiled by hardware installation.
- .3 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

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Legend:




-  Link to catalog cut sheet
-  Electrified Opening

Hardware Group No. 01

For use on Door #(s):

0:01 0:02

Provide each SGL door(s) with the following:


QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	3CB1HW 114X114MM		652	IVE
1	EA	PASSAGE SET	ND10S SPA		626	SCH
1	EA	SURFACE CLOSER	1461 CUSH STD		622	LCN

Hardware Group No. 02

For use on Door #(s):

1:01.1 1:01.2

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	SLIDING AUTOMATIC ENTRANCE HARDWARE	REFER TO SECTION 08 42 29.23			

Hardware Group No. 03

For use on Door #(s):

1:03 1:04 1:23.1

Provide each SGL door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	9500		613	HES
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-4'-06		626	VON
1	EA	RIM CYLINDER	20-021		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
1	EA	KEY SWITCH (ADO- HOLD OPEN)	CM-170/23		⚡ 630	CAM
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
1	EA	DOOR BOTTOM	355AA TO SUIT DOOR WIDTH		AA	ZER
1	EA	WIRE HARNESS	CON-6W (IN FRAME)		⚡	SCH
1	EA	DOOR CONTACT	BY DIVISION 28		⚡	NOT
1	EA	ACCESS CONTROL SYSTEM C/W KEY SWITCH	BY DIVISION 28		⚡	

DOOR NORMALLY CLOSED AND LOCKED AFTER HOURS
VALID CREDENTIALS AT READER WILL RELEASE ELECTRIC STRIKE AND ALLOW ENTRY BY PULLING LEVER AND OR ENGAGE ACTUATOR FOR AUTO OPERATOR
AUTO OPERATOR TO BE TIED TO FIRE ALARM, RELEASE HOLD OPEN ON FIRE ALARM AND DOOR TO CLOSE AND LATCH
IN THE CASE OF LOSS OF POWER AND OR FIRE ALARM, ELECTRIC STRIKE WILL REMAIN IN LOCKED POSITION
FREE EGRESS AT ALL TIMES VIA PUSHBAR AND OR PRESSING INTERIOR ACTUATOR WILL RELEASE ELECTRIC STRIKE AND ENGAGE OPERATOR

Hardware Group No. 04

For use on Door #(s):
1:05

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
2	EA	ELECTRIC HINGE	3CB1HW 114X114MM CON TW8		⚡ BBLK/6 22	IVE
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-9849-L-DT-F-4'-06-LBLAFL- CON 24 VDC		⚡ 626	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-9849-L-NL-F-4'-17-LBL- CON 24 VDC		⚡ 626	VON
1	EA	RIM CYLINDER	20-021		622	SCH
1	EA	OH STOP	100S		BLK	GLY
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	FIRE/LIFE CLOSER	4040SE LONG WMS120V AC/DC		⚡ 693	LCN
1	EA	AUTO OPERATOR C/W ACTUATORS KEYSWITCH	REFER TO SECTION 08 71 13		⚡	
1	EA	KEY SWITCH	CM-170/23		⚡ 630	CAM
2	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
2	EA	WIRE HARNESS	CON-____(SIZE TO SUIT)		⚡	SCH
1	EA	POWER SUPPLY	BY DIVISION 28		⚡ 600	UNK
2	EA	DOOR CONTACT	BY DIVISION 28		⚡	NOT
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28		⚡	

DOORS NORMALLY CLOSED AND LOCKED

DURING NORMAL HOURS OF OPERATION, DOORS CAN BE ELECTRONICALLY DOGGED DOWN FOR PUSH/PULL OPERATION

VALID CREDENTIALS AT READER WILL RETRACT LATCH , ENTRY BY MANUALLY PULLING LEVER AND OR ENGAGE ACTUATOR FOR AUTO OPERATOR










AUTOMATIC OPERATOR AND SENTRONIC CLOSER IN HOLD OPEN POSITION, IN THE CASE OF FIRE ALARM OR LOSS OF POWER, DOORS WILL RELEASE AND LATCH

FREE EGRESS AT ALL TIMES VIA PUSH BAR AND OR PRESSING INTERIOR ACTUATOR WILL RETRACT LATCH AND ENGAGE OPERATOR

Hardware Group No. 05

For use on Door #(s):
1:34







Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
2	EA	MANUAL FLUSH BOLT	FB458		622	IVE
1	EA	DUST PROOF STRIKE	DP1		626	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	OH STOP & HOLDER	100H		BLK	GLY
1	EA	SURFACE CLOSER W/HO ARM	4040XP HEDA TBWMS 1 3/4"		622	LCN
2	EA	ARMOR PLATE	8400 808MM X 25MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 06

For use on Door #(s):
1:06.1


Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	SURFACE CLOSER W/HO ARM	4040XP HEDA TBWMS 1 3/4"		622	LCN
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 07

For use on Door #(s):
X1:06

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	SURFACE CLOSER W/HO ARM	4040XP HEDA TBWMS 1 3/4"		622	LCN
1	EA	REMAINING HARDWARE	TO BE RE-USED			

Hardware Group No. 08

For use on Door #(s):
1:07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	CLASSROOM LOCK	ND70P6D SPA		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28		⚡	

DOOR NORMALLY CLOSED AND LOCKED
VALID CREDENTIALS AT READER, OR BUTTON FROM RECEPTION, ALLOW ACCESS VIA MANUAL LEVER
AND OR ENGAGE ACTUATOR FOR AUTO OPERATOR
DOOR CAN BE PUT INTO PASSAGE MODE DURING NORMAL WORKING HOURS, MANUAL ENTRY AND OR
PUSHING ACTUATOR WILL RELEASE ELECTRIC STRIKE AND ENGAGE OPERATOR
FREE EGRESS AT ALL TIMES VIA MANUAL LEVER AND OR PUSHING ACTUATOR ON POOL VIEWING SIDE
TO RELEASE ELECTRIC STRIKE AND ENGAGE OPERATOR

Hardware Group No. 09

For use on Door #(s):
1:08 1:29.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC HINGE	3CB1HW 114X114MM CON TW8		⚡ BBLK/6 22	IVE
1	EA	ELEC PANIC HARDWARE	RX-98-EO-4'-ALK 9-VOLT BATTERY WITH HARDWIRED OPTION		⚡ 315	VON
1	EA	OH STOP	100S		BLK	GLY
1	EA	SURFACE CLOSER	4040XP EDA SRI		622	LCN
1	SET	GASKETING	429BK-S X FRAME PERIMETER		BK	ZER
1	EA	DOOR SWEEP	39BK X DOOR WIDTH		BK	ZER
1	EA	THRESHOLD	626BK X DR. WIDTH		BK	ZER
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ROUGH IN , CABLING AND FIRE ALARM CONNECTION	BY DIVISION. 28		⚡	

DOOR NORMALLY CLOSED AND LATCHED
EMERGENCY ALARM WILL SOUND UPON DOOR OPENING

Hardware Group No. 10

For use on Door #(s):

1:09 1:10 1:24 1:32.2 1:32.3

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		↗	
1	EA	PUSH TO LOCK BUTTON	CM-AF550R		↗ 630	CAM
1	EA	OCCUPANCY INDICATOR	CM-AF500		630	CAM
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ROUGH IN , CABLING AND FIRE ALARM CONNECTION	BY DIV. 28		↗	

DOOR NORMALLY CLOSED AND UNLOCKED
OUTSIDE ACTUATOR CYCLES DOOR OPERATOR ALLOWING ASSISTED ACCESS, PUSHING THE DOOR
ALLOWS MANUAL ACCESS
INSIDE "PUSH TO LOCK" BUTTON SECURES ELECTRIC STRIKE, CHANGES THE STATE OF THE OUTSIDE
LED OCCUPANCY-INDICATOR
MANUAL EGRESS BY INSIDE LEVER, OR ASSISTED EGRESS VIA INSIDE ACTUATOR.
EXITING SPACE CHANGES OUTSIDE OCCUPANCY INDICATOR STATUS AND UNLOCKS ELECTRIC
STRIKE FOR THE NEXT USER (VIA DOOR CONTACT)
IN CASE OF FIRE ALARM OR LOSS OF POWER, DOOR REMAINS UNLOCKED

Hardware Group No. 11

For use on Door #(s):

1:12 1:13



Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ENTRANCE LOCK	ND53P6D SPA		622	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA		622	LCN
1	EA	KICK DOWN HOLDER	FS452-5		BLK	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE

Hardware Group No. 12

For use on Door #(s):
1:14

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONTINUOUS HINGE				
1	EA	RIM CYLINDER	20-021		622	SCH
1	EA	FLOOR STOP	FS429		BLK	IVE
1	EA	ROLLER LATCH	RL30		BLK	IVE
1	EA	BALANCE OF HARDWARE	BY DOOR SUPPLIER			

Hardware Group No. 13

For use on Door #(s):
1:14.1









Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	ALL HARDWARE	BY FOLDING GRILLE SUPPLIER			

Hardware Group No. 14

For use on Door #(s):
1:15.1 1:21 1:25 1:27

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBWMS		622	LCN
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28			






DOOR NORMALLY CLOSED AND LOCKED
VALID CREDENTIALS AT READER RELEASES ELECTRIC STRIKE ALLOWING ACCESS
IN THE CASE OF LOSS OF POWER OR FIRE ALARM, ELECTRIC STRIKE REMAINS LOCKED
FREE EGRESS AT ALL TIMES

Hardware Group No. 15

For use on Door #(s):

1:15.2

Provide each SGL door(s) with the following:





QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	PASSAGE SET	ND10S SPA		622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBWMS		622	LCN
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 16

For use on Door #(s):

1:16 1:17 1:18 1:19 1:20

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ENTRANCE LOCK	ND53P6D SPA		622	SCH
1	EA	WALL STOP	WS406/407CCV		622	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 17

For use on Door #(s):
1:23.2 1:28.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	CLASSROOM LOCK	ND70P6D SPA		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
1	EA	KEY SWITCH (ADO HOLD OPEN)	CM-170/23		⚡ 630	CAM
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	ROUGH IN , CABLING AND FIRE ALARM CONNECTION	BY DIV . 28		⚡	

DOOR NORMALLY CLOSED AND LOCKED AFTER NORMAL HOURS
DOOR TO BE MANUALLY UNLOCKED, KEYSWITCH ENABLES ACTUATORS
ENTRY VIA LEVER AND OR PUSHING ACTUATOR RELEASES ELECTRIC STRIKE AND ENGAGES
OPERATOR
IN THE CASE OF LOSS OF POWER AND OR FIRE ALARM, OPERATOR HOLD OPEN WILL DISENGAGE AND
CLOSE, ELECTRIC STRIKE WILL STAY IN THE LOCKED POSITION
FREE EGRESS AT ALL TIMES

Hardware Group No. 18

For use on Door #(s):
1:22.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
8	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
2	EA	ROLLER LATCH	RL30		BLK	IVE
2	EA	SINGLE DUMMY TRIM	ND170 SPA		622	SCH
2	EA	OH STOP	100S		BLK	GLY

Hardware Group No. 19

For use on Door #(s):
1:25.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	ALL HARDWARE	BY FLOOR ACCESS HATCH SUPPLIER			

Hardware Group No. 20

For use on Door #(s):

1:28

Provide each SGL door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM	BBLK/6 22	IVE
1	EA	CLASSROOM LOCK	ND70P6D SPA	622	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		
1	EA	KEY SWITCH (ADO- HOLD OPEN)	CM-170/23	630	CAM
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	BLK	IVE
1	EA	WIRE HARNESS	CON-____(SIZE TO SUIT)		SCH
1	EA	POWER SUPPLY	BY DIVISION 28	600	UNK
1	EA	RELAY(S)	BY DIVISION 28		
1	EA	DOOR CONTACT	BY DIVISION 28		NOT
1	EA	ACCESS CONTROL SYSTEM WITH KEY SWITCH	BY DIVISION 28		

DOOR NORMALLY CLOSED AND LOCKED AFTER NORMAL HOURS
VALID CREDENTIALS AT READER WILL RELEASE ELECTRIC STRIKE ALLOWING ENTRY VIA LEVER OR
ENGAGE ACTUATOR FOR AUTO OPERATOR
ENTRY DURING NORMAL HOURS VIA LEVER AND OR PUSHING ACTUATOR RELEASES ELECTRIC
STRIKE AND ENGAGES OPERATOR
IN THE CASE OF LOSS OF POWER AND OR FIRE ALARM, ELECTRIC STRIKE WILL REMAIN IN LOCKED
POSITION. OPERATOR HOLD OPEN WILL DISENGAGE AND CLOSE, ELECTRIC STRIKE WILL STAY IN THE
LOCKED POSITION.
FREE EGRESS AT ALL TIMES

Hardware Group No. 21

For use on Door #(s):

1:28.2 1:28.3

Provide each RU door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ALL HARDWARE	BY COILING COUNTER DOOR SUPPLIER		

Hardware Group No. 22

For use on Door #(s):
1:29

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
2	EA	ELECTRIC HINGE	3CB1HW 114X114MM CON TW8		⚡ BBLK/6 22	IVE
1	EA	ELEC FIRE EXIT HARDWARE	QEL-9849-L-DT-F-17-LBLAFL-CON 24 VDC		⚡ 315	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-9849-L-F-17-LBL-CON 24 VDC		⚡ 315	VON
1	EA	OH STOP	100S		BLK	GLY
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	SURFACE CLOSER	4040XP EDA		622	LCN
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
2	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28		⚡	

DOORS NORMALLY CLOSED AND LOCKED AFTER HOURS
DOORS ELECTRONICALLY DOGGED DURING NORMAL HOURS, PUSH/PULL OPERATION
VALID CREDENTIALS AFTER HOURS RETRACTS LATCH, ALLOWS ENTRY VIA LEVER TRIM AND OR
LOBBY ACTUATOR
IN THE CASE OF LOSS OF POWER OR FIRE ALARM, EXIT DEVICE LATCHES WILL ENGAGE AND DOOR
WILL REMAIN IN CLOSED POSITION
FREE EGRESS AT ALL TIMES

Hardware Group No. 23

For use on Door #(s):
X1:30.1 X1:30.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	EXISTING HARDWARE	TO BE RE-USED			

Hardware Group No. 24

For use on Door #(s):
X1:34.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	EXISTING HARDWARE	TO BE RE-USED			

Hardware Group No. 25

For use on Door #(s):

1:31.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
2	EA	DOOR PULL, 1" ROUND	8103EZHD 305MM STD		BLK	IVE
2	EA	PUSH PLATE	8200 100X405MM		BLK	IVE
2	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
2	EA	ARMOR PLATE	8400 808MM X 25MM LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CVX		BLK	IVE
1	EA	ROUGH IN , CABLING AND FIRE ALARM CONNECTION	BY DIVISION 28		⚡	

DOORS NORMALLY OPEN
ENTRY VIA PUSH/PULL OR PUSHING ACTUATOR ON EITHER SIDE TO ENGAGE OPERATORS

Hardware Group No. 26

For use on Door #(s):

1:31.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	9600		630	HES
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-4'-06		626	VON
1	EA	RIM CYLINDER	20-021		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
1	EA	KEY SWITCH (ADO HOLD OPEN)	CM-170/23		⚡ 630	CAM
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
1	EA	DOOR BOTTOM	355AA TO SUIT DOOR WIDTH		AA	ZER
1	EA	WIRE HARNESS	CON-6W (IN FRAME)		⚡	SCH
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 38		⚡	

DOOR NORMALLY CLOSED AND LOCKED
VALID CREDENTIALS AT READER RELEASE ELECTRIC STRIKE, ACCESS VIA LEVER AND OR ENGAGE ACTUATOR FOR AUTO OPERATOR FOR ACCESSING THE HALL.
FREE EGRESS AT ALL TIMES VIA PUSH/PAD AND OR PRESSING ACTUATOR WILL RELEASE ELECTRIC STRIKE AND ENGAGE OPERATOR

Hardware Group No. 27 - Not Used

Hardware Group No. 28

For use on Door #(s):
1:35

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	SURFACE CLOSER	4040XP EDA		622	LCN
1	EA	ARMOR PLATE	8400 808MM X 40MM LDW B-CS		630	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 29

For use on Door #(s):
1:36

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13	⚡		
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28	⚡		

DOOR NORMALLY CLOSED AND LOCKED
VALIDE CREDENTIALS AT READER RELEASES ELECTRIC STRIKE AND ALLOWS ACCESS MANUALLY OR
ENGAGE ACTUATOR FOR AUTO OPERATOR.
IN THE CASE OF LOSS OF POWER AND OR FIRE ALARM, ELECTRIC STRIKE STAYS IN THE LOCKED
POSITION
FREE EGRESS AT ALL TIMES

Hardware Group No. 30

For use on Door #(s):
1:37

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	ENTRANCE LOCK	ND53P6D SPA		622	SCH
1	EA	SURFACE CLOSER	4040XP EDA		622	LCN
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
1	EA	GASKETING	188S-BK (1 X DR W, 2X DR H)		BK	ZER
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28			

DOOR NORMALLY CLOSED AND LOCKED
VALID CREDENTIALS AT READER RELEASES ELECTRIC STRIKE ALLOWING ACCCESS
DOOR CAN BE MANUALLY OPENED AND LEFT OPEN WITH KEY
IN THE CASE OF LOSS OF POWER AND OR FIRE ALARM, ELECTRIC STRIKE STAYS IN THE LOCKED POSITION
FREE EGRESS AT ALL TIMES

Hardware Group No. 31

For use on Door #(s):
X1:38

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13			
1	EA	KEY SWITCH (ADO HOLD OPEN)	CM-170/23		630	CAM
1	EA	ROUGH IN , CABLING AND FIRE ALARM CONNECTION	BY DIVISION 28			







DOOR NORMALLY CLOSED AND LOCKED
ADD AUTO OPERATOR WITH HOLD OPEN TO EXISTING DOOR.
OPERATOR TIED TO FIRE ALARM. HOLD OPEN RELEASES UPON FIRE ALARM.
FREE EGRESS AT ALL TIMES

Hardware Group No. 32

For use on Door #(s):

1:40.1

Provide each SGL door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	9600		630	HES
1	EA	PANIC HARDWARE	98-L-BE-4'-06		315	VON
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		↗	
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ROUGH IN , CABLING AND FIRE ALARM CONNECTION	BY DIV. 28		↗	

DOOR NORMALLY CLOSED, ALWAYS FREE ENTRY AND EGRESS.
ENTRY VIA LEVER AND OR PUSHING ACTUATOR WILL RELEASE ELECTRIC STRIKE AND ENGAGE
ACTUATOR FOR AUTO OPERATOR
FREE EGRESS AT ALL TIMES VIA PUSHBAR AND OR PUSHING INTERIOR ACTUATOR TO RELEASE
ELECTRIC STRIKE AND ENGAGE OPERATOR.

Hardware Group No. 33

For use on Door #(s):
1:40.2

Provide each SGL door(s) with the following:

QTY	EA	DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	9600		630	HES
1	EA	PANIC HARDWARE	98-NL-OP-4'-110MD		315	VON
1	EA	RIM CYLINDER	20-021		622	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 305MM STD		BLK	IVE
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	SET	GASKETING	429BK-S X FRAME PERIMETER		BK	ZER
1	EA	DOOR SWEEP	39BK X DOOR WIDTH		BK	ZER
1	EA	THRESHOLD	626BK X DR. WIDTH		BK	ZER
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-____(SIZE TO SUIT)		⚡	SCH
1	EA	POWER SUPPLY	BY DIVISION 28		⚡ 600	UNK
1	EA	RELAY(S)	BY DIVISION 28		⚡	
1	EA	DOOR CONTACT	BY DIVISION 28		⚡	NOT
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28		⚡	










DOOR NORMALLY CLOSED AND LOCKED AFTER HOURS
VALID CREDENTIALS AT READER WILL RELEASE ELECTRIC STRIKE, MANUALLY PULL AND OR ACTUATOR TO ENGAGE OPERATOR
DURING NORMAL HOURS OF OPERATION, PULLING THE DOOR OPEN AND OR PRESSING EXTERIOR ACTUATOR WILL RELEASE ELECTRIC STRIKE AND ENGAGE OPERATOR
FREE EGRESS AT ALL TIMES VIA PUSHBAR AND OR VESTIBULE ACTUATOR

Hardware Group No. 34

For use on Door #(s):

1:41 1:42

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	PANIC HARDWARE	98-EO-4'		315	VON
1	EA	OH STOP	100S		BLK	GLY
1	EA	SURFACE CLOSER	4040XP EDA		622	LCN
1	EA	KICK PLATE	8400 305MM X 40MM LDW B-CS		630	IVE
1	EA	JAMB SEAL	328AA X 2 @ JAMB		D	ZER
1	EA	HEAD SEAL	429D (1 X HEADER)		D	ZER
1	EA	DOOR SWEEP	39BK X DOOR WIDTH		BK	ZER
1	EA	THRESHOLD	626BK X DR. WIDTH		BK	ZER








EXIT ONLY. NO ENTRY. FREE EGRESS AT ALL TIMES.

Hardware Group No. 35

For use on Door #(s):

1:05.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	PANIC HARDWARE	33A-EO-4'		315	VON
1	EA	OH STOP	100S		BLK	GLY
1	EA	SURFACE CLOSER	4040XP TOP JAMB LONG		622	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ SRT		693	LCN
1	EA	WEATHER STRIPPING	By Aluminum Door & Frame Supplier			
1	EA	DOOR SWEEP	39BK X DOOR WIDTH		BK	ZER
1	EA	THRESHOLD	626BK X DR. WIDTH		BK	ZER






EXIT ONLY. NO ENTRY. FREE EGRESS AT ALL TIMES.

Hardware Group No. 36

For use on Door #(s):

1:07.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	CLASSROOM LOCK	ND70P6D SPA		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATOR	REFER TO SECTION 08 71 13		↗	
3	EA	SILENCER	SR64		GRY	IVE

DOOR NORMALLY CLOSED AND LOCKED




DOOR CAN BE PUT INTO PASSAGE MODE DURING NORMAL WORKING HOURS, MANUAL ENTRY AND OR PUSHING ACTUATOR ON POOL VIEWING ROOM SIDE WILL RELEASE ELECTRIC STRIKE AND ENGAGE OPERATOR

Hardware Group No. 37

For use on Door #(s):

1:21.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	OH STOP	454S		SPBLK	GLY

Hardware Group No. 38

For use on Door #(s):
1:26

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	STOREROOM LOCK	ND80P6D SPA		622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBWMS		622	LCN
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
1	EA	JAMB SEAL	328AA X 2 @ JAMB		D	ZER
1	EA	HEAD SEAL	429D (1 X HEADER)		D	ZER
1	EA	DOOR BOTTOM	355AA TO SUIT DOOR WIDTH		AA	ZER
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28			

DOOR NORMALLY CLOSED AND LOCKED
VALID CREDENTIALS AT READER RELEASES ELECTRIC STRIKE ALLOWING ACCESS
IN THE CASE OF LOSS OF POWER OR FIRE ALARM, ELECTRIC STRIKE REMAINS LOCKED
FREE EGRESS AT ALL TIMES

Hardware Group No. 39

For use on Door #(s):
1:21

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	CLASSROOM LOCK	ND70P6D SPA		622	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBWMS		622	LCN
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		BLK	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28			






DOOR NORMALLY CLOSED AND LOCKED. DOOR MAY BE MANUALLY UNLOCKED DURING HOURS OF OPERATION.
VALID CREDENTIALS AT READER RELEASES ELECTRIC STRIKE ALLOWING ACCESS WHEN DOOR IS LOCKED.
IN THE CASE OF LOSS OF POWER OR FIRE ALARM, ELECTRIC STRIKE REMAINS LOCKED
FREE EGRESS AT ALL TIMES

Hardware Group No. 40

For use on Door #(s):

1:22

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
4	EA	HINGE	3CB1HW 114X114MM NRP		BBLK/6 22	IVE
1	EA	ELECTRIC STRIKE	1006CS		630	HES
1	EA	CLASSROOM LOCK	ND70P6D SPA		622	SCH
1	EA	OH STOP	100S ADJ		BLK	GLY
1	EA	AUTO OPERATOR C/W ACTUATORS	REFER TO SECTION 08 71 13		⚡	
1	EA	KEY SWITCH (ADO HOLD OPEN)	CM-170/23		⚡ 630	CAM
1	EA	KICK PLATE	8400 305MM X 25MM LDW B-CS		630	IVE
1	EA	ACCESS CONTROL SYSTEM	BY DIVISION 28		⚡	

DOOR NORMALLY CLOSED AND LOCKED AFTER NORMAL HOURS
DOOR TO BE MANUALLY UNLOCKED, KEYSWITCH ENABLES ACTUATORS
ENTRY VIA LEVER AND OR PUSHING ACTUATOR RELEASES ELECTRIC STRIKE AND ENGAGES
OPERATOR
IN THE CASE OF LOSS OF POWER AND OR FIRE ALARM, OPERATOR HOLD OPEN WILL DISENGAGE AND
CLOSE, ELECTRIC STRIKE WILL STAY IN THE LOCKED POSITION
FREE EGRESS AT ALL TIMES

Part 1 General

1.1 SECTION INCLUDES

- .1 Low energy power operated swing door operators.
- .2 Actuators and safety devices.

1.2 RELATED REQUIREMENTS

- .1 Division 28 - Electronic Safety and Security: Connection to access control system

1.3 DEFINITIONS

- .1 AAADM - American Association of Automatic Door Manufacturers.
- .2 Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.
- .3 Low Energy Power Operated Doors: Doors with a power mechanism that opens and closes the door upon receipt of an actuating signal and does not generate more kinetic energy than specified in BHMA A156.19. Closing of doors is linked to and integral with power operator mechanism.

1.4 REFERENCE STANDARDS

- .1 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- .2 BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated Doors; 2013.
- .3 City of Winnipeg Accessibility Design Standards - City of Winnipeg Accessibility Design Standards; 2018.
- .4 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations; 2021.
- .5 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
 - .2 Coordinate layout and installation of automatic door operators with connections to power supplies, remote activation devices, and electric door latching hardware.
 - .3 Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

- .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), and electrified hardware consultant (EHC).
 - .3 Hardware installer.
 - .4 City's security consultant.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Convene pre-installation meeting prior to rough-in and installation of automatic door operators. Required attendance of parties directly affecting work of this Section include Contractor, Automatic Door Operator Subcontractor, Electrical Subcontractor, and Contract Administrator. Purpose of meeting is to coordinate all electrical wiring and access control requirements, and discuss quality of workmanship expected.

1.7 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
 - .2 Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.
- .3 Product data: Provide data on system components, sizes, features, and finishes.
- .4 Samples: Submit two samples of door actuators. Samples will be returned for installation in the Work.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Manufacturer's installation instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.
- .7 Manufacturer's qualification statement.
- .8 Installer's qualification statement.
- .9 Project record documents: Record actual locations of concealed equipment, services, and conduit.
- .10 Maintenance data: Include manufacturer's parts list and maintenance instructions for each type of operating component.

- .11 Site quality control submittals:
 - .1 Submit completed AAADM recommended inspection forms after installation of automatic door equipment.
 - .2 Provide AAADM 'Safety Information' sticker at inside face of mullion for doors operated by barrier free equipment and automatic door operators. Ensure sticker shows step-by-step safety check required at start-up.
- .12 Warranty: Submit manufacturer warranty and ensure that forms have been completed in City's name and registered with manufacturer.
- .13 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, 01 60 00 - Product Requirements, for additional provisions.
 - .2 Wrenches and other tools required for maintenance of equipment.

1.8 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience, and a member of AAADM.
- .2 Installer qualifications: Company specializing in performing work of the type specified and with at least five years documented experience and approved by manufacturer.
 - .1 Certified by AAADM.

1.9 WARRANTY

- .1 See Section 01 78 00 - 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 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 Comply with City of Winnipeg Accessibility Design Standards for low-energy automatic door operators, actuators, and safety devices.
- .2 Electrically operated or controlled hardware: Provide necessary power supplies, 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.
- .3 Emergency-exit door requirements: Comply with requirements of authorities having jurisdiction for swinging automatic entrance doors serving as a required means of egress.
- .4 System integration:
 - .1 Where indicated to install both knowing act and secure activation system, configure automatic door operators to operate by knowing act after verification from secure activation system when secured; and by knowing act when not secured.

- .2 Where required for proper operation, provide a time delay relay to signal automatic door operator to activate only after electric lock system is released.
- .3 Provide electrical interface with door latching hardware to enable exterior knowing act activation device only when latching hardware is dogged.
- .4 Provide electrical interface to deactivate automatic door operators on activation of fire alarm system.

2.2 MANUFACTURERS

- .1 Basis-of-Design Products for door operators for swing doors:
 - .1 Assa Abloy; Besam SW100.
 - .2 Stanley Access Technologies; M-Force.
 - .3 Horton; Series 7100/7900 LE EasyAccess.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 POWER OPERATED DOORS

- .1 Swinging doors with low-energy power operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by a manual actuator, not a sensor.
 - .1 In addition to other requirements, provide equipment ULC (DIR) listed as a fire door operator with automatic closer.
 - .2 Fully adjustable for opening and closing speeds, checking speeds, and hold-open time; in the event of power failure, disengage operator allowing door to function as a door with a spring closer.
 - .3 Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

2.4 OPERATORS FOR SWINGING DOORS

- .1 Door operator: Electric or electro-mechanical, surface mounted overhead.
 - .1 Operation: Full-power open, spring close or power-boost close operation.
 - .2 Variable speed control for opening and closing cycles.
 - .3 Actuators and safeties: As specified in this Section.
 - .4 Finish for door operator enclosure: AAMA 611 custom anodized, black.
 - .5 Fasteners and accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
 - .6 Signage: Provide signage in accordance with BHMA A156.19.

2.5 ACTUATORS AND SAFETIES

- .1 Full-length actuator: Hard-wired, weather-resistant, extruded aluminum construction, tapered low profile design, complete with end caps, and International Access symbol and "Push to Open" lettering.
 - .1 Size: 915 high by 150 wide by 41 mm deep, with full-length activation area.
 - .2 Finish: Clear anodized.
 - .3 Basis-of-Design Products:

- .1 Wikk Industries; Ingress'r S-I36-3.
 - .2 Camden; CM-7536.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Swinging door safety device: Door-mounted presence sensor infrared device arranged to prevent operation of door when persons or obstructions are in the swing zone; mounted on approach side of door; detects person in its path and sends signal to hold open or reactivate door until person has moved out of its pattern.
- .1 Detection response time <50 ms; infinite presence detection time; detection range 685 mm to 2490 mm.
 - .2 Relay: Prevents presence detector from activating door when door is manually operated permitting door to close without hold-open delay.
 - .3 Basis-of-Design Product:
 - .1 BEA; Superscan-T II.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that electric power is available and is of the correct characteristics.

3.2 PREPARATION

- .1 Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

3.3 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions.
- .2 Set work plumb, square, level, free from warp, twist and superimposed loads.
- .3 Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment. Seal joints weathertight.
- .4 Provide for dimensional distortion of components during operation.
- .5 Coordinate installation of components with related and adjacent work; level and plumb.
- .6 Install rubber dampening devices to sound isolate operators from door frames.

3.4 SITE QUALITY CONTROL

- .1 Inspection: Engage installer's certified inspector to test and inspect automatic door operators and prepare test and inspection reports.
- .2 Certified inspector shall test and inspect each automatic door operator to determine compliance of installed systems with applicable BHMA standards.

- .3 Inspection report: Certified inspector shall submit report in writing to the Contract Administrator and Contractor within 24 hours after inspection.

3.5 ADJUSTING

- .1 Adjust door equipment for correct function and smooth operation.

3.6 CLEANING

- .1 Remove temporary protection, clean exposed surfaces.

3.7 CLOSEOUT ACTIVITIES

- .1 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Insulating glass units.
- .2 Glazing units.
- .3 Plastic sheet glazing units.
- .4 Plastic films.
- .5 Laminated glass interlayers.
- .6 Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 07 25 00 - Weather Barriers.
- .2 Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- .3 Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and sidelites.
- .4 Section 08 42 29 - Automatic Entrances: Glazing provided as part of door assembly.
- .5 Section 08 44 35 - Fire-Resistive Framed Glazing Assemblies: Glazing fire-tested as part of the wall assembly.

1.3 REFERENCE STANDARDS

- .1 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- .2 ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- .3 ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- .4 ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- .5 ASTM C1036 - Standard Specification for Flat Glass; 2021.
- .6 ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- .7 ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- .8 ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- .9 ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- .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 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .13 CAN/CGSB 12.1 - Safety Glazing; 2017.
- .14 CAN/CGSB 12.20 - Structural Design of Glass for Buildings; 1989.
- .15 CAN/CGSB 19.13 - Sealing Compound, One Component, Elastomeric, Chemical Curing; 1987.
- .16 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .17 GANA (GM) - GANA Glazing Manual; 2008.
- .18 GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- .19 GANA (SM) - GANA Sealant Manual; 2008.
- .20 IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- .21 IGMA TM-4000 - Insulating Glass Manufacturing Quality Procedures; 2002 (2007).
- .22 ITS (DIR) - Intertek Testing Services, Directory of Listed Products; current edition.
- .23 LBNL WINDOW - Lawrence Berkeley National Laboratory WINDOW; 8.
- .24 MBC - Manitoba Building Code - MBC - M.R. 78/2023; 2024.
- .25 NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.
- .26 NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).
- .27 NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.
- .28 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .29 SCS (CPD) - SCS Certified Products; Current Edition.
- .30 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
- .31 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Preinstallation meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data on each insulating glass unit, glazing unit, plastic sheet glazing unit, and plastic film glazing type: 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 for selection: Submit one sample 1000 by 1000 mm in size of IGU-2 complete with bird-friendly etching, low e coatings, and frit. Frit colour to be consulted with Contract Administrator before fabrication; mounted in black anodized aluminum framing. Provide sample within 2 months of award of Contract.
- .5 Samples for verification: Submit two samples 300 by 300 mm in size of each type of insulating glass unit; fire-resistance rated glass; butt-glazed monolithic glass with silicone joint in centre of sample; plastic sheet glazing with finished edge on two adjacent edges, and plastic glazing film applied to 6 mm thick monolithic clear glass.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Design data: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- .8 Certificate: Certify that products of this section meet or exceed specified requirements.
- .9 Installer's qualification statement.
- .10 Warranty documentation: Submit manufacturer warranty and ensure that forms have been completed in City's name and registered with manufacturer.
- .11 Maintenance data: Include recommended cleaning methods, and cleaning materials for plastic sheet glazing.

1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 and IGMA TM-4000 for fabrication and glazing installation methods.
- .2 Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- .3 Installer qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- .4 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 Maximum deviation from flatness at any peak (peak to valley deviation), 0.08 mm at center of lite and 0.20 mm within 267 mm of leading or trailing edge.
 - .3 Apply heat treatment prior to the application of low-e coatings to minimize appearance of roller wave distortion.

1.7 SITE CONDITIONS

- .1 Ambient conditions: Maintain temperature, humidity and solar exposure conditions of glass glazing materials during shipping, storage and site installation as required by manufacturer to maintain warranty and performance of installed products, and as

follows:

- .1 Install glazing when ambient temperature is above manufacturer's written minimum requirement and rising.

1.8 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- .2 Insulating glass units: Provide a ten (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 (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.
- .4 Polycarbonate sheet glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the CAL (CDPH SM) or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 Sealants: Complying with SCAQMD 1168.

2.2 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 CAN/CGSB 12.20 or ASTM E1300 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 - Manitoba Building Code for Normal Importance Category using Importance Factor (Iw)

- 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 Seismic loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of the MBC - Manitoba Building Code.
- .5 Limit of centre of glass deflection: Limit centre of glass deflection to a maximum of 1/60 and not exceeding 10 mm relative to the undeflected glass plane.
- .6 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.
- .7 Glass thicknesses listed are minimum.
- .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 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 Centre 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.

2.3 GLASS MATERIALS

- .1 Float glass: Provide float glass based glazing unless noted otherwise.
 - .1 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 Exposed edges: Ground with no chips, cracks or flaws, with sharp corners and edges eased and polished before heat treatment.
 - .4 Labelling: Required.
 - .2 Impact resistant safety glass: Complies with CAN/CGSB 12.1 criteria; Impact Class A, and fully tempered in accordance with ASTM C1048.
- .2 Fritted glass: Ceramic frit is fused into glass creating permanent designs.
 - .1 Applications: Locations as indicated on Drawings.

- .2 Colour: Grey, as selected by Contract Administrator.
- .3 Pattern: 6 mm squares, pattern to be determined, 30 percent coverage.
- .4 Glass type: Fully tempered; insulated glass (IG) system, applied side #3 of triple glazed unit.
- .5 Thickness: 6 mm, nominal.
- .3 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 Exposed edge alignment: Not withstanding requirements of ASTM C1172; grind and polish edges after assembly and heat treatment to minimize mismatch of exposed edges to a tolerance not exceeding plus 1.25 mm / minus 0.00 mm; align patterns to the greatest extent possible to reduce moiré effect.
 - .6 Standard tolerances listed in ASTM C1172 apply to glass having non-exposed edges.
 - .7 Laminating film material:
 - .1 Safety film, Polyvinyl Butyral (PVB).
 - .2 Safety film for use with butt-glazed (sealant) joints: Ionoplast.
 - .8 Colour: Transparent.

2.4 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.
 - .3 Warm-edge spacers: For IGU, unless otherwise indicated.
 - .1 Spacer width: As required for specified insulating glass unit.
 - .2 Spacer height: 6.4 mm.
 - .3 Basis-of-Design Product:
 - .1 Quanex IG Systems, Inc; Super Spacer Premium Plus.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Spacer colour: Black.
 - .4 Edge seal:
 - .1 Dual-sealed system: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
 - .2 Colour: Black.
 - .5 Purge interpane space with dry air, hermetically sealed.

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- .2 Type IGU1 - 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: Clear.
 - .2 Acid-etched pattern: 5 mm squares on 50 by 50 mm random pattern, on #1 surface.
 - .3 Coating: Low-E (passive type) Vitro Solarban 70VT, on #2 surface.
 - .4 Basis-of-Design Product: Walker Glass AviProtek E.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Middle lite: Heat-strengthened float glass, 6 mm thick, minimum.
 - .1 Tint: Clear.
 - .5 Inboard lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Clear.
 - .6 Total thickness: 43 mm.
 - .7 Thermal transmittance (USI Factor), Winter - Centre of Glass: 1.4 Watts per square metre per degree Kelvin, nominal.
 - .8 Glazing method: To meet performance requirements.
 - .3 Type IGU2 - 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: Clear.
 - .2 Acid-etched pattern: 5 mm squares on 50 by 50 mm random pattern, on #1 surface.
 - .3 Coating: Low-E (passive type) Vitro Solarban 70VT, on #2 surface.
 - .4 Basis-of-Design Product: Walker Glass AviProtek E.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Middle lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Clear.
 - .2 Coating: Ceramic frit (silk-screened), on #3 surface, dark gray, to 30 percent coverage, 6 mm squares on clear (colour to be confirmed by Contract Administrator).
 - .5 Inboard lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Clear.
 - .6 Total thickness: 43 mm.
 - .7 Thermal transmittance (USI Factor), Winter - Centre of Glass: 1.4 Watts per square metre per degree Kelvin, nominal.
 - .8 Glazing method: To meet performance requirements.

- .4 Type IGU3 - Insulating glass: Fire-rated curtain wall.
 - .1 As specified in Section 08 44 35 - Fire-Resistive Framed Glazing Assemblies.
- .5 Type IGU4 - Insulating glass units: Safety glazing, double-glazed.
 - .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 with acid-etched pattern, 6 mm thick, minimum.
 - .1 Tint: Clear.
 - .2 Coating: Low-E (passive type) Vitro Solarban 70VT, on #2 surface.
 - .4 Inboard lite: Fully tempered float glass, 6 mm thick, minimum.
 - .1 Tint: Clear.
 - .5 Total thickness: 25 mm.
 - .6 Glazing method: To meet performance requirements.

2.5 GLAZING UNITS

- .1 Type FRRG - Fire-resistance-rated glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-rating period.
 - .1 Applications:
 - .1 Glazing in fire-rated door assembly.
 - .2 Glazing in sidelites, borrowed lites, and other glazed openings in fire-rated wall assemblies.
 - .2 Glass type: Multi-laminate annealed glass with intumescent fire retardant interlayers.
 - .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 scheduled.
 - .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.
 - .7 Temperature rise rating (if applicable).
 - .8 Basis-of-Design Products:
 - .1 SAFTIFIRST. a division of O'Keeffe's Inc; SuperLite II-XLM.
 - .2 Vetrotech North America; Contraflam.

- .3 Pilkington; Pyrostop.
- .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Type SG - Monolithic safety glazing: Non-fire-rated.
 - .1 Applications:
 - .1 Glazed lites in interior doors, except fire doors.
 - .2 Glazed sidelights to doors, except in fire-rated walls and partitions.
 - .3 Other locations required by applicable federal, provincial, and local codes and regulations.
 - .4 Other locations indicated on Drawings.
 - .2 Glass type: Fully tempered safety glass as specified.
 - .3 Tint: Clear.
 - .4 Thickness: 6 mm, nominal.
- .3 Type LSG - Laminated safety glazing: Laminated glass, 2-Ply.
 - .1 Applications: Locations as indicated on Drawings.
 - .2 Tint: Clear.
 - .3 Thickness: As required to meet performance criteria.
 - .4 Outer lite: Tempered glass.
 - .5 Interlayer: Ionoplast for laminated glass with butt-glazed (sealant) joints; polyvinyl butyral (PVB), thickness of interlayer as required to meet performance criteria.
 - .6 Inside lite: Tempered glass.
 - .7 Glazing method: Gasket glazing, or butt-joint (sealant) as indicated.

2.6 PLASTIC SHEET GLAZING UNITS

- .1 Polycarbonate flat sheet: Ultraviolet (UV) stabilized.
 - .1 Applications: Locations as indicated on Drawings.
 - .2 Type: Monolithic (single layer solid) sheet.
 - .3 Tint: Clear, transparent.
 - .4 Thickness: 6 mm.
 - .5 Edge treatment: File and sand edges and corners to smooth finish without sharp edges.
 - .6 Glazing method: Stand-offs.
 - .7 Basis-of-Design Products:
 - .1 SABIC Innovative Plastics US LLC; Lexan.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.7 PLASTIC FILMS

- .1 Glass surface film - Type GSF - Decorative plastic film: Vinyl type.
 - .1 Application: Locations as indicated on Drawings.
 - .2 Series type: Textured frost.
 - .3 Colour: Sandblast.
 - .4 Thickness without liner: 0.127 mm.

- .5 Visible light transmittance (VLT): 87 percent, nominal.
- .6 Basis-of-Design Product:
 - .1 Lumar, an Eastman Chemical Company; Textured Frost; Sandblast.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.8 GLAZING COMPOUNDS

- .1 General:
 - .1 Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, fire-rated glass, laminated glass, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - .2 Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - .3 Colours of exposed glazing sealants: as selected by Contract Administrator from manufacturer's full range.
- .2 Silicone sealant: Single component or multi-component; neutral curing; compatible with laminated glass; 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.

2.9 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; 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.
- .4 Glazing gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; colour black.
- .5 Stand-offs: 32 mm dia. by 25 mm high Type 316 solid stainless steel stand-off base, complete with stainless steel hanger bolts, and 32 mm dia. by 6 mm thick Type 316 stainless steel stand-off cap with gasket and shoulder sleeve.
 - .1 Finish: Brushed stainless steel.
 - .2 Basis-of-Design Products:

- .1 Base: Richelieu; SB125150-170.
- .2 Cap: Richelieu; SC125025-170.
- .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

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 - Glazed aluminum windows, aluminum doors, interior glazed aluminum frames: Set glazing for aluminum windows from interior of building; set glazing infills for doors and interior framing from either side of the glazing.
- .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 hollow metal doors and frames, wood doors.
- .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 GLAZING METHOD (TAPE AND SEALANT)

- .1 Application - Exterior hollow metal doors: Set glazing infills from the interior of the building.
- .2 Cut glazing tape to length and install 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 to ensure full contact at perimeter of pane or unit.
- .5 Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm intervals, 6 mm below sight line.
- .6 Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.
- .7 Carefully trim protruding tape with knife.
- .8 Apply continuous cap bead of silicone type sealant at perimeter glass on exterior side. Tool or wipe sealant surface smooth.

3.7 INSTALLATION - BUTT JOINT GLAZING METHOD (SEALANT ONLY)

- .1 Application - Vertical joints between glass panels in interior storefront framing.
- .2 Temporarily brace glass in position for duration of glazing process; mask edges of glass at adjoining glass edges and between glass edges and framing members.
- .3 Temporarily secure a small diameter non-adhering foamed rod on back side of joint.
- .4 Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod, and then tool sealant surface smooth to concave profile.
- .5 Permit sealant to cure then remove foam backer rod, and then apply sealant to opposite side, tool smooth to concave profile.
- .6 Remove masking tape.

3.8 INSTALLATION - PRESSURE GLAZED SYSTEMS

- .1 Application - Exterior glazed curtain wall: Set glazing infills from exterior side of 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 pressure plates without displacing glazing gasket; exert pressure for full continuous contact.
- .5 Install cover plates.

3.9 INSTALLATION - PLASTIC SHEET GLAZING

- .1 Install plastic sheet glazing on stand-offs after installation of City-supplied televisions.

3.10 INSTALLATION - PLASTIC FILM

- .1 Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- .2 Place without air bubbles, creases or visible distortion.
- .3 Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1.6 mm to 3.2 mm gap at perimeter of glazed panel unless otherwise required. Do not score the glass.
- .4 Do not cut plastic film on fire-resistive framed glazing assemblies. Precut to fit.

3.11 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.

3.12 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 RELATED REQUIREMENTS

- .1 Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Framed mirrors.

1.3 REFERENCE STANDARDS

- .1 ASTM C1036 - Standard Specification for Flat Glass; 2021.

1.4 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 Samples: Submit two samples, 150 mm long in size, illustrating mirror mounting accessories.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.

1.5 SITE CONDITIONS

- .1 Do not install mirrors when ambient temperature is less than 10 degrees C.

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; Type UM1: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating; and safety film on back.
 - .1 Thickness: 6 mm.
 - .2 Edges: Ground and polished.
 - .3 Size: As indicated on Drawings.

2.2 ACCESSORIES

- .1 Mirror attachment accessories: Stainless steel J-profile channels, at top and bottom.

Part 3 Execution

3.1 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 Frameless mirrors: Set mirrors with top and bottom channels, and anchor rigidly to wall construction. Butt edges of mirrors where placed side-by-side. Align top and bottom edges.

3.2 CLEANING

- .1 Clean mirrors and adjacent surfaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - .1 Resilient tile and sheet.
 - .2 Resilient athletic sheet.
 - .3 Carpet tile.
- .2 Contractor shall perform and be responsible for the following:
 - .1 Preparation of new and existing concrete floor slabs for installation of floor coverings. Preparation of existing marble base for reinstallation.
 - .2 Testing of concrete floor slabs for moisture and alkalinity (pH).
 - .3 Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - .1 Contractor shall perform specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
 - .4 Patching compound.
 - .5 Remedial floor coatings.
- .3 Flooring Subcontractor shall remove existing floor coverings and marble base where indicated.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Limitations on curing requirements for new concrete floor slabs and topping; concrete flatness tolerances and remediation.
- .2 Section 09 65 00 - Resilient Flooring: Testing performed by Flooring Subcontractor.
- .3 Section 09 65 66 - Resilient Athletic Flooring: Testing performed by Flooring Subcontractor.
- .4 Section 09 68 13 - Tile Carpeting: Testing performed by Flooring Subcontractor.

1.3 REFERENCE STANDARDS

- .1 ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2021.
- .2 ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
- .3 ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

- .4 ASTM F3191 - Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring; 2023.
- .5 ASTM F3441 - Standard Guide for Measurement of pH Involving Resilient Flooring Installations; 2023.
- .6 NFCA (FCRM) - National Floor Covering Association, Floor Covering Reference Manual; Current Edition.
- .7 RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.
- .2 Pre-construction meeting:
 - .1 Convene pre-construction meeting in accordance with Section 01 31 00, prior to start of cast-in-place concrete installation, with Contractor, Contract Administrator, Cast-in-Place Concrete Subcontractor, Flooring Subcontractors, and resilient flooring and adhesive manufacturer's technical representative, in attendance, to confirm the following:
 - .1 Temporary heating and humidity control required for installation of flooring products.
 - .2 Acceptable substrate conditions (moisture, pH, relative humidity, straightedge gap measurements).
 - .3 Floor flatness responsibilities of Cast-in-Place Concrete Subcontractor. Co-ordination with Cast-in-Place Concrete Subcontractor for starting concrete flatness and levelness tolerances.
 - .3 Pre-installation meeting:
 - .1 Convene pre-installation meeting in accordance with Section 01 31 00, with Contractor, Contract Administrator, and Flooring Subcontractors in attendance. Discuss the following:
 - .1 Removal and disposal of existing floor coverings, and removal and salvage of existing marble base.
 - .2 Substrate requirements.
 - .3 Floor moisture, and alkalinity test results.
 - .4 Other testing requirements including adhesive bond test
 - .5 Facility room temperatures/HVAC requirements.
 - .6 Installation and application procedure for products specified including floor preparation, adhesive application, seaming methods, self-covered base (inside/outside corners), rubber base, transitions to adjacent flooring materials, co-ordination with work by other subtrades, protection of finished work.
 - .7 Quality of workmanship expected.

1.5 SUBMITTALS

- .1 Floor covering and adhesive manufacturers' Product literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - .1 Moisture and alkalinity (pH) limits and test methods.
 - .2 Manufacturer's required bond/compatibility test procedure.
- .2 Testing agency's report:
 - .1 Description of areas tested; include floor plans and photographs if helpful.
 - .2 Summary of conditions encountered.
 - .3 Moisture and alkalinity (pH) test reports.
 - .4 Copies of specified test methods.
 - .5 Recommendations for remediation of unsatisfactory surfaces.
 - .6 Product data for recommended remedial coating.
 - .7 Include certification of accuracy by authorized official of testing agency.
 - .8 Submit report to Contract Administrator.
 - .9 Submit report not more than two business days after conclusion of testing.
- .3 Adhesive bond and compatibility test report.
- .4 Copy of RFCI (RWP).
- .5 Remedial materials Product data: Manufacturer's published data on each product to be used for remediation.

1.6 QUALITY ASSURANCE

- .1 Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- .2 Testing agency qualifications: Independent testing agency experienced in the types of testing specified.
 - .1 Submit evidence of experience consisting of at least three test reports of the type required, with project owner's project contact information.
- .3 Contractor's responsibility relating to independent agency testing:
 - .1 Provide access for and cooperate with testing agency.
 - .2 Confirm date of start of testing at least 10 days prior to actual start.
 - .3 Allow at least 4 business days on site for testing agency activities.
 - .4 Achieve and maintain specified ambient conditions.
 - .5 Notify Contract Administrator when specified ambient conditions have been achieved and when testing will start.
- .4 Installation requirements: Install floor preparation materials and flooring products in accordance with NFCA (FCRM) and manufacturer's written instructions.
- .5 Installer qualifications: Install using personnel that are experienced with installation of flooring preparation Products required for the project.
- .6 Certifications: Provide proof of the following during the course of the Work:

- .1 Compatibility certificate: Provide letter from flooring adhesive manufacturers stating that Products proposed for use on the Project are compatible with flooring substrates, flooring preparation and flooring.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- .2 Deliver materials in manufacturer's packaging; include installation instructions.
- .3 Keep materials from freezing.

1.8 SITE CONDITIONS

- .1 Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 18 degrees C or more than 30 degrees C.
- .2 Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

Part 2 Products

2.1 MATERIALS

- .1 Patching compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - .1 Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - .2 Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 - .3 Compressive strength: 20 PMA, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
- .2 Alternative flooring adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- .3 Remedial floor coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapour transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

- .1 Thickness: As required for application and in accordance with manufacturer's installation instructions.
- .2 Use product recommended by testing agency.

Part 3 Execution

3.1 CONCRETE SLAB PREPARATION

- .1 Prepare existing and new concrete floors in accordance with ASTM F710.
- .2 Perform following operations in the order indicated:
 - .1 Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - .1 Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - .2 Removal of existing floor covering (performed by Flooring Subcontractor).
 - .2 Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
 - .1 Do not attempt to remove coating or penetrating material.
 - .2 Do not abrade surface.
 - .3 Preliminary cleaning.
 - .4 Moisture vapour emission tests; 3 tests in the first 100 square metres and one test in each additional 100 square metres, unless otherwise indicated or required by flooring manufacturer.
 - .5 Alkalinity (pH) tests; in same locations as moisture vapour emission tests, unless otherwise indicated.
 - .6 Concrete porosity tests.
 - .7 Specified remediation, if required.
 - .8 Patching, smoothing, and leveling, as required.
 - .9 Other preparation specified.
 - .10 Adhesive bond and compatibility test.
 - .11 Protection.
- .3 Remediations:
 - .1 Active water leaks or continuing moisture migration to surface of slab: Correct this condition before doing any other remediation; re-test after correction.
 - .2 Excessive moisture emission or relative humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 - .3 Excessive alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS - BY FLOORING SUBCONTRACTOR

- .1 Comply with local, provincial, and federal regulations and recommendations of RFCI (RWP) for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- .2 Carefully remove and salvage existing marble base, where indicated, in quantities as required for reinstallation.
- .3 Dispose of removed materials in accordance with local, provincial, and federal regulations and as specified.

3.3 PRELIMINARY CLEANING

- .1 Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mould, mildew, and other materials that might prevent adhesive bond.
- .2 Do not use solvents or other chemicals for cleaning.
- .3 Clean salvaged marble base free from existing bonding materials, contaminants, and other debris detrimental to bond and final surface appearance.

3.4 MOISTURE VAPOUR EMISSION TESTING

- .1 Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- .2 Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- .3 Test in accordance with ASTM F1869 and as follows.
- .4 Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- .5 In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 1.4 kg per 93 square metres per 24 hours.
- .6 Report: Report the information required by the test method.

3.5 ALKALINITY TESTING

- .1 Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- .2 The following procedure is the equivalent of that described in ASTM F3441, repeated here for the Contractor's convenience.

- .3 Use alkalinity (pH) test paper with a minimum range of 4 pH to 12 pH, its associated colour comparison chart, and distilled or deionized water.
- .4 Place several drops of water on a clean surface of concrete, forming a puddle approximately 25 mm in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
- .5 In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.6 CONCRETE POROSITY TESTING

- .1 Perform testing in accordance with ASTM F3191 to confirm that concrete substrate porosity is acceptable to adhesive manufacturer's written installation requirements.

3.7 PREPARATION

- .1 See individual floor covering sections for additional requirements.
- .2 Comply with requirements and recommendations of floor covering manufacturer.
- .3 Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- .4 Do not fill expansion joints, isolation joints, or other moving joints.

3.8 APPLICATION OF REMEDIAL FLOOR COATING

- .1 Comply with requirements and recommendations of coating manufacturer.

3.9 PROTECTION

- .1 Cover prepared floors with building paper or other durable covering.

END OF SECTION

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ABBREV	MATERIAL	SPEC NO	ABBREV	MATERIAL	SPEC NO
-	No Work or Material unless otherwise noted				
AFGP	Aluminum Framed Glass Partition	varies	PF	Prefinished	-
AWP	Acoustic Wall Panels	09 84 30	PL	Plaster	
C	Concrete	03 30 00	PLP	Plastic-Laminate-Faced Wood Paneling	06 40 00
CSH	Concrete Sealer with Hardener	03 35 11	PLWD	Plywood	
CMU	Concrete Masonry Unit	04 20 00	PTC	Phenolic Toilet Compartments	10 21 13.17
CT	Ceramic Tile	09 30 00	R	Rubber Base	09 65 00
EP	Epoxy Paint	09 91 00	RAF	Resilient Athletic Vinyl Sheet Flooring	09 65 66
FG	Floor Grate and Frame	12 48 13	SC	Self-Coved Base	09 65 00
FH	Full Height		SSM	Solid Surface Material	06 40 00
FPP	Folding Panel Partition	10 22 39	SSW	Stainless Steel Wall Covering	10 26 00
GB	Gypsum Board	09 21 16	TC	Tiled Carpet	09 68 13
GL	Glazing	08 80 00	TRZ	Terrazzo	09 66 23
LVT	Luxury Vinyl Tile (Resilient Flooring)	09 65 00	U	Unfinished	
M	Marble Base - Salvaged from existing	09 30 00	VS	Vinyl Sheet (Resilient Flooring)	09 65 00
P	Paint	09 91 00	X	Existing	

TYPICAL NOTES:	
1.	All sub-floor material to be concrete unless otherwise noted.
2.	All measurements indicated are millimeters and are indicated as height above floor finish (AFF), unless otherwise noted.
3.	Where two wall materials are indicated, refer to interior elevations or plans for extents.
4.	All welding seams to match field colour, unless otherwise noted.
5.	All SC base to be 100mm AFF, unless otherwise noted.
6.	Where SC base is specified in rooms with millwork, millwork base is to receive SC base of same floor finish specified for room.
7.	All walls to receive paint (P) finish, unless otherwise noted.
8.	All ceiling and bulkheads to receive paint (P#) finish, unless otherwise noted; match gloss level of adjacent surfaces.
9.	All CMU walls to be painted INT4.2E/G3 unless otherwise noted.
10.	All access hatches to be painted to match adjacent wall.
11.	Paint new and exposed steel columns.
12.	Where ES-P is indicated on RCP, the structure (steel decking, OWSJ, columns, etc.), mechanical ducts, electrical conduits, junction boxes etc., and fire protection piping, and associated accessories above the suspended ceiling planes to full extent of room ceiling area are to be painted black, unless otherwise noted.
13.	Where GB is noted in the Room Finish Schedule as material receiving ceramic tile, GB is to be tile backerboard. Refer to specification.
14.	Refer to Door Schedule for doors and door frames to be painted.

REMARKS:	
R1	Wall base is applied to GB finished walls only.
R2	Glass Surface Film applied to Glazing Unit, as shown on drawings.
R3	Glass Surface Film applied to Glazing Unit, as shown on drawings.
R4	New solid surface material base (SSM-3) to be installed on new West gypsum board partition. Transition to rubber base (R) on new gypsum board partition return.
R5	Finishes described for a typical water closet stalls as part of Room 1:32.1. Apply finishes to the 12 stalls in Room 1:32.1.
R6	SSW behind stove ranges to span from ceiling to 150mm below counter height behind stove range. Refer to interior elevations.
R7	Provide large scale graphic signage on back reception wall with 12mm thick felt sound absorptive material (AWP-2). Graphic to be confirmed and provided during construction.
R8	Install salvaged marble base to East wall where room is receiving new terrazzo floor finish. Transition to rubber base (R) on new gypsum board partition return, and install rubber base on existing concrete columns.
R9	Finish concrete curb beneath aluminum storefront assembly with exterior grade gypsum board complete with mosaic ceramic tile, as noted in schedule.
R10	CMU on south wall refers to CMU infill where door at stage level was removed.
R11	Paint south wall up to first inside corner adjacent to stair entry. Paint North wall full extent.
R12	North/South wall material refers to wall at extent of room, behind water closets. Partitions forming part of lavatory assembly are GB material to receive paint.
R13	Paint gypsum board behind PLP and AWP, colour tbd. Confirm sheen with Contract Administrator.
R14	Allow for approximately 150mm retiling work (CT-3) around new pool viewing bay, c/w matching tile cove base.
R15	CT-2 on East Wall applies only to window infill, colour pattern to be similar to existing. Refer to interior elevations. Confirm pattern with Contract Administrator prior to install.
R16	Paint existing columns.
R17	Patch, repair and paint where impacted by installation of ADO.
R18	Wall base is applied to all wall surfaces, inclusive of columns and millwork base. Patch, repair walls where existing base was removed to make surface like-new condition.
R19	Paint abandoned folding partition bulkhead.
R20	Install flooring finish under lockers.

ROOM NO.	ROOM NAME	FLOOR		BASE		NORTH WALL		EAST WALL		SOUTH WALL		WEST WALL		REMARKS
		MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	
<i>Refer to Drawing Sheet A2.1 Main Floor Plan</i>														
1:01	ENTRY VESTIBULE	C	LVT / FG		R	GB / AFGP	P / -	GB	CT-1	GB / AFGP	P / -	GB	P	
1:02	LOBBY	C	LVT-1/ LVT-2/ LVT-3		R	-	-	GB	P / AWP/PLP	GB / AFGP	CT-1 / -	GB	P	
1:02.1	EXISTING LOBBY	xC / C	xTRZ / TRZ	C / GB	M / R / SSM-3	C	P	xC	P	-	-	GB	P	R4, R16, R8
1:03	MULTI-PURPOSE ROOM 1	C	TC-1 / TC-2		R	GB	P	GB	P / -	AFGP / GB	- / P	GB / FPP	P / -	R3
1:04	MULTI-PURPOSE ROOM 2	C	TC-1 / TC-2		R	GB	P	GB / FPP	P / -	AFGP / GB	- / P	GB	P	R3
1:05	STUDIO	C	RAF-2		R	GB	P	GB	P	GB	P	AFGP / GB	P / -	R3
1:06	POOL STORAGE	C	VS		VS-SC	GB	EP	GB	EP	GB	EP	GB	EP	
1:06.1	MPR STORAGE		CSH		R	GB	P	GB	P	GB	P	GB	P	
1:07	POOL VIEWING	C	VS1		R	GB / AFGP	P / -	GB	P	GB	P	GB	P	R2
1:08	EXISTING POOL DECK	xC	xCT / CT-4		CT-3	-	-	xG-CMU / GB	- / CT-2	xG-CMU / C / GB / AFGP	- / CT-3 / -	-	-	R9, R14, R15
1:09	PUBLIC WASHROOM	C	VS1	GB	VS1-SC	GB	EP	GB	EP	GB	EP	GB	EP	
1:10	PUBLIC WASHROOM	C	VS1	GB	VS1-SC	GB	EP	GB	EP	GB	EP	GB	EP	
1:11	LOBBY-2	C	LVT-1/ LVT-2/ LVT-3	GB	R	GB	PLP / AWP	GB	P	AFGP / GB	- / P	GB	CT-1	R13
1:12	SUPPORT SERVICE	C	LVT-1/ LVT-2	GB	R	GB	P	GB	P	GB	P	GB	P	R3, R1

ROOM NO.	ROOM NAME	FLOOR		BASE		NORTH WALL		EAST WALL		SOUTH WALL		WEST WALL		REMARKS
		MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	
1:13	ADMINISTRATION	C	LVT-1/ LVT-2	GB	R	GB	P	GB	P	GB	P	GB	P	R3, R1
1:14	RECEPTION	C	LVT-1/ LVT-2	GB	R	-	-	GB	P / AWP-2	GB	P	-	-	R7
1:15	COPY ROOM	C	LVT-1	GB	R	GB	P	GB	P	GB	P	GB	P	
1:16	EXECUTIVE DIRECTOR	C	TC-1/ TC-2	GB	R	GB	P	GB	P	GB	P	GB	P	R3, R1
1:17	PROGRAM COORDINATOR	C	TC-1/ TC-2	GB	R	GB	P	GB	P	GB	P	GB	P	R3, R1
1:18	SHARED OFFICE	C	TC-1/ TC-2	GB	R	GB	P	GB	P	GB	P	GB	P	R3, R1
1:19	CLINIC	C	LVT-3	GB	R	GB	P	GB	P	GB	P	GB	P	R5, R3
1:20	CLINIC	C	LVT-3	GB	R	GB	P	GB	P	GB	P	GB	P	R5, R3
1:21	CORRIDOR	C	LVT-1/ LVT-2	GB	R	GB	P	GB	P	-	-	GB	P	R3, R1
1:21.1	CORRIDOR	C	LVT-1	GB	R	GB	P	GB	P	GB	P	GB	P	R1
1:22	MEMBERS' LOUNGE	C	LVT-1/ LVT-2	GB	R	GB	P	GB	P	GB	P	GB	P	
1:23	MULTI-PURPOSE ROOM 3	C	LVT-1/ LVT-2	GB	R	GB	P	GB / AFGP	P / -	GB	P	GB	P	
1:24	PUBLIC WASHROOM	C	VS1	GB	VS1-SC	GB	EP	GB	EP	GB	EP	GB	EP	
1:25	LAUNDRY	C	VS1	GB	VS1-SC	GB	EP	GB	EP	GB	EP	GB	EP	
1:26	STORAGE	C	CSH	GB	R	GB	P	GB	P	GB	P	GB	P	
1:27	ELECTRICAL ROOM	C	CSH	GB	R	GB	P	GB	P	GB	P	PLWD	P	

ROOM NO.	ROOM NAME	FLOOR		BASE		NORTH WALL		EAST WALL		SOUTH WALL		WEST WALL		REMARKS
		MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	
1:35	X. JANITOR	C	xVS2/ VS2	xCMU	xVS2- SC/ VS2-SC	xCMU	-	xCMU	-	xCMU/ CMU	- / EP	xCMU	-	
1:36	STAFF ROOM	C	VS2	GB	VS2-SC	GB	P	GB	P	GB	P	GB	P	R20
1:37	OFFICE	C	VS2	GB	VS2-SC	GB	P	GB	P	GB	P	GB	P	
1:38	CLASSROOM	C	xVS2	xCMU	xVS2-SC	xCMU	-	xCMU	-	xCMU	-	xCMU	-	R17
1:39	CORRIDOR	C	VS2	GB	VS2-SC	GB	P	GB	P	GB	P	-	-	R11
1:39.1	CORRIDOR	C	VS2	GB	VS2-SC	GB	P	GB	P	GB	P	GB	P	
1:40	VESTIBULE	C	VS2	GB	VS2-SC	CMU	P	GB	P	xCMU / CMU	p	GB	P	
1:41	CORRIDOR	C	LVT-1/ LVT-2	GB	R	GB	PLP / P	GB	P	GB	P	-	-	
1:41.1	CORRIDOR	C	LVT-2	GB	R	GB	P	GB	P	-	-	GB	P	
1:42	CORRIDOR	C	LVT-1/ LVT-2	GB	R	GB / AFGP	P / -	-	-	GB / AFGP	P / -	AFGP / GB	- / P	

Part 1 General

1.1 SECTION INCLUDES

- .1 Performance criteria for gypsum board assemblies.
- .2 Acoustic insulation.
- .3 Gypsum sheathing.
- .4 Cement board.
- .5 Gypsum board.
- .6 Tile backing board.
- .7 Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- .2 Section 07 95 13 - Expansion Joint Assemblies: Expansion joints in gypsum board partitions
- .3 Section 09 22 16 - Non-Structural Metal Framing: Interior metal stud framing, gypsum board ceiling suspension system.

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 C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
 - .13 ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
 - .14 ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022.
 - .15 ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
 - .16 ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.
 - .17 ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).
 - .18 ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
 - .19 ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.
 - .20 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
 - .21 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
 - .22 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies; 2018.
 - .23 CAN/ULC S114 - Test for Determination of Non Combustibility in Building Materials; 2018.
 - .24 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
 - .25 GA-216 - Application and Finishing of Gypsum Panel Products; 2016.
 - .26 SCS (CPD) - SCS Certified Products; Current Edition.
 - .27 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings: Indicate special details associated with fireproofing, acoustic seals, and control joint locations.
- .3 Product data: Provide data on metal framing for shaft wall assemblies, gypsum board, glass mat faced gypsum board, accessories, joint finishing system, and control joints.

- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Installers qualification statement.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 The ceilings product category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights. Overhead structural elements (exposed, finished, and unfinished) are excluded.
- .4 The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation. Insulation for HVAC ducts and plumbing piping are excluded.
- .5 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 GYPSUM BOARD ASSEMBLIES

- .1 Provide completed assemblies complying with ASTM C840 and GA-216.
 - .1 See PART 3 for finishing requirements.
- .2 Fire rated assemblies: Provide completed assemblies complying with applicable code.

2.3 METAL FRAMING MATERIALS

- .1 Shaft wall studs and accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

2.4 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 and ceilings, 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.
 - .3 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .1 Mould- and moisture-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 - .2 Mould- and moisture-resistant board is required where plumbing penetrates partition assembly, on both sides of partition extending to floor and to minimum 900 mm on each side of penetration; within pool storage areas, and where indicated.
 - .4 At assemblies indicated with fire-rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, ULC listed.
 - .5 Thickness:
 - .1 Vertical surfaces: 16 mm, unless otherwise indicated.
 - .2 Ceilings: 16 mm.
 - .3 Multi-layer assemblies: Thicknesses as indicated on Drawings.
 - .6 Basis-of-Design Products - Mould-resistant paper faced:
 - .1 CertainTeed; M2Tech Moisture & Mold Resistant Gypsum Board.
 - .2 CGC; Sheetrock MoldTough Gypsum Board.
 - .3 Georgia-Pacific; ToughRock Mold-Guard Gypsum Board.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Impact-resistant gypsum board:
 - .1 Application: High-traffic areas including corridors, lobbies, hall bulkhead, washrooms, toilet stalls, and water closets (W/C); Pool Storage 1:06, MPR Storage 1:06.1, and Equipment Storage 1:34.
 - .2 Surface abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.

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- .3 Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 - .4 Soft body impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 - .5 Hard body impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 - .6 Moisture-resistant core, sandwiched between mould- and moisture-resistant paper facers.
 - .7 Paper-faced type: Gypsum board as defined in ASTM C1396/C1396M.
 - .8 Type: Fire resistance rated Type X, ULC or WH listed.
 - .9 Thickness: 16 mm.
 - .10 Edges: Tapered.
 - .11 Basis-of-Design Product:
 - .1 CGC; Sheetrock Mold Tough VHI Firecode X Panels.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Tile backing board:
 - .1 Application: Surfaces behind thin-set wall tile locations.
 - .2 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .3 Glass mat faced board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - .1 Thickness 16 mm.
 - .2 Basis-of-Design Products:
 - .1 CertainTeed; GlasRoc Tile Backer.
 - .2 CGC; Durock GlassMat Tile Backerboard.
 - .3 Georgia-Pacific; DensShield Tile Backer.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 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 Application: Crawlspace fire separations.
 - .2 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .3 Basis-of-Design Products:
 - .1 CGC; Durock Cement Board with EdgeGuard.
 - .2 National Gypsum; PermaBASE Cement Board.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .5 Exterior sheathing board: Sizes to minimize joints in place; ends square cut.
 - .1 Application: Exterior sheathing and soffit board, unless otherwise indicated.
 - .2 Mould resistance: Score of 10, when tested in accordance with ASTM D3273.
 - .3 Fungal resistance: No fungal growth when tested in accordance with ASTM G21.

- .4 Glass mat faced sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
- .5 Edges: Square.
- .6 Basis-of-Design Products:
 - .1 CGC; Securock Glass-Mat Sheathing.
 - .2 Georgia-Pacific; DensGlass Gold Exterior Sheathing.
 - .3 Cabot Gypsum; BlueGlass Exterior Sheathing.
 - .4 CertainTeed; GlasRoc Sheathing.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .6 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.

2.5 ACCESSORIES

- .1 Acoustic insulation for non-rated and fire and smoke rated assemblies: Meeting the requirements of CAN/ULC S702.1, formaldehyde-free glass fibre or mineral fibre acoustic sound batts, Type 1 for all properties except thermal performance, width to friction fit steel studs; unfaced. Thickness as indicated; 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:
- .2 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.
- .3 Acoustic sealants for smoke rated assemblies: Lightweight low trigger resistance, non-sag, smooth surface finishing smoke and acoustic sealant in accordance with ASTM C834.
- .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.
- .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.
- .6 Beads, joint accessories, and other trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - .1 Rigid corner beads: Low profile, for 90 degree outside corners.
 - .2 Special shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 - .3 Architectural reveal beads:

- .1 Material: Extruded aluminum; factory-primed for field painting.
- .2 Reveal depth: 16 mm.
- .3 Reveal width: As selected by Contract Administrator from manufacturer's standard range.
- .4 Shapes: As indicated on Drawings.
- .4 Column collar: Extruded aluminum shadow trim with drywall taping fin where used with gypsum board ceilings; finish selected by Contract Administrator from manufacturer's full range.
- .5 Control joints:
 - .1 Type: V-shaped PVC with tear away fins.
- .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 for glass-mat faced panel products.
 - .2 Tape: 50 mm wide, creased paper tape for joints and corners for paper-faced panel products.
 - .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 On walls over 4.8 metres high, screw-attach studs to runners top and bottom.
 - .2 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, rough-in boxes, and other items penetrating partitions, 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 Double-layer non-rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- .4 Fire-rated construction: Install gypsum board in strict compliance with requirements of assembly listing.
- .5 Exposed gypsum board in interior wet areas: Seal joints, cut edges, and holes with water-resistant sealant.
- .6 Exterior sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - .1 Seal joints, cut edges, and holes with water-resistant sealant.
- .7 Exterior soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
 - .1 Seal joints, cut edges, and holes with water resistant sealant.
- .8 Cementitious backing board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- .9 Installation on metal framing: Use screws for attachment of gypsum board.

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 and as indicated.
- .4 Decorative trim: Install at locations shown on Drawings and in accordance with manufacturer's instructions.

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, unless otherwise indicated.
 - .2 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.
 - .2 Taping, filling and sanding is not required at base layer of double layer applications.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Metal partition and ceiling framing.
- .2 Framing accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 05 40 00 - Cold-Formed Metal Framing: Exterior wall stud framing, and soffit 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.

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 C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- .3 ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- .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 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.
- .7 ASTM C1925 - Standard Test Method for Strength Properties of Direct Hung, Suspended T-bar Type Ceiling System Components Intended to Receive Gypsum Panel Products; 2022.
- .8 CSSBI S18 - Guide Specification for Non-loadbearing Steel Framing; Current Edition.
- .9 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.
- .10 SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.4 SUBMITTALS

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

- .2 Shop Drawings:
 - .1 Indicate design loads, member sizes and spacing, design thickness exclusive of coatings, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
 - .2 Describe method for securing studs to tracks, and for blocking and reinforcement of framing connections.
 - .3 Design data: Include material data, calculations, and details.
 - .1 Shop Drawings signed and sealed by a professional engineer licensed in the location of the Project.
- .3 Product data:
 - .1 Provide data describing framing member materials and finish, product criteria, load charts, limitations, and pre-engineered drywall suspension system.
 - .2 Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- .4 Certifications: Manufacturer's certifications that pre-engineered drywall suspension system complies with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- .5 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention for pre-engineered drywall suspension system.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Installer's qualification statement.

1.5 QUALITY ASSURANCE

- .1 Pre-engineered suspension system manufacturer qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- .2 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 Fire rated assemblies: Comply with applicable code and as indicated on Drawings.
- .2 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/240 at 360 Pa for standard assemblies up to 3.6 m high, L/240 at 360 Pa for tall assemblies greater than 3.6 m high to a maximum of 4.8 m high, and L/240 at 480 Pa for assemblies greater than 4.8 m high.

- .1 Studs: C shaped with flat or formed webs with knurled faces.
- .2 Runners: U shaped, sized to match studs.
- .3 Furring: Hat-shaped sections, minimum depth of 22 mm.
- .3 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 indicated on Drawings.
- .4 Tracks and runners: Same material and thickness as studs, bent leg retainer notched to receive studs.
- .5 Furring and bracing members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.
- .6 Pre-engineered drywall ceiling suspension system:
 - .1 Complying with ASTM C635/C635M and ASTM C1925; with clips, splices, perimeter mouldings, and wire hangers, fasteners, and other accessories as required for a complete system.
 - .2 Steel suspension system: Formed galvanized steel minimum G40, commercial quality cold rolled; heavy-duty.
 - .3 Profile: Tee; 38 mm wide face.
 - .4 Construction: Double web.
 - .5 Basis-of-Design Products:
 - .1 Armstrong; Frameall Flat Drywall Grid.
 - .2 CGC/USG Drywall Suspension System.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .7 Fasteners: ASTM C1002 self-piercing tapping screws.
- .8 Anchorage devices: Powder actuated, drilled expansion bolts, or screws with sleeves.
- .9 Acoustic insulation: As specified in Section 09 21 16.
- .10 Touch-up primer for galvanized surfaces: SSPC-Paint 20 Type I - Inorganic.

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 Brace stud framing system rigid.
- .14 Coordinate erection of studs with requirements of door frames, window frames, and other openings in partitions; install supports and attachments.
- .15 Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- .16 Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware.
- .17 Furring: Install at spacing and locations shown on Drawings. Lap splices a minimum of 150 mm.

3.3 CEILING FRAMING

- .1 Install pre-engineered ceiling suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- .2 Rigidly secure pre-engineered ceiling suspension system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- .3 Install ceiling after major above-ceiling or soffit work is complete. Coordinate the location of hangers with other work.

- .4 Install ceiling suspension system independent of walls, columns, ducts, pipes, and conduit.
- .5 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
- .6 Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated, and to support for expected ceiling loads and layout.
- .7 Provide additional wires at light fixtures, grilles, and access doors.
- .8 Space main beams at manufacturer's recommended maximum spacing based on expected loads.
- .9 Install cross tees at on centre spacing as specified by the gypsum board manufacturer based on thickness and weight of panels.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Cement plastering, referred to as "parging" on the Drawings.
- .2 Metal lath.
- .3 Weather barrier under cement plastering.

1.2 REFERENCE STANDARDS

- .1 AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.
- .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 C847 - Standard Specification for Metal Lath; 2018.
- .4 ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2022.
- .5 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.
- .6 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.
- .7 ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2022.
- .8 ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission of Materials; 2022.
- .9 ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- .10 CAN/CSA A179 - Mortar and Grout for Unit Masonry; 2014.
- .11 CAN/ULC S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials; 2014.
- .12 CSA A3000 - Cementitious Materials Compendium; 2018.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittals Procedures.
- .2 Product data: Provide data on parging materials and trim accessories.
- .3 Samples:
 - .1 Submit two samples, 150 by 150 mm in size illustrating finish colour and texture.
- .4 Installer's qualification statement.

1.4 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 SITE CONDITIONS

- .1 Comply with ASTM C926.
- .2 Exterior plaster work: Do not apply plaster when substrate or ambient air temperature is 4 degrees C or lower, or when temperature is expected to drop below 4 degrees C within 48 hours of application.
- .3 Protect parging from uneven and excessive evaporation during hot, dry or windy weather.

Part 2 Products

2.1 CEMENT PLASTER APPLICATIONS

- .1 Lath plaster base: Metal lath.
 - .1 Plaster type: Factory prepared plaster mix.
 - .2 Number of coats: Two.
 - .3 First coat: Apply to a thickness of 12 to 16 mm.
 - .4 Finish coat: Apply to a nominal thickness of 3 mm.
 - .1 Texture: Smooth troweled.
 - .2 Finish: Cementitious.

2.2 FACTORY PREPARED CEMENT PLASTER

- .1 Fire-resistance rating: Determined in accordance with test procedures in CAN/ULC S101.
- .2 Premixed one-coat base: Mixture of Type GU Portland cement complying with CSA A3000, hydrated lime complying with CAN/CSA A179, fibres and other approved ingredients; install in accordance with ASTM C926.
 - .1 Basis-of-Design Product:
 - .1 The QUIKRETE Companies; One Coat Fiberglass Reinforced Stucco.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Premixed finish coat: Mixture of cement, aggregate, and proprietary admixtures; install in accordance with ASTM C926. Colour selected by Contract Administrator .
 - .1 Basis-of-Design Product:

- .1 The QUIKRETE Companies; Finish Coat.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 ACCESSORIES

- .1 General: Comply with ASTM C1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- .2 Expanded-metal lath: ASTM C847 with ASTM A653/A653M, Z180, hot-dip galvanized zinc coating.
 - .1 Diamond-mesh lath: Self-furring, 1.4 kg/sq. m.
- .3 Corner mesh: Formed sheet steel, minimum 0.5 mm thick, perforated flanges shaped to permit complete embedding in plaster, minimum 50 mm size; same finish as lath.
- .4 Strip mesh: Expanded metal lath, same weight as lath, 50 mm wide by 600 mm long; same finish as lath.
- .5 Beads, screeds, and joint accessories: Depth governed by plaster thickness, and maximum possible lengths.
 - .1 Material: Formed sheet steel with rust inhibitive primer, expanded metal flanges.
 - .2 Casing beads: Square edges.
 - .3 Base screeds: Bevelled edges.
 - .4 Control joints: Accordion profile with factory-installed protective tape, 50 mm flanges.
- .6 Water-resistive barrier: Spunbonded polyolefin, non-perforated, non-woven, non-absorbing, breathable membrane with ribbed surface texture, basis weight: 71 g per sq. m, air penetration resistance in accordance with ASTM E2178, water vapour transmission in accordance with ASTM E96/E96M, water penetration resistance in accordance with AATCC Test Method 127.
 - .1 Basis-of-Design Product:
 - .1 Dupont; Tyvek StuccoWrap.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .7 Steel drill screws: For metal-to-metal fastening, ASTM C1002 or ASTM C954 , as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- .8 Fasteners for attaching metal lath to substrates: Complying with ASTM C1063.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions are acceptable prior to starting this work.

3.2 INSTALLATION - WATER-RESISTIVE BARRIER (WRB)

- .1 Install in accordance with manufacturer's instructions over rigid insulation provided in accordance with Section 07 21 00. Secure to insulation thermostud channel fastening system specified using building paper manufacture's recommended fasteners.
- .2 Install WRB with grooved surface pattern in vertical position.
- .3 Install shingle lapped such that each successive course (starting from the bottom and going upward) overlaps the previous (lower) course for proper water drainage. Maintain proper shingling where any flashing, termination, or penetration exists above WRB.
- .4 Seal laps, holes, tears, and punctures in WRB with manufacturer's recommended tape.

3.3 INSTALLATION - METAL LATH

- .1 Install according to ASTM C1063 and at locations indicated on Drawings.
- .2 Reinforcement for external corners:
 - .1 Install lath-type, external-corner reinforcement at exterior locations.
 - .2 Install corner bead at interior locations.
- .3 Control joints: Install control joints in specific locations approved by Contract Administrator for visual effect and as follows:
 - .1 Where control joints occur in surface of construction directly behind plaster.

3.4 MIXING

- .1 Mix only as much plaster as can be used prior to initial set.
- .2 Mix materials dry, to uniform colour and consistency, before adding water.
- .3 Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.5 APPLICATION

- .1 Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
- .2 Base coats:
 - .1 Apply base coat over lath and exterior face of board insulation at concrete grade beam, beginning at elevation 100 000 and extending down to minimum 200 mm below finish grade with sufficient material and force to form good key.
 - .2 Apply base coats to fully embed lath and to minimum specified thickness.
 - .3 Follow guidelines in ASTM C926 for moist curing base coat and application of subsequent coat.
- .3 Finish coats:
 - .1 Cement plaster:
 - .1 Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
 - .2 Apply desired surface texture while mix is still workable.
 - .3 Smooth trowel to a consistent finish.

3.6 TOLERANCES

- .1 Maximum variation from true flatness: 6 mm in 3 m.

3.7 REPAIR

- .1 Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Tile for wall applications.
- .2 Installation of salvaged marble wall base.
- .3 Non-ceramic trim.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.3 DEFINITIONS

- .1 Large Format Tile: Tile larger than 380 mm in one or more directions.

1.4 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 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).
- .4 ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
- .5 ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).
- .6 ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).
- .7 ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- .8 ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
- .9 ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.
- .10 ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-Tile Fired Ceramic Whiteware Products; 2018.
- .11 ASTM C650 - Standard Test Method for Determination of Resistance to Chemical Substances; 2020.

- .12 ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- .13 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .14 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .15 CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.
- .16 ISO 10545-3 - Ceramic Tiles - Part 3: Determination of water absorptions, apparent porosity, apparent relative density and bulk density; 2018.
- .17 ISO 13007-1 - Ceramic tiles -- Grouts and adhesives -- Part 1: Terms, definitions and specifications for adhesives; 2014.
- .18 NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.
- .19 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .20 SCS (CPD) - SCS Certified Products; Current Edition.
- .21 TTMAC (IM) - Tile Installer Technical Handbook; 2018/2019.
- .22 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.5 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 and adhesives.
- .3 Samples for verification: Two 300 by 300 mm samples of CT-1 illustrating pattern, and colour variations; two full size tiles of CT-2, and cove trim for CT-3; and one full sheet of each mosaic tile CT-3 and CT-4.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Installer's qualification statement.
- .6 Maintenance data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- .7 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals for additional provisions.
 - .2 Extra tile: 1 percent of each size, colour, and surface finish combination, but not less than one box of each type.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.7 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control for additional requirements.

- .2 Construct mock-up of marble base where directed by Contract Administrator, incorporating all components specified for the location.
 - .1 Minimum size of mock-up: Two lengths of marble base.
 - .2 Accepted mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect from freezing or overheating in accordance with manufacturer's instructions.

1.9 SITE CONDITIONS

- .1 Do not install solvent-based products in an unventilated environment.
- .2 Maintain ambient and substrate temperature no lower than 10 degrees C during installation of mortar materials.

Part 2 Products

2.1 EXISTING PRODUCTS

- .1 Marble base salvaged during selective demolition.

2.2 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 At least 90 percent of all flooring products hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, by cost or surface area, within the waterproofing membrane must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 FloorScore (Resilient Floor Covering Institute) certified for hard flooring
 - .2 NSF 332 certified for resilient floor coverings

- .3 CRI (GL) for carpet products
 - .4 UL (GGG)
 - .5 SCS (CPD) Indoor Advantage Gold
 - .6 Blue Angel
 - .7 MAS Certified Green
 - .8 Berkeley Analytical ClearChem
 - .9 EMICODE EC1 or EMICODE EC1 Plus
 - .10 Intertek ETL Environmental VOC+
 - .11 Eco-INTITUT-Label
 - .12 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .4 All setting adhesives and grout must meet SCAQMD 1168.
- .5 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.3 TILE

- .1 Porcelain tile, Type CT-1: Through-body porcelain .
- .1 Moisture absorption: 0 to 0.5 percent as tested in accordance with ISO 10545-3.
 - .2 Size: 900 mm by 1800 mm, nominal.
 - .3 Thickness: 10 mm.
 - .4 Edges: Rectified.
 - .5 Surface finish: Matte glazed.
 - .6 Colour: To be selected by Contract Administrator from manufacturer's standard range.
 - .7 Basis-of-Design Product:
 - .1 Provence, colour Coal; available from Julian Tile and Ceramics.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Glazed wall tile, Type CT-2:
- .1 Moisture absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
 - .2 Chemical resistant: to ASTM C650.
 - .3 Size: 109 by 109 mm, nominal.
 - .4 Surface finish: Semi-gloss.
 - .5 Colours: Allow for four colours to be selected by Contract Administrator from manufacturer's full range to blend into existing.
 - .6 Basis-of-Design Product:
 - .1 Daltile; Color Wheel Collection Classic.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

- .3 Ceramic mosaic tile, Type CT-3:
 - .1 Moisture absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - .2 Chemical resistant: to ASTM C650.
 - .3 Size: 50 by 50 mm, nominal.
 - .4 Thickness: 6 mm.
 - .5 Shape: Square.
 - .6 Surface finish: Unglazed.
 - .7 Colours: Allow for two colours based on Basis-of-Design Product Pepper White, and Black Ebony.
 - .8 Mounted sheet size: 300 by 600 mm, nominal.
 - .9 Trim units: Matching cove shapes in sizes coordinated with field tile.
 - .10 Basis-of-Design Product:
 - .1 Daltile; Keystones Colorbody Porcelain.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

- .4 Ceramic mosaic tile, Type CT-4:
 - .1 Moisture absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 - .2 Chemical resistant: to ASTM C650.
 - .3 Size: 25 by 25 mm, nominal.
 - .4 Thickness: 6 mm.
 - .5 Shape: Square.
 - .6 Surface finish: Unglazed.
 - .7 Colours: Allow for one colour based on Basis-of-Design Product Pepper White.
 - .8 Mounted sheet size: 300 by 600 mm, nominal.
 - .9 Basis-of-Design Product:
 - .1 Daltile; Keystones Colorbody Porcelain.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 TRIM AND ACCESSORIES

- .1 Non-ceramic trim: Aluminum or stainless steel, as selected by Contract Administrator, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - .1 Applications:
 - .1 Open edges of wall tile.
 - .2 Wall corners, outside.
 - .2 Basis-of-Design Products:
 - .1 Schluter Schiene (open edges), Quadec (at outside corners).
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.5 SETTING MATERIALS

- .1 Mortar Type 1 - Modified non-sagging dry-set lightweight cement mortar complying with ANSI A118.4, ANSI A118.11, or ISO 13007-1 C2TES1P1.

-
- .1 Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
 - .2 Basis-of-Design Products:
 - .1 Mapei; Ultralite.
 - .2 Custom Building Products: Versabond.
 - .3 Flextile; 66 Flexlite Mortar.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Mortar Type 2 - Improved latex-Portland cement mortar bond coat: Polymer-modified, non-sagging, dry-set cement mortar for use with large and heavy tile, to ANSI A118.4, ANSI A118.11, ANSI A118.15, or ISO 13007-1 C2TES1P1.
 - .1 Applications: Use this type of bond coat for reinstalling marble base.
 - .2 Basis-of-Design Products:
 - .1 Mapei; Ultraflex LFT.
 - .2 Custom Building Products: Versabond LFT.
 - .3 Laticrete; 4-XLT.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Mortar Type 3 - Premium highly deformable, lightweight thin-tile mortar, polymer enriched, non-sag thin-set mortar, complying with ANSI A118.4, and ANSI A118.11, or ISO 13007-1 C2ES2P2.
 - .1 Applications: Use this type of bond coat for CT-1.
 - .2 Basis-of-Design Products:
 - .1 Mapei; Ultralite S2.
 - .2 Custom Building Products; TVIS.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .4 Mortar bed materials: ANSI A108.1a, pre-packaged polymer-modified mix of Portland cement, sand, and water.
 - .1 Basis-of-Design Products:
 - .1 Mapei; Modified Mortar Bed.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .5 Leveling coat/rendering mortar: Rapid-setting, polymer-modified, patching and leveling mortar.
 - .1 Basis-of-Design Products:
 - .1 Mapei; Planitop 330 Fast.
 - .2 Custom Building Products; SpeedSlope.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.6 GROUTS

- .1 Polymer-modified grout: ANSI A118.6 and ANSI A118.7; fine aggregate, fast-setting, colour-consistent, non-shrinking, for use with joints 1.5 to 12 mm wide; non-abrasive.
 - .1 Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - .2 Colours: As selected by Contract Administrator from manufacturer's full line.
 - .3 Basis-of-Design Products:
 - .1 Mapei; Ultracolor Plus FA.
 - .2 Custom Building Products; Prism Ultimate Performance Grout.
 - .3 Flextile; 1600 Ultra Performance Grout.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Epoxy grout: ANSI A118.3 and ISO 13007-1 RG, chemical- and stain resistant and water-cleanable epoxy grout.
 - .1 Applications: Wall tile in existing pool area.
 - .2 Colours: As selected by Contract Administrator from manufacturer's full line.
 - .3 Basis-of-Design Products:
 - .1 Mapei; Kerapoxy CQ.
 - .2 Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout.
 - .3 Flextile; 100-Flex Epoxy.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Flexible grout: Silicone rubber to ASTM C920, non-solvent curing type; colours 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 Basis-of-Design Products:
 - .1 Mapei; Mapesil T Plus.
 - .2 Custom Building Products; Commercial 100% Silicone Seal.
 - .3 Flextile; Ultra-Performance Hybrid Caulk.
 - .4 Laticrete; Latacil.
 - .5 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

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 tile.

3.2 PREPARATION

- .1 Clean back of existing marble base.
- .2 Protect surrounding work from damage.
- .3 Vacuum clean surfaces and damp clean.
- .4 Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- .5 Tape joints in backer board. Cover with skim coat of setting material to a feather edge.

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 Request tile pattern if not indicated. Do not interrupt tile pattern through openings.
- .3 Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners neatly.
- .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 angles square and external angles square with non-ceramic trim.
- .6 Install non-ceramic trim in accordance with manufacturer's instructions.
- .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 - WALL TILE

- .1 On interior masonry or concrete walls, install in accordance with TTMAC (IM) 303W, thin set method. Apply leveling coat if required.
- .2 Over coated glass mat backer board, install in accordance with TTMAC (IM), 305W, Detail B.
- .3 Over gypsum board on wood or metal studs, install in accordance with TTMAC (IM) 304W, thin set method.

3.5 INSTALLATION - MARBLE BASE

- .1 Install salvaged marble base on walls using Mortar Type 2, and polymer-modified grout.

3.6 INSTALLATION - WALLS - LARGE FORMAT TILE

- .1 Install large format tile on walls to TTMAC (IM) 330LFTW, thin set method.

3.7 CLEANING

- .1 Clean tile and grout surfaces.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Suspended acoustic ceiling system (referred to on the Drawings as "ACS#").

1.2 RELATED REQUIREMENTS

- .1 Section 09 22 16 - Non-Structural Metal Framing: Pre-engineered drywall grid system
- .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.

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 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .5 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies; 2018.
- .6 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .7 SCS (CPD) - SCS Certified Products; Current Edition.
- .8 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

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 Shop Drawings:
 - .1 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, and acoustic unit support at ceiling fixture.
 - .2 Indicate octave band acoustic data.
- .3 Product data: Provide data on suspension system components and acoustical units.

- .4 Samples:
 - .1 Submit two samples 150 by 150 mm in size illustrating material and finish of acoustical units.
 - .2 Submit 200 mm length of each type of wall moulding and suspension system including main runner and cross tee.
 - .3 Submit 200 mm length of each type of perimeter trim.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - 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.

1.7 WARRANTY

- .1 Manufacturer's Product Warranty: Provide an extended warranty for Work of this Section for a period of 30 years from date of Substantial Performance of the Work. Manufacturer hereby warrants acoustical ceilings to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City. Failures include, but are not limited to:
 - .1 Acoustical panels: visible sag, mould/mildew & bacteria.
 - .2 Grid system: rusting and manufacturer's defects.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The ceilings product category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and

clouds), and glazed skylights. Overhead structural elements (exposed, finished, and unfinished) are excluded.

- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 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: Certified as Low Emission by one of the following:
 - .1 Product listing in UL (GGG).
 - .2 Product listing in CHPS (HPPD).
 - .2 Glass fibre acoustical ceiling system Type ACS1: Acoustically transparent fabric faced glass fibre, ASTM E1264 Type XII, with the following characteristics:
 - .1 Thickness: 19 mm.
 - .2 Composition: Form 2 - Cloth
 - .3 Light reflectance: 85 to 90 percent for white panels, determined in accordance with ASTM E1264.
 - .4 NRC: 0.90 minimum, determined in accordance with ASTM E1264.
 - .5 Edge: Square.
 - .6 Surface colour: White.
 - .7 Basis-of-Design Products:
 - .1 Armstrong; Open Plan 3151.
 - .2 USG/CGC; Halcyon 97241.
 - .3 CertainTeed; Symphony f 1320-IOF-1.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .3 Acoustical tile ceiling system Type ACS2: Vinyl faced mineral fibre, ASTM E1264 Type IV with the following characteristics:
 - .1 Size: 610 by 1220 mm.
 - .2 Thickness: 15.9 mm.
 - .3 Composition: Form 2 - Wet formed.
 - .4 Light reflectance: 78 to 80 percent, determined in accordance with ASTM E1264.
 - .5 Edge: Square.
 - .6 Surface colour: White.
 - .7 Surface pattern: Smooth, non-perforated.
 - .8 Basis-of-Design Products:
 - .1 Armstrong; Clean Room VL, 870.
 - .2 USG/CGC; Clean Room Class 100, 56091.
 - .3 CertainTeed VinylShield C.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding*

Procedures.

- .4 Acoustical panels Type ACS3: Mineral fibre, ASTM E1264 Type IV with the following characteristics
 - .1 Size: 610 by 610 mm.
 - .2 Thickness: 22 to 25 mm.
 - .3 Composition: Form 2.
 - .4 Light reflectance: Minimum 85 percent, determined in accordance with ASTM E1264.
 - .5 NRC: 0.85, determined in accordance with ASTM E1264.
 - .6 Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - .7 Panel edge: Square.
 - .8 Surface pattern: E - lightly textured.
 - .9 Surface colour: White.
 - .10 Basis-of-Design Products:
 - .1 Armstrong; Calla 2820.
 - .2 CGC; Mars High-NRC/High-CAC 88134.
 - .3 CertainTeed; Symphony m #1222-85-1.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 SUSPENSION SYSTEM

- .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.
- .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 Basis-of-Design Products:
 - .1 Armstrong; Prelude XL (15/16").
 - .2 USG/CGC; Donn DX/DXL.
 - .3 CertainTeed 15/16" EZ Stab Classic.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 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 L-shaped moulding for mounting at same elevation as face of grid.

- .3 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 fixture loads using supplementary hangers located within 150 mm of each corner, or support components independently.
- .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 Miter 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 (unless otherwise indicated), 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.
- .7 Where round obstructions and bullnose concrete block corners 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 sheet flooring (VS).
- .2 Resilient tile (LVT) flooring.
- .3 Resilient base.
- .4 Resilient stair accessories, for use at book rack shelves.
- .5 Installation accessories.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Restrictions on curing compounds for concrete slabs and floors.
- .2 Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
- .3 Section 09 65 66 - Resilient Athletic Flooring.

1.3 REFERENCE STANDARDS

- .1 ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2017.
- .2 ASTM F1516 - Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended); 2013.
- .3 ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- .4 ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- .5 ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019.
- .6 ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
- .7 ASTM F2659 - Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter; 2023.
- .8 ASTM F3311 - Standard Practice for Mat Bond Evaluation of Performance and Compatibility for Resilient Flooring System Components Prior to Installation; 2019.
- .9 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .10 CAN/ULC S102.2 - Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies; 2018.
- .11 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .12 CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.

- .13 NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.
- .14 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .15 SCS (CPD) - SCS Certified Products; Current Edition.
- .16 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting:
 - .1 Convene pre-installation meeting with Contractor, Contract Administrator, and Resilient Flooring Subcontractor in attendance. Discuss the following, and as outlined in Section 09 05 61:
 - .1 Floor moisture, pH and bond test results.
 - .2 Facility room temperatures/HVAC requirements.
 - .3 Installation and application procedures for all products specified including floor preparation, adhesive application, seaming methods, self-coved base (inside/outside corners), rubber base installation, transitions to adjacent flooring materials, co-ordination with work by others, protection of finished work.
 - .4 Mock-up requirements.
 - .5 Quality of workmanship expected.

1.5 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 Shop Drawings: Indicate seaming plans and floor patterns.
- .4 Selection samples: Submit manufacturer's complete set of colour samples for Contract Administrator's initial selection.
- .5 Verification samples: Submit two samples, 300 by 300 mm in size illustrating colour and pattern for each resilient flooring product specified, and as follows:
 - .1 Flooring with heat-welded seams: Submit samples with welded seam in centre of sample, performed by the actual installer on the project.
 - .2 Flooring with self-cove base: Submit two inside and outside corner samples applied to solid backing, illustrating cap strip, cove former and seaming method, performed by actual installer on project.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- .8 Installer's qualification statement.

- .9 Maintenance data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- .10 Maintenance materials: Furnish the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, for additional provisions.
 - .2 Extra sheet flooring material: Quantity equal to 5 percent of each type and colour installed; full width rolls.
 - .3 Extra tile flooring material: One box of each type and colour.
 - .4 Extra flooring adhesive: Sufficient volume to install maintenance material, but not less than one unopened 1 litre can of each type of adhesive.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- .2 Testing agency qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.7 MOCK-UPS

- .1 Prepare mock-up of each resilient flooring installation in accordance with Section 01 45 00 - Quality Control.
 - .1 Mock-up to include heat weld seaming, typical self-coved base, self-coved base at bullnosed concrete block, and transition strip to adjacent flooring material.
 - .2 Locate mock-up on site as part of final installation. Mock-up will be reviewed for quality of workmanship, seam welding, and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .4 Do not proceed with resilient flooring installation until mock-up area is complete and approved by Contract Administrator.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Store materials off of the floor in an acclimatized, weather-tight space, protected from direct sunlight.
- .2 Maintain temperature in storage area between 13 degrees C and 72 degrees C.
- .3 Protect roll materials from damage by storing on end.
- .4 Do not double stack pallets.

1.9 SITE CONDITIONS

- .1 Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 18 degrees C to achieve temperature stability. Thereafter, maintain conditions in accordance with flooring and adhesive manufacturers' instructions.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of all flooring products hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, by cost or surface area, within the waterproofing membrane must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 FloorScore (Resilient Floor Covering Institute) certified for hard flooring
 - .2 NSF 332 certified for resilient floor coverings
 - .3 CRI (GL) for carpet products
 - .4 UL (GGG)
 - .5 SCS (CPD) Indoor Advantage Gold
 - .6 Blue Angel
 - .7 MAS Certified Green
 - .8 Berkeley Analytical ClearChem
 - .9 EMICODE EC1 or EMICODE EC1 Plus
 - .10 Intertek ETL Environmental VOC+
 - .11 Eco-INTITUT-Label
 - .12 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 Setting adhesives and grout must meet SCAQMD 1168.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 SHEET FLOORING

- .1 Vinyl sheet flooring - Type VS1: Homogeneous single layer without backing, with colour and pattern throughout full thickness; PUR reinforced wear layer.
 - .1 Basis-of-Design Product:
 - .1 Johnsonite Tarkett; iQ Optima, colour Neutral Black
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Minimum requirements: Comply with ASTM F1913.
 - .3 Thickness: 2.0 mm nominal.
 - .4 Sheet width: 2000 mm minimum.
 - .5 Seams: Heat welded.
 - .6 Integral coved base with cap strip.
 - .7 Colour: As indicated.

- .2 Vinyl sheet flooring - Type VS2: Homogeneous single layer without backing, with colour and pattern throughout full thickness; PUR reinforced wear layer.
 - .1 Basis-of-Design Product:
 - .1 Armstrong Medintone, H5532 Grayed Blue, confirm with existing.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Thickness: 2.0 mm nominal.
 - .3 Sheet width: 2000 mm minimum.
 - .4 Seams: Heat welded.
 - .5 Integral coved base with cap strip.
 - .6 Colour: Allow for one colour to be selected by Contract Administrator from manufacturer's full range to match existing flooring.
- .3 Welding rod: Multi-colour bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in colour matching field colour.

2.3 TILE FLOORING

- .1 Luxury vinyl tile - Type LVT: Printed film type, with transparent or translucent wear layer, and commercial grade backing.
 - .1 Basis-of-Design Product:
 - .1 Gerflor; Creation 55.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Minimum requirements: Comply with ASTM F1700, Class III Type B.
 - .3 Coefficient of friction: Minimum 0.65 (dry) to ASTM D2047.
 - .4 Flame spread: Meet requirements of CAN/ULC S102.2 as applicable for required flame spread ratings.
 - .5 Square tile size - LVT-1 and LVT-3: 610 by 610 mm.
 - .6 Plank tile size - LVT-3: 184 by 1219 mm.
 - .7 Wear layer: With polyurethane protective finish coating providing resistance against scratches, scuffs, stains, and abrasions.
 - .1 Wear layer thickness: 0.55 mm.
 - .8 Total thickness: 2.5 mm.
 - .9 Pattern: LVT-1 and LVT-2 - Mineral/stone; LVT-3 - Woodgrain.
 - .10 Colours: Allow for three colours total to be selected by Contract Administrator from manufacturer's full range.

2.4 STAIR COVERING - USED ON BOOT RACK SHELVES

- .1 Stair treads: Rubber; full width and depth of boot rack shelf in one piece per shelf, widths vary; tapered thickness.
 - .1 Application: Boot racks; refer to Drawings.
 - .2 Basis-of-Design Product:
 - .1 Tarkett; Angle Fit VIRNRDS.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding*

Procedures.

- .3 Minimum requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
- .4 Nominal thickness: 2.4 mm.
- .5 Nosing: Square.
- .6 Striping: 50 mm wide contrasting colour strips.
- .7 Texture: Raised.
- .8 Pattern: Round circles.
- .9 Colour: To be selected by Contract Administrator from manufacturer's full range.

2.5 RESILIENT BASE

- .1 Resilient base (R): ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - .1 Basis-of-Design Product:
 - .1 Johnsonite; Baseworks Thermoset Rubber Wall Base.
 - .2 Roppe; Pinnacle.
 - .3 Mannington; BurkeBase Premium.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Height: 100 mm.
 - .3 Thickness: 3.2 mm.
 - .4 Finish: Satin.
 - .5 Length: Roll.
 - .6 Colour: Black.
 - .7 Accessories: Premoulded end stops.

2.6 ACCESSORIES

- .1 Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- .2 Primers and adhesives: Waterproof; types recommended by flooring manufacturer.
- .3 Mouldings, transition and edge strips:
 - .1 Cove base cap strip in Universal Washroom 1:32: Metal; for 3 mm thick flooring, and with 11 mm return; anodized aluminum brushed chrome finish.
 - .1 Basis-of-Design Product:
 - .1 Schluter; VinPro-S VPS30.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Cove base cap strip elsewhere: Resilient; profile and colour selected by Contract Administrator.
 - .1 Basis-of-Design Products:
 - .1 Tarkett SCC-XX-A.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of*

the Bidding Procedures.

- .3 Transition and edge strips:
 - .1 Same height transitions and LVT-to-VS:
 - .1 Basis-of-Design Product:
 - .1 Schluter; VinPro-S.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures.*
 - .2 Between resilient floor coverings and floor coverings at a lower elevation, or finished concrete:
 - .1 Basis-of-Design Product:
 - .1 Schluter; VinPro-U.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures.*
 - .4 Filler for coved base: Plastic.

Part 3 Execution

3.1 EXAMINATION

- .1 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 to substrate.
- .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 resilient base. Verify that gypsum board has been installed to within 6 mm of substrate for areas to receive integral cove base.
- .3 Cementitious sub-floor surfaces: Verify that substrates are dry enough and ready for resilient flooring installation.
 - .1 Flooring Subcontractor shall verify independent testing has been completed in accordance with Section 09 05 61, and obtain test results from Contractor.
 - .2 Before installing flooring, Flooring Subcontractor shall test for moisture in accordance with ASTM F2659, and for adhesive bond in accordance with ASTM F3311.
 - .3 Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - .4 Verify that no curing compounds or sealers have been applied to the concrete subfloor that would impair bond. Report findings to Contract Administrator.
- .4 Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- .1 Preparation of floor substrates for installation of flooring is specified in Section 09 05 61.

- .2 Flooring Subcontractor is responsible for correction and filling of minor imperfections and irregularities with sub-floor filler.
- .3 Neutralize surface of concrete in accordance with manufacturer's printed instructions.
- .4 Seal and prime concrete slab and areas filled with patching and leveling compound as recommended by resilient flooring manufacturer.

3.3 INSTALLATION - GENERAL

- .1 Starting installation constitutes acceptance of sub-floor conditions.
- .2 Install in accordance with manufacturer's written instructions.
- .3 Spread only enough adhesive to permit installation of materials before initial set.
- .4 Fit joints and butt seams tightly.
- .5 Set flooring in place, press with heavy roller to attain full adhesion.
- .6 Where type of floor finish, pattern, or colour are different on opposite sides of door, terminate flooring under centreline of door.
- .7 Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Install transition strips between flooring of differing thickness.
 - .1 Metal strips: Attach to substrate before installation of flooring using stainless steel screws.
- .8 Scribe flooring to walls, columns, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - SHEET FLOORING

- .1 Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- .2 Cut sheet at seams in accordance with manufacturer's instructions.
- .3 Seal seams by heat welding.
 - .1 Heat-weld seams in accordance with ASTM F1516 and manufacturer's instructions.
 - .2 Route out seams and use welding bead to permanently fuse sections into seamless floor covering.
 - .3 Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
- .4 Integral cove base: Install as detailed on Drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with specified cap strip.
 - .1 Mechanically fasten metal cap strip to wall substrate; adhere resilient cap strip to wall substrate. Mitre corners of cap strip.
 - .2 Apply small continuous bead of mildew-resistant paintable silicone sealant along top edge of resilient cap strips.

- .3 At flush door frames and other projections, taper cove former 300 mm back from frame to provide flush cove at face of frame.
- .4 External corners: Fit coved outside corners with "butterfly inset" wrapped around corner at 45 degree angle. Starting from base of corner and joined on each side to flash coved material. Heat weld joints.
- .5 Internal corners: Fit coved inside corners with "half butterfly" formed by cutting material at 45 deg angle from base of coving sharply tucked into inside corner, wrapped and joined to coved material facing non-prominent side wall. Heat weld joints.

3.5 INSTALLATION - TILE FLOORING

- .1 Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- .2 Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern, unless otherwise indicated. Refer to floor finish patterns on Drawings.
- .3 Install square tile to irregular (offset at random dimensions) pattern. Allow minimum 1/2 full size tile width at room or area perimeter.
- .4 Install plank tile in a herringbone pattern.

3.6 INSTALLATION - RESILIENT BASE

- .1 Fit joints tightly and make vertical. Maintain minimum dimension of 450 mm between joints.
- .2 Mitre 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.

3.7 INSTALLATION - STAIR COVERINGS

- .1 Install stair treads in one piece for full width and depth of boot rack shelves.
- .2 Adhere over entire surface. Fit accurately and securely.

3.8 CLEANING

- .1 Remove excess adhesive from floor, base, and wall surfaces without damage.
- .2 Perform initial cleaning and maintenance after adhesives have set, and in accordance with manufacturer's written instructions.

3.9 PROTECTION

- .1 Prohibit foot traffic on resilient flooring for 48 hours after installation. Prohibit rolling traffic on floor for minimum 72 hours after installation.

- .2 Protect floor products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Rubber sheet flooring, adhesively installed.
- .2 Vinyl sheet flooring, adhesively installed.
- .3 Painted game lines.

1.2 RELATED REQUIREMENTS

- .1 Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
- .2 Section 09 65 00 - Resilient Flooring: Floor transition strips.

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 F1516 - Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended); 2013.
- .4 ASTM F2659 - Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter; 2023.
- .5 ASTM F2772 - Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems; 2011 (Reapproved 2019).
- .6 ASTM F3311 - Standard Practice for Mat Bond Evaluation of Performance and Compatibility for Resilient Flooring System Components Prior to Installation; 2019.
- .7 CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.
- .8 NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.
- .9 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .10 SCS (CPD) - SCS Certified Products; Current Edition.
- .11 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting:
 - .1 Convene pre-installation meeting with Contractor, Contract Administrator, and Resilient Flooring Subcontractor in attendance. Discuss the following, and as outlined in Section 09 05 61:
 - .1 Floor moisture, pH and bond test results.

- .2 Facility room temperatures/HVAC requirements.
- .3 Installation and application procedures for all products specified including floor preparation, adhesive application, seaming methods, transitions to adjacent flooring materials, game line painting, co-ordination with work by others, protection of finished work.
- .4 Mock-up requirements.
- .5 Quality of workmanship expected.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's printed data sheets for products specified.
- .3 Shop Drawings: Fabrication and installation details, and layout, colours, and widths of game lines and equipment locations.
- .4 Selection samples: Manufacturer's colour charts for flooring materials specified and game line stripes, indicating full range of colours and textures available.
- .5 Verification samples: Actual flooring material specified, not less than 300 mm square, mounted on solid backing, with completed seam in centre of sample.
 - .1 Include samples of game lines, illustrating colours selected.
- .6 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .7 Installer's qualification statement.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system, and painting of game lines on rubber athletic flooring.

1.7 MOCK-UPS

- .1 Prepare mock-up of each resilient athletic flooring installation in accordance with Section 01 45 00 - Quality Control.
 - .1 Mock-up to include seaming, painted game lines, and transition strip to adjacent flooring material.
 - .2 Locate mock-up on site as part of final installation. Mock-up will be reviewed for quality of workmanship, seam welding, and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .4 Do not proceed with resilient flooring installation until mock-up area is complete and approved by Contract Administrator.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

- .2 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.

1.9 WARRANTY

- .1 Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring including labour that fails within specified warranty period. Defects include material manufacturing defects, excessive wear and deterioration to point of wear-through of wear layer.
 - .1 Warranty period - RAF-1:
 - .1 Manufacturing defects: 1 year from Date of Substantial Performance.
 - .2 Excessive wear: 10 years from Date of Substantial Performance.
 - .2 Warranty period - RAF-2:
 - .1 Manufacturing defects: 1 year from Date of Substantial Performance.
 - .2 Excessive wear: 10 years from Date of Substantial Performance.

1.10 SITE CONDITIONS

- .1 Maintain temperature in spaces to receive adhesively installed resilient flooring at minimum 18 degrees C for not less than one week before the beginning of installation, during installation, and after installation has been completed.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of all flooring products hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, by cost or surface area, within the waterproofing membrane must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 FloorScore (Resilient Floor Covering Institute) certified for hard flooring
 - .2 NSF 332 certified for resilient floor coverings
 - .3 CRI (GL) for carpet products
 - .4 UL (GGG)
 - .5 SCS (CPD) Indoor Advantage Gold
 - .6 Blue Angel
 - .7 MAS Certified Green
 - .8 Berkeley Analytical ClearChem
 - .9 EMICODE EC1 or EMICODE EC1 Plus
 - .10 Intertek ETL Environmental VOC+
 - .11 Eco-INTITUT-Label
 - .12 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 All setting adhesives and grout must meet SCAQMD 1168.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or

untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 PREFORMED ATHLETIC FLOORING

- .1 Resilient athletic rubber flooring - Type RAF-1: Prefabricated dual durometer construction, calendared and vulcanized with a base of natural and synthetic rubbers, stabilizing agents, and pigmentation.
 - .1 Thickness: Minimum 6 mm.
 - .2 Sheet width: Minimum 1830 mm.
 - .3 Tensile strength: Minimum 2.0 MPa, per ASTM D412.
 - .4 Durometer hardness, Type A: 78 plus or minus 5 (top layer); 60 plus or minus 8 (bottom layer), when tested in accordance with ASTM D2240.
 - .5 Colour: To be selected by Contract Administrator from manufacturer's full range.
 - .6 Game lines: Primer and two-component polyurethane paint as recommended by manufacturer of rubber sheet flooring. Allow for three colours as selected by Contract Administrator from manufacturer's standard range.
 - .7 Basis-of-Design Product:
 - .1 Mondo America Inc; Advance, L92 Dark Maple.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Resilient athletic vinyl sheet flooring - Type RAF-2: Prefabricated multilayer PVC resilient athletic flooring, consisting of an embossed high-density wear resistant vinyl layer, a high density compression resistant vinyl layer, a fiberglass-reinforced foam layer, a dual density foam layer, and finally an anti-slip backing.
 - .1 Sheet thickness: Minimum 7 mm.
 - .2 Sheet width: Minimum 1800 mm.
 - .3 Sheet lengths: As necessary to minimize transverse seams.
 - .4 Force reduction: Class 2 to ASTM F2772.
 - .5 Ball rebound: Greater or equal to 90 percent to ASTM F2772.
 - .6 Surface finish effect: 80 to 110 PBN (British Pendulum Number) to ASTM F2772.
 - .7 Vertical deformation: Class B to ASTM F2772.
 - .8 Seaming method: Welding with heat.
 - .9 Surface texture: Embossed.
 - .10 Colour: As selected by Contract Administrator from manufacturer's entire hardwood flooring series.
 - .11 Basis-of-Design Product:
 - .1 Mondo Sport; Vinylsport, colour VM66.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 ACCESSORIES

- .1 Flooring adhesive: Waterproof; types recommended by flooring manufacturer for fully adhered installation.
- .2 Welding rod: Multi-colour bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in colour matching field colour.

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 Flooring Subcontractor shall 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 athletic flooring to substrate.
- .3 Cementitious sub-floor surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH, and adhesive bond.
 - .1 Flooring Subcontractor shall verify independent testing has been completed in accordance with Section 09 05 61, and obtain test results from Contractor.
 - .2 Before installing flooring, Flooring Subcontractor shall test for moisture in accordance with ASTM F2659, and for adhesive bond in accordance with ASTM F3311.
 - .3 Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - .4 Verify that no curing compounds or sealers have been applied to the concrete subfloor that would impair bond. Report findings to Contract Administrator.
 - .5 Telegraphing of imperfections to the new flooring will not be accepted.

3.2 PREPARATION

- .1 Preparation of floor substrates for installation of flooring is specified in Section 09 05 61.
- .2 Flooring Subcontractor is responsible for correction and filling of minor imperfections and irregularities with sub-floor filler.
- .3 Neutralize surface of concrete in accordance with manufacturer's printed instructions.
- .4 Seal and prime concrete slab and areas filled with patching and leveling compound as recommended by resilient flooring manufacturer.

3.3 INSTALLATION

- .1 Starting installation constitutes acceptance of sub-floor conditions.
- .2 Comply with manufacturer's recommendations.
- .3 Resilient sheet flooring - RAF-1:
 - .1 Unroll flooring and allow to relax before beginning installation.

- .2 Dry lay and cut to fit before applying adhesive.
- .3 Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive. Ensure proper adhesive transfer by checking periodically for minimum 90 percent transfer.
- .4 Cut flooring with slight bevel and complete end and side seams in accordance with manufacturer's instructions butting edges and compression fitting without applying excessive pressure.
- .5 Roll entire flooring surface with steel roller to ensure adhesion to substrate and eliminate air bubbles.
- .6 Immediately remove adhesive from flooring surface, using chemical recommended by flooring manufacturer.
- .7 Butt seams of rubber sheet flooring in compliance with manufacturer's printed instructions. Hold seams, perimeter, and edges in place with masking tape and suitable weights for a minimum of 12 hours, depending on site temperature and adhesive curing.
- .8 Game lines:
 - .1 Apply game lines after weights have been removed and adhesive has cured.
 - .2 Clean and prepare floor surfaces, and lay out and paint game lines in strict accordance with manufacturer's instructions.
 - .3 Allow paint to cure, and protect from traffic.
- .4 Resilient sheet flooring - RAF-2:
 - .1 Unroll flooring and allow to relax before beginning installation.
 - .2 Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
 - .3 Roll entire flooring surface with steel roller to ensure adhesion to substrate and eliminate air bubbles.
 - .4 Immediately remove adhesive from flooring surface, using chemical recommended by flooring manufacturer.
 - .5 Seal seams by heat welding.
 - .1 Heat-weld seams in accordance with ASTM F1516 and manufacturer's instructions.
 - .2 Route out seams and use welding bead to permanently fuse sections into seamless floor covering.
 - .3 Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
- .5 Install transition strips at unprotected or exposed edges, and between flooring materials of differing thickness:
 - .1 Metal strips: Attach to substrate before installation of flooring using stainless steel screws.

3.4 CLEANING

- .1 Clean flooring using methods recommended by manufacturer.
- .2 Perform initial cleaning and maintenance after adhesives have set, and in accordance with manufacturer's written instructions.

3.5 PROTECTION

- .1 Prohibit foot traffic on resilient flooring for 48 hours after installation. Prohibit rolling traffic on floor for minimum 72 hours after installation.
- .2 Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Performance.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Epoxy matrix terrazzo with ground and polished finish.
- .2 Divider strips.
- .3 Patching existing terrazzo flooring to accommodate renovation work.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Concrete subfloor with steel trowel finish.

1.3 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 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .3 CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.
- .4 ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.
- .5 NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.
- .6 SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- .7 SCS (CPD) - SCS Certified Products; Current Edition.
- .8 TTMAC - IM - Terrazzo Specification Guide 096600; 2016-2018.
- .9 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meeting: Convene pre-installation meeting before start of resinous terrazzo flooring. Required attendance of parties directly affecting work of this Section to include Contractor, Contract Administrator, and Flooring Subcontractor. Review installation procedures, joint details, substrate specification, divider strip pattern and design, dust control procedures, mock-ups, and co-ordination with other work.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current TTMAC - IM recommendations for type of terrazzo specified.
- .3 Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components.

- .4 Samples: Submit two samples, 300 mm by 300 mm in size illustrating colour, chip size and variation, chip gradation, matrix colour, and typical divider strip.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Installer's qualification statement.
- .7 Cleaning and maintenance data: Include procedures for stain removal, stripping, and sealing.

1.6 QUALITY ASSURANCE

- .1 Perform work in accordance with TTMAC - IM recommendations.
- .2 Installer qualifications: Company specializing in performing the type of work specified in this section.
 - .1 Minimum five years of documented experience.
 - .2 Approved by matrix manufacturer.
 - .3 Contractor Member of Terrazzo, Tile & Marble Association of Canada.

1.7 MOCK-UP

- .1 See Section 01 45 00 - Quality Control, for additional requirements.
- .2 Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 5 sq m.
- .3 Locate where directed on site as part of final installation.
- .4 Mock-up may remain as part of the work, and will set standard of acceptance for remaining installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Store terrazzo materials in a dry, secure area.
- .2 Maintain minimum temperature of 16 degrees C.
- .3 Keep products away from fire or open flame.

1.9 SITE CONDITIONS

- .1 Do not install terrazzo when ambient air and surface temperature are below 15 degrees C or above 32 degrees C.
- .2 Maintain temperature within specified range 72 hours before, during, and 72 hours after installation of flooring.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of all flooring products hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, by cost or surface area, within the waterproofing membrane must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 FloorScore (Resilient Floor Covering Institute) certified for hard flooring
 - .2 NSF 332 certified for resilient floor coverings
 - .3 CRI (GL) for carpet products
 - .4 UL (GGG)
 - .5 SCS (CPD) Indoor Advantage Gold
 - .6 Blue Angel
 - .7 MAS Certified Green
 - .8 Berkeley Analytical ClearChem
 - .9 EMICODE EC1 or EMICODE EC1 Plus
 - .10 Intertek ETL Environmental VOC+
 - .11 Eco-INTITUT-Label
 - .12 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 Setting adhesives and grout must meet SCAQMD 1168.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 MANUFACTURERS

- .1 Resinous Matrix Terrazzo Flooring:
 - .1 Basis-of-Design Products:
 - .1 Key Resin Company; Key Resin Epoxy Terrazzo.
 - .2 Terrazzo & Marble Supply Companies; Terroxy Resin Systems.
 - .3 Sika; Sikafloor Terrazzo.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 EPOXY MATRIX TERRAZZO APPLICATIONS

- .1 Floors:
 - .1 Thickness: 10 mm, nominal.
 - .2 Colour: Match existing.
 - .3 Aggregate type and size: To match existing, made up of the following:
 - .1 45 percent No. 0 chip size, consisting of 75 percent North American Chip Collection and Italian Marble Chip Collection, 15 percent exotic Mother of Pearl, and 10 percent post-consumer recycled aggregate.

- .2 45 percent No. 1 chip size, consisting of 75 percent North American Chip Collection and Italian Marble Chip Collection, 15 percent exotic Mother of Pearl, and 10 percent post-consumer recycled aggregate.
- .3 10 percent No. 2 chip size, consisting of 100 percent North American Chip Collection and Italian Marble Chip Collection.

2.4 MATERIALS

- .1 Epoxy matrix terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
- .2 Matrix: Two component resin and epoxy hardener with mineral filler and colour pigment, non-volatile, thermo-setting.
- .3 Aggregate: Type and size as indicated; sized in accordance with TTMAC - IM aggregate gradation standards; colour to match existing.
- .4 Reinforcing membrane: 100 percent solid flexible epoxy membrane, designed to suppress reflective and hairline cracking
- .5 Finishing grout: Epoxy resin, colour to match terrazzo matrix.

2.5 ACCESSORIES

- .1 Divider strips: White zinc alloy, exposed top width to match existing.
- .2 Divider strip adhesive: 100 percent solid epoxy resin recommended by resinous matrix terrazzo manufacturer.
- .3 Divider and control joint strip height: To suit thickness of terrazzo topping, with allowance for grinding.
- .4 Sealer: Colourless, non-yellowing, penetrating water-based urethane liquid type to completely seal matrix surface; not detrimental to terrazzo components; slip- and stain-resistant.
- .5 Patching and fill material: Epoxy resin blended with selected aggregates recommended by terrazzo flooring system manufacturer.
- .6 Primer: As recommended by terrazzo flooring system manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that sub-floor surfaces are smooth and flat within 6 mm in 3 metres and are ready to receive terrazzo.
- .2 Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.
- .3 Verify that concrete sub-floor surfaces are ready for terrazzo installation by testing for moisture vapour emission, internal relative humidity, and alkalinity; obtain instructions if test results are not within limits recommended by terrazzo materials manufacturer.

- .4 Proceed with installation only after unsatisfactory conditions, including flatness tolerances, have been corrected.

3.2 PREPARATION

- .1 Clean substrate of foreign matter.
- .2 Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.
- .3 Prepare concrete surfaces according to ICRI 310.2R, CSP 3 to CSP 5.
- .4 Repair or level damaged and deteriorated concrete in accordance with manufacturer's instructions.
- .5 Repair cracks and non-expansion joints greater than 1.6 mm wide in accordance with TTMAC - IM.
- .6 Apply flexible reinforcing membrane over entire area to receive epoxy terrazzo flooring system, in accordance with manufacturer's instructions.
- .7 Apply primer in accordance with manufacturer's instructions.

3.3 INSTALLATION

- .1 Install control joint strips straight and flat to locations indicated.
- .2 Install divider strips according to pattern approved on Shop Drawings.
- .3 Place terrazzo mix over substrate to thickness indicated, in accordance with manufacturer's instructions.

3.4 FINISHING

- .1 Finish terrazzo to TTMAC - IM requirements.
- .2 Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.
- .3 Apply grout to fill voids exposed from grinding.
- .4 Remove grout coat by grinding, using a fine grit abrasive.

3.5 TOLERANCES

- .1 Maximum variation from flat surface: 6 mm in one m.

3.6 CLEANING

- .1 Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.
- .2 Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.
- .3 Polish surfaces in accordance with manufacturer's instructions.

3.7 PROTECTION

- .1 Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Carpet tile, loose laid with edges and control grid adhered.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Restrictions on curing compounds for concrete slabs and floors.
- .2 Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.3 REFERENCE STANDARDS

- .1 ASTM F2659 - Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter; 2023.
- .2 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .3 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .4 CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.
- .5 CRI (TARR) - Texture Appearance Retention Rating; current edition.
- .6 NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.
- .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.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate installation of carpet tile and tile connectors with requirements of radiantly heated floors to ensure compatibility of products.
 - .2 Turn heat down to adhesive manufacturer's recommended temperature for recommended length of time before, during and after installation.
 - .3 Gradually return heat to operating temperatures after manufacturer's minimum recommended length of time after installation.
 - .4 Do not exceed adhesive manufacturer's recommended maximum operating temperature.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colours available, and method of installation.

- .3 Samples: Submit two carpet tiles illustrating colour and pattern design for each carpet colour selected.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .6 Maintenance data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- .7 Maintenance materials: Provide the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, for additional provisions.
 - .2 Extra carpet tiles: Quantity equal to 5 percent of total installed of each colour and pattern installed.
- .8 Warranty documentation.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.7 MOCK-UPS

- .1 See Section 01 45 00 - Quality Control, for additional requirements.
- .2 Prepare mock-up of tile carpeting installation, including transition strip to adjacent flooring material.
- .3 Locate where directed on site as part of final installation. Mock-up will be reviewed for quality of workmanship and overall appearance.
- .4 Mock-up may remain as part of the work, and will set standard of acceptance for remaining installation.

1.8 SITE CONDITIONS

- .1 Store materials in area of installation for minimum period of 24 hours prior to installation.

1.9 WARRANTY

- .1 Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - .1 Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - .2 Failures include: Excessive surface wear, edge ravel, backing separation, shrinking, stretching, cupping, doming, and excess static electricity discharge.
 - .3 Warranty period: 15 years from date of Substantial Performance.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of all flooring products hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, by cost or surface area, within the waterproofing membrane must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 FloorScore (Resilient Floor Covering Institute) certified for hard flooring
 - .2 NSF 332 certified for resilient floor coverings
 - .3 CRI (GL) for carpet products
 - .4 UL (GGG)
 - .5 SCS (CPD) Indoor Advantage Gold
 - .6 Blue Angel
 - .7 MAS Certified Green
 - .8 Berkeley Analytical ClearChem
 - .9 EMICODE EC1 or EMICODE EC1 Plus
 - .10 Intertek ETL Environmental VOC+
 - .11 Eco-INTITUT-Label
 - .12 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 Setting adhesives and grout must meet SCAQMD 1168.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 MATERIALS

- .1 Tile carpeting, Type TC1 and TC2: Tufted texture loop, manufactured in one colour dye lot.
 - .1 Basis-of-Design Product:
 - .1 Interface Open Air 420, colours Oat and Charcoal, with CQuestGB backing.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Tile size: 500 by 500 mm, nominal.
 - .3 Total thickness: 6 mm.
 - .4 Pile thickness: 2 to 3 mm.
 - .5 Fibre: 100 percent recycled nylon.
 - .6 Dye method: 100 percent solution dyed.
 - .7 Colours: Allow for two colours, as selected by Contract Administrator from manufacturer's full range.
 - .8 Traffic classification: Heavy to CRI (TARR).

- .9 Certified carbon neutral.
- .10 Primary backing material: Proprietary vinyl, with a construction of post-consumer carpet tiles, bio-based additives, and pre consumer recycled materials, which are net carbon negative.

2.3 ACCESSORIES

- .1 Sub-floor filler: Type recommended by flooring material manufacturer.
- .2 Carpet tile connectors: Manufacturer's recommended glue-free adhesive squares; type applicable for use with specified backing material.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- .2 Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- .3 Cementitious sub-floor surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
 - .1 Flooring Subcontractor shall verify independent testing has been completed in accordance with Section 09 05 61, and obtain test results from Contractor.
 - .2 Before installing flooring, Flooring Subcontractor shall test for moisture in accordance with ASTM F2659.
 - .3 Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

- .1 Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.3 INSTALLATION

- .1 Starting installation constitutes acceptance of sub-floor conditions.
- .2 Blend carpet from different cartons to ensure minimal variation in colour match.
- .3 Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- .4 Lay carpet tile in square pattern, installed monolithic method.
- .5 Adhere carpet tile to substrate using carpet tile connectors, in accordance with manufacturer's recommended spacing.
- .6 Trim carpet tile neatly at walls and around interruptions.

3.4 CLEANING

- .1 Clean and vacuum carpet surfaces.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Fibreglass insulation applied to underside of structure.

1.2 REFERENCE STANDARDS

- .1 ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.
- .2 ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2020).
- .3 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .4 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies; 2018.
- .5 CAN/ULC S114 - Test for Determination of Non Combustibility in Building Materials; 2018.
- .6 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .7 SCS (CPD) - SCS Certified Products; Current Edition.
- .8 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on materials, describing insulation properties.
- .3 Sample: Two samples of sprayed insulation bonded to rigid backing; 150 mm by 150 mm in size.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Certificates: Certify that products of this section meet or exceed specified requirements.
- .6 Manufacturer's installation instructions: Indicate special procedures, conditions of acceptance, and perimeter conditions requiring special attention.
- .7 Manufacturer's qualification Statement.
- .8 Installer's qualification statement.

1.4 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing 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 and with at least three years of documented experience and approved by manufacturer.

1.5 SITE CONDITIONS

- .1 Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation materials.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation. Insulation for HVAC ducts and plumbing piping are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

2.2 MATERIALS

- .1 Fibreglass sprayed insulation:
 - .1 Dry density: 125 kg/cu m.
 - .2 Noise reduction coefficient (NRC): 0.75 for 20 mm thickness on solid backing, when tested to ASTM C423.
 - .3 Flame spread rating / smoke development classification: 0/0, when tested in accordance with CAN/ULC S102.
 - .4 Combustibility: Non-combustible to CAN/ULC S114.
 - .5 Air erosion: 0.11 gram mass loss when tested to ASTM E859/E859M.
 - .6 Basis-of-Design Product:
 - .1 Monoglass Inc.; Sonoglass Spray-On White Fiber.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding*

Procedures.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

3.2 PREPARATION

- .1 Mask and protect adjacent surfaces from overspray or damage.
- .2 Clean surfaces free from dust, dirt, foreign material, and other deleterious materials that could affect bond or staining of insulation. Clean and seal as required.
- .3 Verify bond requirements and compatibility of surfaces to receive sprayed acoustic insulation.

3.3 INSTALLATION

- .1 Mix and apply sprayed acoustic insulation in accordance with manufacturer's instructions.
- .2 Install sprayed insulation to a uniform monolithic density without voids.
- .3 Install to achieve an acoustic rating of NRC 0.75.
- .4 Tamp wet sprayed insulation surface to improve adhesion and to achieve a smooth surface, similar to adjacent surfaces.

3.4 CLEANING

- .1 Remove sprayed acoustic insulation from surfaces not scheduled to receive insulation.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Sound-absorbing wall panels, referred to on the Drawings as "AWP-#".
- .2 Sound-absorbing ceiling baffles, referred to on the Drawings as "ACB".
- .3 Mounting accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 09 91 00 - Painting: Site painting of sound-absorbing wall panels type AWP-3.

1.3 REFERENCE STANDARDS

- .1 ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.
- .2 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .3 CAN/ULC S102 - Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies; 2018.
- .4 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .5 SCS (CPD) - SCS Certified Products; Current Edition.
- .6 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate priming and painting of wall surfaces before installation of acoustic wall panels.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's printed data sheets for products specified.
- .3 Shop Drawings: Fabrication and installation details, and ceiling baffle layout.
- .4 Verification samples: Samples of each type of panel specified; 300 by 300 mm, showing edge details, texture and colour; include mounting accessories for ceiling baffles.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Manufacturer's installation instructions.
- .7 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, for additional provisions.

- .2 Extra blades and panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- .2 Store units flat, in dry, well-ventilated space; do not stand on end.
- .3 Protect edges from damage.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 The ceilings product category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights. Overhead structural elements (exposed, finished, and unfinished) are excluded.
- .4 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the California Department of Public Health (CDPH) Standard Method v1.2-2017, EN 16516:2017 or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green

- .5 Berkeley Analytical ClearChem
- .6 EMICODE EC1 or EMICODE EC1 Plus
- .7 Intertek ETL Environmental VOC+
- .8 Eco-INTITUT-Label
- .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)

2.2 SOUND-ABSORBING UNITS

- .1 Acoustic wall panel - Type AWP-1: Felt made from 100 percent polyethylene terephthalate (PET) plastic, with up to 60 percent recycled content.
 - .1 Thickness: 9 mm.
 - .2 Colours: Allow for five Luxe colours printed on slate coloured panel. Colours selected by Contract Administrator from manufacturer's full range; panel layout and arrangement as indicated on Drawings.
 - .3 Shape and size: As indicated on Drawings.
 - .4 Noise reduction coefficient (NRC): 0.3 minimum when tested in accordance with ASTM C423 with no air gap.
 - .5 Surface burning characteristics: Flame spread rating of 25 or less and smoke developed classification of 50 or less, when tested in accordance with CAN/ULC S102.
 - .6 Mounting method: Back-mounted with Z-clips.
 - .7 Basis-of-Design Product:
 - .1 Hush Acoustics.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Acoustic wall panel - Type AWP-2: Felt made from 100 percent polyethylene terephthalate (PET) plastic, with up to 60 percent recycled content.
 - .1 Thickness: 12 mm.
 - .2 Colours: Allow for three colours selected by Contract Administrator from manufacturer's full range.
 - .3 Custom cut large scale graphic signage. Graphic to be determined.
 - .4 Noise reduction coefficient (NRC): 0.35 minimum when tested in accordance with ASTM C423 with no air gap.
 - .5 Surface burning characteristics: Flame spread rating of 25 or less and smoke developed classification of 50 or less, when tested in accordance with CAN/ULC S102.
 - .6 Mounting method: Back-mounted with Z-clips.
 - .7 Basis-of-Design Product:
 - .1 Hush Acoustics.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Acoustic wall panel - Type AWP-3: Cementitious wood-fibre, FSC-certified; with acoustical fleece backer.
 - .1 Thickness: 25 mm.
 - .2 Colour: Natural, for site painting as specified in Section 09 91 00.

- .3 Size: As indicated.
- .4 Edge profile: Beveled, unless otherwise indicated.
- .5 Noise reduction coefficient (NRC): 0.60 minimum when tested in accordance with ASTM C423 with 19 mm air gap (D-20 mounting).
- .6 Surface burning characteristics: Flame spread rating of 25 or less and smoke developed classification of 50 or less, when tested in accordance with CAN/ULC S102.
- .7 Mounting method: Direct-mounted on furring strips (Method D-20).
- .8 Basis-of-Design Product:
 - .1 Armstrong; Tectum Direct-Attached High NRC Wall Panels.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .4 Ceiling baffles - Type ACB: Felt made from 100 percent polyethylene terephthalate (PET) plastic, with up to 60 percent recycled content.
 - .1 Fin shape: Rectangular; square profile.
 - .2 Fin thickness: 24 mm.
 - .3 Fin length: 1800 mm.
 - .4 Fin depth: 300 mm.
 - .5 Noise reduction coefficient (NRC): 0.85 when tested in accordance with ASTM C423.
 - .6 Colour: Slate.
 - .7 Mounting method: Suspended shoulder-mount bracket, with wire and single anchor per bracket.
 - .8 Surface burning characteristics: Flame spread rating of 25 or less and smoke developed classification of 50 or less, when tested in accordance with CAN/ULC S102.
 - .9 Basis-of-Design Product:
 - .1 Hush; Fins.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 FABRICATION

- .1 Cut PET felt panels to form dimensional letters with crisp, clean edges.
- .2 Tolerances:
 - .1 Panels: Fabricate to finished tolerance of plus or minus 3.2 mm for thickness, overall length and width.
 - .2 Dimensional letters: Fabricate to finished tolerance of plus or minus 1.6 mm for thickness, overall length and width. Font: san serif type as selected by Contract Administrator.

2.4 ACCESSORIES

- .1 Ceiling-suspended accessories: Manufacturer's standard accessories at manufacturer's recommended spacing on each ceiling baffle, sized appropriately for weight of acoustical unit.

- .1 Provide galvanized wire and anchors for fastening through gypsum board ceiling at heights as indicated.
- .2 Mounting clips: Two-piece aluminum Z-clips; size and spacing based on type, weight and size of panels, and panel substrate and framing. Minimize projection from wall.
- .3 Furring strips: As indicated on Drawings, design furring and attachment to support weight of panels.
- .4 Fasteners: Size, type and finish to suit application.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- .2 PET felt wall panels:
 - .1 Apply Z-clips to back of PET wall felt panels and dimensional letters using PET panel manufacturer's recommended adhesive.
 - .2 Mechanically fasten Z-clips on wall surfaces in accordance with clip manufacturer's instructions.
 - .3 Place panels on wall substrate to layout indicated on Drawings.
 - .4 Align panels accurately, with edges plumb and top edges level, unless otherwise indicated.
 - .5 Butt individual panels together, unless otherwise indicated.
 - .6 Space dimensional letters as indicated.
- .3 PET ceiling baffles:
 - .1 Suspend ceiling baffles at locations and heights as indicated.
- .4 Furring mounted wall panels:
 - .1 Install furring perpendicular to long edge of panels, in accordance with manufacturer's instructions, and to suit weight of panels.
 - .2 Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 610 mm on centre, maximum.
 - .3 Direct fasten panels through furring using manufacturer's recommended screw fasteners and spacing.
- .5 Install acoustical units to construction tolerances of plus or minus 1.6 mm for the following:
 - .1 Plumb and level.
 - .2 Flatness.

3.3 CLEANING

- .1 Clean panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.4 PROTECTION

- .1 Provide protection of installed acoustical panels until Date of Substantial Performance.
- .2 Replace panels that cannot be cleaned and repaired to satisfaction of the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Surface preparation.
- .2 Site application of paints.
- .3 Scope: Finish new and existing interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - .1 Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - .2 Mechanical and electrical:
 - .1 In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - .2 In finished areas, paint shop-primed items.
 - .3 Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvres with one coat of flat black paint to visible surfaces.
 - .4 Paint dampers exposed behind louvres, grilles, and convector and baseboard cabinets to match face panels.
- .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 Stainless steel, and anodized aluminum items.
 - .6 Floors, unless specifically indicated.
 - .7 Ceramic and other tiles.
 - .8 Glass.
 - .9 Acoustical materials, unless specifically indicated.
 - .10 Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- .1 Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

- .1 ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- .2 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.

- .3 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .4 MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- .5 MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- .6 MPI MRM - Master Painters Institute; Maintenance Repainting Manual; Current Edition.
- .7 NFC(AE) - National Fire Code (Alberta Edition); 2019.
- .8 SCS (CPD) - SCS Certified Products; Current Edition.
- .9 UL (GGG) - GREENGUARD Gold Certified Products; 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 Label each card with the following:
 - .1 Job name.
 - .2 Date.
 - .3 Product number.
 - .4 Colour number as stated in the colour schedule.
 - .5 Name, address, and phone number of the supplying facility.
- .4 Samples: Submit two painted samples, illustrating selected colours and sheen for each colour of site finished AWP-3 cementitious wood-fibre acoustic wall panel. Submit on specified acoustic wall panel, 600 by 600 mm in size.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- .7 Applicator qualification statement.
- .8 Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

- .9 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.
- .10 Maintenance materials: Supply the following for City's use in maintenance of project.
 - .1 See Section 01 78 00 - Closeout Submittals, for additional provisions.
 - .2 Extra paint and finish materials: one , 4 L can of each colour; from the same product run, store where directed.
 - .3 Label each container with colour and room locations 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 documented experience.

1.6 MOCK-UP

- .1 See Section 01 40 00 - Quality Requirements for general requirements for mock-up.
- .2 When requested by the City or Contract Administrator, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Manual standards for review and approval. Surface, area, room and/or items, when approved, become acceptable standard of finish quality and workmanship for similar on-site 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 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.
- .4 Fire safety requirements:
 - .1 Provide Type ABC fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the NFC(AE).

1.8 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 Provide lighting level of 860 lx measured mid-height at substrate surface.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 75 percent of all adhesives, sealants, paints, and coatings, by volume or surface area, applied on site and within the weatherproofing barrier must be tested and determined compliant in accordance with the CAL (CDPH SM) or complies with the LCI values from Table 1 of the German AgBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)

2.2 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.
- .3 Paints:
 - .1 Dulux Paints: www.dulux.ca/#sle.
 - .2 Sherwin-Williams Company.
 - .3 Benjamin Moore.
 - .4 Cloverdale Paint.
- .4 Primer sealers: Same manufacturer as top coats.

2.3 PAINTS AND FINISHES - GENERAL

- .1 Interior and exterior paint and repainting systems: MPI Premium Grade, unless no premium grade is available.
- .2 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.

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- .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.
- .3 Volatile organic compound (VOC) content: Comply with Section 01 33 29 - General LEED Requirements.
 - .4 Flammability: Comply with applicable code for surface burning characteristics.
 - .5 Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Contract Administrator from the manufacturer's full line.
 - .1 Walls:
 - .1 Main corridors and washrooms: G3.
 - .2 Elsewhere: G2.
 - .2 Ceilings and bulkheads: G1.
 - .3 Hollow metal doors and frames: G4.
 - .4 Metal fabrications: G5.
 - .6 Colours: To be selected from manufacturer's full range of available colours.
 - .1 Selection to be made by Contract Administrator after award of contract.
 - .2 Allow for minimum of five interior colours and five exterior colours for each system, unless otherwise indicated, without additional cost to City.
 - .3 Extend colours to surface edges; colours may change at any edge as directed by Contract Administrator.
 - .4 In finished areas, finish pipes, ducts, conduit, and equipment the same colour as the wall/ceiling they are mounted on/under.

2.4 PAINTING AND REPAINTING SYSTEMS - INTERIOR

- .1 INT 4.2E - Institutional Low Odour/Low VOC over Latex Block Filler
 - .1 Surfaces include: New CMU, unless otherwise noted.
- .2 INT 4.2K (modified) - Water-Based Light Industrial Coating over Latex Block Filler
 - .1 Surfaces include: New CMU, where scheduled and referred to on the Room Finish Schedule as "EP".
 - .2 Intermediate and topcoats: Pre-catalyzed waterborne epoxy.

- .3 RIN 4.2G (modified) - Water-Based Light Industrial Coating
 - .1 Surfaces include: Existing CMU, where scheduled to be repainted and referred to on the Room Finish Schedule as "EP".
 - .2 Intermediate and topcoats: Pre-catalyzed waterborne epoxy.
- .4 RIN 4.2L - Institutional Low Odour/Low VOC
 - .1 Surfaces include: Existing CMU scheduled to be repainted, unless otherwise noted.
- .5 INT 5.1C - Water-Based, Dry-Fall, over Quick-Dry Alkyd Primer, or INT 5.1CC - Water-Based, Dry-Fall, over Alkyd Primer
 - .1 Surfaces include: Open web steel joists, where indicated as "ES-P" on Drawings.
- .6 INT 5.1N - Waterbased Light Industrial Coating (over Epoxy Primer)
 - .1 Surfaces include: New structural steel and metal fabrications in Pool Storage 1:06.
- .7 INT 5.1S - Institutional Low Odour/Low VOC over Water-Based Rust-Inhibitive Primer
 - .1 Surfaces include: New structural steel and metal fabrications, except as otherwise specified.
- .8 RIN 5.1S - Institutional Low Odour/Low VOC over Water-Based Rust-Inhibitive Primer
 - .1 Surfaces include: Existing structural steel and metal fabrications scheduled to be repainted.
- .9 INT 5.3H - Water-Based Dry-Fall: For low contact/traffic areas.
 - .1 Surfaces include underside of exposed steel roof decking, where indicated as "ES-P" on Drawings.
- .10 INT 5.3N - Institutional Low Odour/Low VOC over Water-Based Galvanized Primer
 - .1 Surfaces include: New hollow metal doors and frames, and other galvanized items.
- .11 RIN 5.3K - Institutional Low Odour/Low VOC over Water-Based Galvanized Primer
 - .1 Surfaces include: Existing hollow metal doors and frames, and other galvanized items scheduled to be repainted.
- .12 INT 6.4PP - Fire-Retardant, Pigmented, Water-Based: ULC certified.
 - .1 Surfaces include: Electrical and communications backerboards.
- .13 INT 9.2L (modified) - Water-Based Light Industrial Coating over Latex Primer Sealer.
 - .1 Surfaces include: New gypsum board surfaces, where indicated and referred to on the Room Finish Schedule as "EP", and in Pool Storage 1:06.
 - .2 Intermediate and topcoats: Pre-catalyzed waterborne epoxy.
- .14 INT 9.2M - Institutional Low Odour/Low VOC over Low Odour/Low VOC Primer Sealer
 - .1 Surfaces include: New gypsum board surfaces, unless otherwise indicated.
- .15 RIN 9.2LL (modified) - Water-Based Light Industrial Coating over Water-Based Stain-Blocking Primer
 - .1 Surfaces include: Existing gypsum board surfaces where scheduled to be repainted and referred to on the Room Finish Schedule as "EP".
 - .2 Intermediate and topcoats: Pre-catalyzed waterborne epoxy.

- .16 RIN 9.2M - Institutional Low Odour/Low VOC over Water-Based Stain Blocking Primer
 - .1 Surfaces include: Existing gypsum board surfaces scheduled to be repainted, unless otherwise indicated.
- .17 Non-MPI system: 100 percent acrylic water based coating recommended by cementitious wood-fibre acoustic wall panel manufacturer; spray-applied.
 - .1 Surfaces include: AWP-3 cementitious wood-fibre acoustic wall panels.
 - .2 Basis-of-Design Product:
 - .3 Sherwin Williams ArmorSeal Tread-Plex.
 - .1 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 EXT 2.1B: Alkyd zone/traffic marking
 - .1 Surfaces include: Asphalt.
- .2 EXT 5.1T: Polyurethane, Pigmented (over high build self-priming epoxy).
 - .1 Surfaces include: Ferrous metal fabrications, structural steel.
- .3 EXT 5.3J: Water-based Light Industrial Coating (over waterborne galvanized primer)
 - .1 Surfaces include: Galvanized/galvannealed metal, high contact/high traffic surfaces including hollow metal doors and frames, galvanized metal fabrications scheduled for painting.

2.6 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 Concrete, and masonry: 12 percent.
 - .3 Interior wood: 15 percent, measured in accordance with ASTM D4442.

3.2 EXISTING CONDITIONS

- .1 Degree of surface deterioration (DSD) to be assessed using MPI Identifiers and Assessment criteria indicated in the MPI MRM.
- .2 Include costs of repair of DSD-1 through DSD-3 defects in the Work. Do not repaint surfaces until DSD-4 defects have been corrected.

Condition	Description
DSD-0	Sound Surface (includes visual (aesthetic) defects that do not affect film's protective properties).
DSD-1	Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes and scratches).
DSD-2	Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, and staining).
DSD-3	Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
DSD-4	Substrate Damage (repair or replacement of surface required).

3.3 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) and MPI MRM "Repaint Surface Preparation Standards", and 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.

3.4 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", and MPI MRM "Maintenance Repainting 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.

3.5 CLEANING

- .1 Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

- .1 Protect finishes until completion of project.
- .2 Touch-up damaged finishes after Substantial Performance.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Interior vinyl decal for information sign.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate installation of vinyl decals on gypsum board substrates to allow for appropriate curing time of paint before vinyl film is installed.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's printed product literature for each type of sign, indicating font, colour, locations, overall dimensions.
- .3 Samples: Submit two samples of die-cut letter, of specified size, illustrating font and selected colour and finish.
- .4 Selection samples: Where colours are not specified, submit two sets of colour selection charts or chips.
- .5 Manufacturer's installation instructions.

Part 2 Products

2.1 SIGNS

- .1 General: Refer to Drawings for sign size, type and location.
- .2 Vinyl decals: Die-cut decals and characters from cast vinyl film of nominal minimum thickness of 0.051 mm with pressure-sensitive adhesive backing suitable for direct application to painted gypsum board. Resistant to mild acids, moisture absorption and static build up.
 - .1 Colour: White, as selected by Contract Administrator.
 - .2 Wording: To be confirmed by Contract Administrator during construction.
 - .3 Character case: As indicated.
 - .4 Character height: As indicated.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

- .1 Clean bonding surfaces, without damaging finished surfaces.

- .2 Install in accordance with manufacturer's instructions.
- .3 Install neatly, with horizontal edges level, without air bubbles, creases or visible distortion.
- .4 Apply without seams or splices.
- .5 Protect from damage until Substantial Performance; repair or replace damaged items.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Phenolic toilet compartments, comprised of pilasters and doors.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Concealed steel support members.
- .2 Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS

- .1 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- .2 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .3 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .4 SCS (CPD) - SCS Certified Products; Current Edition.
- .5 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on panel construction, hardware, and accessories.
- .3 Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
- .4 Samples: Submit two samples of partition panels, 150 by 150 mm in size illustrating panel finish, colour, and sheen.
- .5 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .6 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.

2.2 MANUFACTURERS

- .1 Phenolic toilet compartments:
 - .1 Basis-of-Design Product:
 - .1 Bobrick Washroom Equipment, Inc; DuraLine Series Compact Grade Laminate (CGL), Extended Privacy, gap-free.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 PHENOLIC TOILET COMPARTMENTS

- .1 Toilet compartments: Factory fabricated doors, and pilasters made of solid phenolic core panels with integral melamine finish, floor-to-ceiling; interlocking, gap-free doors and stiles.
 - .1 Colour: To match woodgrain plastic laminate (PL1) specified in Section 06 40 00; black core.
- .2 Doors:
 - .1 Thickness: 19 mm, minimum.
 - .2 Width: 760 mm.
 - .3 Height: Extended height to 275 mm below finished ceiling, with 25 mm floor clearance.
- .3 Pilasters (stiles):
 - .1 Thickness: 19 mm, minimum.

- .2 Width: As required to fit space; minimum 76 mm.
- .3 Height: Floor to ceiling.

2.4 ACCESSORIES

- .1 Pilaster shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 76 mm high, concealing floor and ceiling fastenings.
 - .1 Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
 - .2 Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- .2 Wall and pilaster brackets: Satin stainless steel; continuous type.
- .3 Attachments, screws, and bolts: Stainless steel, tamper proof type.
 - .1 For attaching pilasters to brackets: Through-bolts and nuts ; tamper proof.
- .4 Hardware: Satin stainless steel:
 - .1 Barrel hinges, gravity type, adjustable for door close positioning; four per door.
 - .2 Door latch: Occupancy indicator type with exterior emergency access feature.
 - .3 Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that field measurements are as indicated.
- .2 Verify correct spacing of and between plumbing fixtures.
- .3 Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- .1 Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- .2 Attach pilasters to partitions with continuous brackets. Minimize space between end of partition and back of pilasters.
- .3 Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

- .1 Maximum variation from true position: 6 mm.
- .2 Maximum variation from plumb: 3 mm.

3.4 ADJUSTING

- .1 Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 5 mm.

- .2 Adjust hinges to position doors in partial opening position when unlatched.
- .3 Adjust adjacent components for consistency of line or plane.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Top-supported folding panel partitions, horizontal opening, manually operated.

1.2 RELATED REQUIREMENTS

- .1 Structural Drawings: Primary structural support.
- .2 Section 08 71 00 - Door Hardware: Lock cylinders for panels pocket doors
- .3 Section 09 91 00 - Painting: Site applied paint finish to panels and pocket doors.

1.3 REFERENCE STANDARDS

- .1 ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- .2 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- .3 ASTM E413 - Classification for Rating Sound Insulation; 2022.
- .4 ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).
- .5 ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.
- .6 CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- .7 CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- .8 CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- .9 SCS (CPD) - SCS Certified Products; Current Edition.
- .10 UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Preinstallation meeting: Convene at project site minimum one week prior to scheduled beginning of construction activities of this section to review section requirements.
 - .1 Require attendance by representatives of installer and other entities directly affecting, or affected by, construction activities of this section.
 - .2 Notify Contract Administrator four calendar days in advance of scheduled meeting date.

1.5 SUBMITTALS

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

- .2 Product data: Provide data on partition materials, operation, hardware and accessories, and colours and finishes available.
- .3 Design data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the Province in which the Project is located, showing loads at points of attachment to the building structure.
- .4 Shop Drawings: Indicate plans, elevations, sections, opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, stacking depth, floor tolerance, direction of travel, and storage pocket doors/panels and hardware.
- .5 Samples for selection: Submit two samples of full manufacturer's colour range for selection of colours.
- .6 Samples for verification: Submit two samples of surface finish, 300 by 300 mm size, illustrating quality and colours selected.
- .7 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .8 Certificates: Certify that partition system meets or exceeds specified acoustic requirements.
- .9 Manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.
- .10 Installer's qualification statement.
- .11 Operation and maintenance data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

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.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Store products in manufacturer's unopened packaging until installation.

1.8 SITE CONDITIONS

- .1 Site measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- .2 Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

- .1 At least 90 percent of ceilings, 75 percent of wall panels, and 75 percent of insulation building products must be tested and determined compliant in accordance with CAL (CDPH SM), or recognized by one of the following equivalent programs:
 - .1 UL (GGG)
 - .2 SCS (CPD) Indoor Advantage Gold
 - .3 Blue Angel
 - .4 MAS Certified Green
 - .5 Berkeley Analytical ClearChem
 - .6 EMICODE EC1 or EMICODE EC1 Plus
 - .7 Intertek ETL Environmental VOC+
 - .8 Eco-INTITUT-Label
 - .9 CHPS (HPPD) Collaborative for High Performance Schools (CHPS)
- .2 The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- .3 Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.
- .4 At least 75 percent of all composite wood, by cost or surface area, shall have low-formaldehyde emissions that meet the Composite Wood Products Regulations CARB (ATCM) for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or contain no added formaldehyde resins. Composite wood and agrifibre products include:
 - .1 Particleboard
 - .2 Medium density fiberboard (MDF)
 - .3 Plywood
 - .4 Wheatboard
 - .5 Strawboard
 - .6 Panel substrates
 - .7 Door cores

2.2 MANUFACTURERS

- .1 Folding panel partitions - Horizontal opening: Type FPP
 - .1 Modernfold, a DORMA Group Company; Acousti-Seal Premier - Paired Panel (932), STC 50.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 FOLDING PANEL PARTITIONS - TYPE FPP

- .1 Folding panel partitions: Side opening; paired panels; side stacking; manually operated.
- .2 Panel construction:
 - .1 Frame: Minimum 1.2 mm thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction.
 - .2 Substrate: Medium-density fibreboard.
 - .3 Hinges: Continuous piano type, stainless steel.
 - .4 Panel properties:
 - .1 Thickness: 75 mm, nominal.
 - .2 Width: Standard width.
 - .3 Weight: 40 kg/sq m.
- .3 Panel finishes: Refer to Drawings for locations of the following finishes:
 - .1 Facing: Primed MDF for site painted finish.
 - .2 Facing: Heavy-duty vinyl coated fabric, minimum 930 g per linear metre.
 - .3 Facing: Markerboard, full-height.
 - .4 Exposed metal trim at top and bottom of panels: Black. No exposed vertical trim between panels.
- .4 Panel seals:
 - .1 Panel to panel seals: Interlocking grooved and gasketed steel astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; colour to match panel finish.
 - .2 Acoustic seals: Flexible acoustic seals at jambs, ceilings, retractable floor seals.
 - .1 Top seals: Continuous contact extruded vinyl.
 - .2 Bottom seals: Automatic, with nominal 50 mm clearance, and operating range of plus 13 mm to minus 38 mm.
- .5 Suspension system:
 - .1 Track: Formed steel; size, thickness and profile designed to support loads, supported by adjustable steel hanger brackets.
 - .2 Carriers: Steel, ball bearing wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- .6 Performance:
 - .1 Acoustic performance:
 - .1 Sound Transmission Class (STC): 50 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 9.3 sq m.
 - .2 Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
- .7 Accessories:
 - .1 Ceiling closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments.

- .2 Pocket enclosures: Doors, frame, and trim to match adjacent panels.
 - .1 Pocket door: Manufacturer's prefabricated non-acoustic double doors hinged to a jamb on each side and closing in the centre. One door panel equipped with a smaller hinged panel that folds back when operable partition is extended into pocket; 76 mm thick; MDF panel face; site painted.
 - .2 Hardware: Full leaf butt hinges, latching door handle finish selected by Contract Administrator; lock cylinder keyed to building keying system.
 - .1 Refer to Section 08 71 00 for additional requirements.
- .3 Acoustic sealant: As recommended by partition manufacturer.

2.4 MATERIALS

- .1 Aluminum extrusions: ASTM B221M, 6063 alloy, T6 temper.
- .2 Vinyl coated fabric: ASTM F793/F793M Category VI; colour as selected by Contract Administrator from manufacturer's standard range.
- .3 Markerboard: Porcelain enamel on steel, laminated to core; white colour.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site measurements are as indicated on Shop Drawings.
- .2 Verify track supports are laterally braced and will permit track to be level within 6 mm of required position and parallel to the floor surface.
- .3 Verify floor flatness of 3 mm in 3 m, non-cumulative.
- .4 Verify wall plumbness of 3 mm in 3 m, non-cumulative.
- .5 Do not begin installation until supports and adjacent substrates have been properly prepared.
- .6 If substrate preparation is the responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- .1 Install partition in accordance with manufacturer's instructions and ASTM E557.
- .2 Fit and align partition assembly and pocket doors level and plumb.
- .3 Lubricate moving components.
- .4 Install acoustic sealant to achieve required acoustic performance.

3.3 ADJUSTING

- .1 Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

- .2 Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- .3 Adjust partition assembly to achieve lightproof seal.

3.4 CLEANING

- .1 Clean finish surfaces and partition accessories.
- .2 Condition markerboard surfaces in accordance with manufacturer's instructions.

3.5 CLOSEOUT ACTIVITIES

- .1 Demonstrate operation of partition and identify potential operational problems.

3.6 PROTECTION

- .1 Protect installed products and materials until Date of Substantial Performance.
- .2 Touch-up, repair or replace damaged products before Date of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Corner guards.
- .2 Protective wall covering.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Indicate physical dimensions and features.
- .3 Shop Drawings: Include plans, elevation, sections, and attachment details of each type of .
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 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 wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- .2 Store products in either horizontal or vertical position, in conformance with manufacturer's instructions.

Part 2 Products

2.1 PRODUCT TYPES

- .1 Corner guards - surface mounted - Type CG-SS:
 - .1 Material: Type 304 stainless steel, No. 4 finish, 1.6 mm thick.
 - .2 Width of wings: 50 mm.
 - .3 Corner: Square.
 - .4 Length: One piece.
 - .5 Mounting: Clear adhesive.
 - .6 Basis-of-Design Products:
 - .1 Construction Specialties; CO-8 50 mm wings.
 - .2 Korogard; Stainless Steel Corner Guards GS20.
 - .3 Inpro Corp.; Stainless Steel Corner Guards.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

- .2 Protective wall covering - Type SSW:
 - .1 Material: Type 304 stainless steel, No. 4 finish, 1.6 mm thick.
 - .2 Texture: Smooth.
 - .3 Mounting: Adhesive.

2.2 FABRICATION

- .1 Fabricate wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- .2 Grind and polish surfaces to produce uniform finish, free of cross scratches.
- .3 Run grain of directional finishes with long dimension of each piece.
- .4 Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site measurements are as indicated on Drawings.
- .2 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.
- .3 Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

- .1 Install components in accordance with manufacturer's instructions, level and plumb, adhered rigidly in position to supporting construction.
- .2 Corner guards:
 - .1 Apply adhesive to back surface of each wing of corner guard.
 - .2 Position bottom edge of corner guard at top of wall base. Top of corner guard at 2400 mm AFF, unless otherwise indicated.
 - .3 Apply pressure along entire length until units are tight and secure.
- .3 Protective wall covering: Position protective wall covering with bottom of sheet at 150 mm below top of cooktop and extending to underside of ceiling.
 - .1 Install without horizontal seams. Minimize vertical seams.
 - .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 Use a roller to ensure maximum contact with adhesive.

3.3 CLEANING

- .1 Remove strippable, temporary protective covering.

- .2 Remove excess adhesive using methods and materials recommended in writing by manufacturer.
- .3 Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Commercial toilet accessories.
- .2 Electric hand dryers.
- .3 Diaper changing stations.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.
- .2 Section 08 83 00 - Mirrors: Unframed mirrors.
- .3 Section 10 21 13.17 - Phenolic Toilet Compartments.

1.3 REFERENCE STANDARDS

- .1 ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- .2 ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).
- .3 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- .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 Sustainable design submittals: Submit Schedule S1 – Material Information Data Sheet and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .4 Manufacturer's installation instructions: Indicate special procedures and conditions requiring special attention.

Part 2 Products

2.1 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 Fasteners, screws, and bolts: Hot dip galvanized; tamper-proof; security type.
- .6 Expansion shields: Type as recommended by accessory manufacturer for component and substrate.

2.2 FINISHES

- .1 Stainless steel: Satin finish, unless otherwise noted.
- .2 Galvanizing for items other than sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- .3 Back paint components where contact is made with building finishes to prevent electrolysis.

2.3 COMMERCIAL TOILET ACCESSORIES

- .1 Toilet paper dispenser - W:TPD: Double roll (two-stacked), surface mounted, for standard core type rolls up to 135 mm diameter; stainless steel; tumbler lock. Extra roll shall automatically drop in place when bottom roll is depleted.
 - .1 Basis-of-Design Products:
 - .1 Bobrick; B-4288.
 - .2 ASI Global Inc.; 20030.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Paper towel dispenser - W:PTD: Roll type, ABS construction, surface-mounted, with translucent viewing window as refill indicator and tumbler lock.
 - .1 Capacity: 200 mm diameter roll towel with 38 mm (1.5-inch) diameter core.
 - .2 Dispenser advances and cuts a nominal 300 mm of towel when activated by pulling exposed towel, complete with emergency feed knob.
 - .3 Basis-of-Design Products:
 - .1 Kimberly-Clark Professional Sanitouch Manual Hard Roll Towel Dispenser, Model #09991.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Waste receptacle - WR: Recessed with projecting waste receptacle, stainless steel, with tumbler lock to permit removal of waste receptacle all welded seamless construction.
 - .1 Liner: Removable seamless stainless steel receptacle.
 - .2 Minimum capacity: 45 litres.
 - .3 Basis-of-Design Products:
 - .1 Bobrick; B-3644.
 - .2 ASI Global Canada; 0458.
 - .3 Bradley Corp.; 344.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .4 Automated soap dispenser - W:LSD: Liquid soap dispenser, wall-mounted, with high impact white ABS plastic cover and window to gauge soap level, tumbler lock.
 - .1 Minimum capacity: 500 to 800 ml.
 - .2 Power: Battery operated, with low battery indicator light or indicator window.
 - .3 Basis-of-Design Products:
 - .1 Frost; 714-C.
 - .2 ASI Global Canada; 0361.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .5 Framed mirrors - FM1: Stainless steel framed, 6 mm thick tempered safety glass; ASTM C1048.
 - .1 Size: 457 mm wide by 915 mm high.
 - .2 Frame: 1.3 mm angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - .3 Backing: Full-mirror sized, minimum 0.8 mm galvanized steel sheet and non-absorptive filler material.
 - .4 Basis-of-Design Products:
 - .1 Bobrick; B-2908.
 - .2 Bradley; 780-2.
 - .3 ASI Group Canada; 0620-B.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .6 Grab bars - GB1 through GB3: Stainless steel, peened gripping surface.
 - .1 Push/pull point load: Installed to resist 2.00 kN, minimum.
 - .2 Dimensions: 32 mm outside diameter, minimum 1.3 mm wall thickness, concealed flange mounting, 38 mm clearance between wall and inside of grab bar.
 - .3 Finish: Satin.
 - .4 Length and configuration as follows:

- .1 GB-1: 610 mm long.
- .2 GB-2: 760 mm long.
- .3 GB-3: 915 mm long.
- .5 Basis-of-Design Products:
 - .1 Bobrick; B5806.99 series.
 - .2 ASI Global Canada; 3700-P series.
 - .3 Bradley Corp.; 832-2 series.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .7 Fold-down grab bars - GB4: Stainless steel, peened gripping surface.
 - .1 Dimensions: 32 mm outside, 1.21 mm minimum wall thickness with wall mounting plate.
 - .2 Length: Extends minimum 760 mm from wall in down position.
 - .3 Basis-of-Design Products:
 - .1 Bradley; 8370-107-2.
 - .2 ASI Group Canada; 6451-P.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .8 Shelf - W:SSS: Type 304 stainless steel, satin finish, 125 mm deep by 455 mm long with returned edges, complete with welded mounting brackets.
 - .1 Basis-of-Design Products:
 - .1 Bobrick; B-295x18.
 - .2 ASI Canada Group; 0692-518.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .9 Sanitary napkin disposal unit - W:SND: Stainless steel, surface-mounted, all-welded construction; removable receptacle.
 - .1 Basis-of-Design Products:
 - .1 Bobrick; B-270.
 - .2 Bradley; A410.
 - .3 ASI Group Canada; 20852.
 - .4 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .10 Sharp disposal container - SC: Heavy-duty stainless steel vandal resistant cover; front loading; tumbler lock; with 4 litre plastic disposable sharps container; rear mounting plate.
 - .1 Capacity: 4 litres.
 - .2 Size: 200 mm long by 150 mm wide by 365 mm high.
 - .3 Basis-of-Design Products:
 - .1 Frost; 878.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .11 Safety coat hooks - W:SCH: Spring-loaded collapsible coat hook designed to collapse when loaded; maximum capacity 11 kg. Stainless steel body; stainless steel hook.
 - .1 Basis-of-Design Products:
 - .1 Frost; 1150-SSS.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.4 ELECTRIC HAND DRYERS

- .1 Electric hand dryers - W:AHD: Traditional fan-in-case type, with downward fixed nozzle.
 - .1 Operation: Automatic, sensor-operated on and off.
 - .2 Mounting: Surface mounted.
 - .3 Cover: Stainless steel with brushed finish.
 - .1 Tamper-resistant screw attachment of cover to mounting plate.
 - .4 Air velocity: 60 to 100 m/s at air outlet.
 - .5 Adjustable heat range, velocity, flow rate, and sound level.
 - .6 Total wattage: 1450, maximum.
 - .7 Warranty: 7 years.
 - .8 Electrical supply voltage: 110-120V.
 - .9 Basis-of-Design Product:
 - .1 Excel Dryer Inc.; Xlerator Hand Dryer with noise reduction nozzle.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.5 DIAPER CHANGING STATIONS

- .1 Baby changing table - BCS: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - .1 Material: Injection-moulded polypropylene with antimicrobial additive embedded into contoured bed surface, with brushed stainless steel veneer.
 - .2 Mounting: Surface.
 - .3 Orientation: Horizontal.
 - .4 Colour: As selected.
 - .5 Steel hinge assembly, integral support mechanism, and pneumatic cylinder for controlled opening and closing.
 - .6 Complete with liner dispenser, safety instructions in both official languages or graphic illustration, labeled with universally accepted symbol, safety strap and bag hooks..
 - .7 Basis-of-Design Products:
 - .1 Koala Kare; KB200-SS.
 - .2 ASI Group Canada; 9013-9.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding*

Procedures.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify exact location of accessories for installation.
- .3 For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- .4 See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

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 Genera

1.1 SECTION INCLUDES

- .1 Fire extinguishers.
- .2 Fire extinguisher cabinets.
- .3 Accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 09 22 16 - Non-Structural Metal Framing: Roughed-in wall openings.

1.3 REFERENCE STANDARDS

- .1 CAN/ULC S504 - Dry Chemical Fire Extinguishers; 2012.
- .2 FM (AG) - Factory Mutual, Approval Guide; current edition.
- .3 NFPA 10 - Standard for Portable Fire Extinguishers; 2017.
- .4 ULC (DIR) - Online Certifications Directory (Canada); Current Edition.

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide cabinet features, extinguisher operational features, extinguisher ratings and classifications, colour and finish, anchorage details, and installation instructions.
- .3 Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, installation procedures, and accessories required for complete installation.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's installation instructions: Indicate special criteria and wall opening coordination requirements.
- .6 Maintenance data: Include test, refill or recharge schedules and re-certification requirements.

1.5 SITE CONDITIONS

- .1 Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

Part 2 Products

2.1 FIRE EXTINGUISHERS

- .1 Fire extinguishers - General: Comply with product requirements of NFPA 10, CAN/ULC S504, and applicable codes, whichever is more stringent.
 - .1 Provide extinguishers labeled by ULC (DIR), FM (AG), or testing firm acceptable to authorities having jurisdiction for purpose specified and as indicated.
- .2 Multipurpose dry chemical type fire extinguishers: Carbon steel tank, with pressure gauge, and squeeze-grip operation, pull-pin safety lock.
 - .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 to 49 degrees C.
 - .5 Basis-of-Design Product:
 - .1 National Fire Equipment; Strike First Model SF-ABC680.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.2 FIRE EXTINGUISHER CABINETS

- .1 Cabinet construction: Non-fire rated.
 - .1 Formed primed steel sheet; 0.76 mm thick base metal.
- .2 Cabinet configuration: Semi-recessed type.
 - .1 Exterior nominal dimensions of 230 mm wide by 610 mm high by 150 mm deep.
 - .2 Projected trim: Returned to wall surface, with 50 mm wide face.
- .3 Door: 1.6 mm metal thickness, reinforced for flatness and rigidity with full length semi-concealed piano hinge and flush stainless steel door latch.
- .4 Door glazing: Float glass, clear, 5 mm thick, and set in resilient channel glazing gasket.
- .5 Cabinet mounting hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- .6 Weld, fill, and grind components smooth.
- .7 Finish of cabinet interior, exterior trim and door: Baked enamel, colour as selected.
- .8 Basis-of-Design Product:
 - .1 National Fire Protection; Model CE-950-3-2.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.3 ACCESSORIES

- .1 Extinguisher brackets: Formed steel, chrome-plated.
- .2 Cabinet signage: Decal selected from manufacturer's full range.

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 height indicated.
- .3 Secure rigidly in place.
- .4 Place extinguishers in cabinets.
- .5 Position cabinet signage on door.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Metal lockers.

1.2 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Manufacturer's published data on locker construction, sizes and accessories.
- .3 Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- .4 Sustainable design submittals: Submit Schedule S1 - Material Information Data Sheet, and supporting documentation in accordance with Section 01 33 29 - General LEED Requirements.
- .5 Manufacturer's installation instructions: Indicate component installation assembly.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Protect locker finish and adjacent surfaces from damage.

Part 2 Products

2.1 MANUFACTURERS

- .1 Metal lockers:
 - .1 Hadrian; Emperor.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.

2.2 LOCKER APPLICATIONS

- .1 Metal lockers, wall mounted with matching closed base.
 - .1 Width: 300 mm.
 - .2 Depth: 380 mm.
 - .3 Height: 1830 mm.
 - .4 Configuration: Two tier.
 - .5 Fittings: Size and configuration as indicated on Drawings.
 - .1 Single shelf in barrier-free lockers.
 - .2 Hooks: Three single prong.
 - .6 Ventilation: Louvres at top and bottom of door panel.
 - .7 Locking: Padlock hasps.

2.3 METAL LOCKERS

- .1 Accessibility: Provide three of the bottom six lockers with shelf at 380 mm AFF.

- .2 Lockers: Factory assembled, made of formed sheet steel, cold-rolled mild steel, uncoated, 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.
 - .2 Provide filler strips where indicated, securely attached to lockers.
 - .3 Colour: To be selected by Contract Administrator.
- .3 Locker body: Formed and flanged; with steel stiffener ribs; electric spot welded.
 - .1 Sides and back: 0.6 mm, minimum.
 - .2 Shelves, tops and bottoms: 0.76 mm, minimum.
 - .3 Base: 0.9 mm, minimum.
 - .4 Metal box base height: 100 mm, installed on finished flooring.
- .4 Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 - .1 Door Frame: 1.5 mm, minimum.
- .5 Doors: Hollow double pan, sandwich construction, 30 mm thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, 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.
- .6 Hinges: Continuous piano hinge with powder coat finish to match locker colour.
- .7 Trim: 0.9 mm.
- .8 Coat hooks: Stainless steel or zinc-plated steel.
- .9 Number plates: Manufacturer's standard.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Place and secure on metal box base.
- .3 Install lockers plumb and square.
- .4 Bolt adjoining locker units together to provide rigid installation.
- .5 Install dress panels at exposed end, expansion trim against wall, and flat top filler against wall at end.
- .6 Install fittings if not factory installed.
- .7 Replace components that do not operate smoothly.

3.2 CLEANING

- .1 Clean locker interiors and exterior surfaces.

END OF SECTION

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Refer to 01 64 00 City Furnished Products for information associated with City Furnished Product designations.


ABBREVIATIONS	
APT/S	Apartment Size
CFP	City Furnished Product (Refer to Code Designation)
C/M	Ceiling-Mounted
FH	Full Height
F/S	Full Size
IC	In-Contract (Refer to Code Designation)
NIC	Not-In-Contract (Refer to Code Designation)
O/C	On-Counter
S/M	Shelf-Mounted
U/C	Under-Counter
W/M	Wall-Mounted





EQUIPMENT CODE DESIGNATION	
CFP- A	New City Furnished Product (CFP-A), Contractor Installed.
CFP- B	New City Furnished Product (OFP-B), Vendor Installed (under contract to City),Contractor Coordinated.
CFP- C	Existing City Furnished Product (OFP-C), Contractor Installed.
CFP- D	Existing City Furnished Product (OFP-D), Vendor Installed (under contract to City), Contractor Coordinated.
NIC	Not-In-Contract, City to supply and install.
NIC-X	Not-In-Contract, Existing to be relocated by City.
IC	In Contract (EQ.##), Contractor Supplied and Installed

TYPICAL NOTES:
1. All interface including structural support, mechanical, electrical and IT services to the equipment indicated are by the Contractor.

REMARKS:
R1: Not Used
R2: Not Used

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ITEM NO.	EQUIP. CODE	ITEM DESCRIPTION	DIMENSIONS	MODEL / BASIS OF DESIGN
EQ.01	NIC	FREEZER	1998mm H x 1000mm W x 759mm D	TRUE GDM-35F-HC-TSL01 
EQ.02	NIC	FRIDGE	2005mm H x 1369mm W x 770mm D	TRUE FLM-54-TSL01 
EQ.03	NIC	STOVE / RANGE	915mm H x 736mm W x 712mm D	WHIRLPOOL YWEE750HOZH 
EQ.03.1	CFP-A	WALL OVEN	730 mm H x 755 mm W x 680 mm D	GE APPLIANCES PTS700LSNS5 
EQ.03.2	OFF-A	COOKTOP	83 mm H x 755 mm W x 543 mm D	GE APPLIANCES DHP7020NTRR 
EQ.04	NIC	MICROWAVE	330mm H x 553mm W x 438mm D	WHIRLPOOL YWMC30516HZ 

ITEM NO.	EQUIP. CODE	ITEM DESCRIPTION	DIMENSIONS	MODEL / BASIS OF DESIGN
EQ.05	CFP-A	DISHWASHER	820mm H x 576mm W x 610mm D	HOBART CENTERLINE CUH HIGH TEMP UNDERCOUNTER 
EQ.06	NIC	TOP FREEZER REFRIGERATOR	1675 mm H x 755 mm W x 835 mm D	WHIRLPOOL WRT519SZDM 
EQ.07	CFP-A	WASHER	981mm H x 685mm W x 800mm D	WHIRLPOOL WFW560CHW 
EQ.08	CFP-A	DRYER	981mm H x 685mm W x 800mm D	WHIRLPOOL WGD560HW 

Part 1 General

1.1 SECTION INCLUDES

- .1 Badminton/pickleball nets and posts.
- .2 Drop-in cap for floor sleeves.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Floor sleeves for net posts.

1.3 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories.
- .3 Manufacturer's qualification statement.
- .4 Installer's qualification statement.

1.4 QUALITY ASSURANCE

- .1 Manufacturer qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
 - .1 Obtain each type of gymnasium equipment through one source from a single manufacturer having experience with the type of installation and complexity indicated in this Section.
- .2 Installer qualifications: Company specializing in performing work of the type specified with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products to project site in manufacturer's original packaging with factory original labels attached.
- .2 Store products indoors and elevated above floor; prevent warping, twisting, or sagging.
- .3 Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

Part 2 Products

2.1 GENERAL REQUIREMENTS

- .1 See Drawings for sizes and locations, unless noted otherwise.

2.2 FLOOR-MOUNTED EQUIPMENT

- .1 Badminton/pickleball nets and posts: Comprised of six posts, and three nets.

- .1 Posts: 48.3 mm O.D. steel tube with net hooks on both sides for use as centre or end posts; 48.3 I.D. round washer to hold post at proper height; plastic top cap. Finish: Powder coated. Colour: Blue.
- .2 Net: 19 mm square mesh made from 1 mm black netting, with white vinyl head band with coated steel cable reinforcing, tape bound.
- .3 Basis-of-Design Products:
 - .1 Royal Stewart; RS-104 posts, RS-104N net.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Floor socket cover: Drop-in bronze cap, round.

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Window shades and accessories, referred to on the Drawings as "window coverings".

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- .2 Section 09 21 16 - Gypsum Board Assemblies: Substrate for window shade systems.

1.3 REFERENCE STANDARDS

- .1 ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.
- .2 CAN/ULC S109 - Standard Method for Flame Tests of Flame-Resistant Fabrics and Films; 2014 (Reaffirmed 2019).
- .3 WCMA A100.1 - Safety of Window Covering Products; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate placement of concealed blocking to support shades.
 - .2 Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- .2 Preinstallation meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
- .3 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, mounting dimension requirements for each product and condition, and head details where shades are mounted in ceiling pockets.
- .4 Source quality control submittals: Provide test reports indicating compliance with specified fabric properties.
- .5 Selection samples: Include fabric samples in full range of available colours and patterns.

- .6 Verification samples: Minimum size 150 mm square, representing actual materials, colour and pattern.
- .7 Manufacturer's instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- .8 Installer's qualification statement.
- .9 Operation and maintenance data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of Shop Drawings.
- .10 Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in City's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- .1 Installer qualifications: Company specializing in performing work of this type with minimum three 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.

1.8 SITE CONDITIONS

1.9 WARRANTY

- .1 See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- .2 Provide manufacturer's warranty from Date of Substantial Performance, covering the following:
 - .1 Shade hardware: Five years.
 - .2 Fabric: Five years.
 - .3 Aluminum and steel coatings: Five years.

Part 2 Products

2.1 MANUFACTURERS

- .1 Manually-operated roller shades:
 - .1 Basis-of-Design Product:
 - .1 Altex; District Fascia with Newton High-Speed Lite-Lift.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Shade fabric:
 - .1 Basis-of-Design Product:
 - .1 TexScreen 9103-3.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .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: Light-diffusing transparent.
 - .1 Type: Roll down, closed position is at window sill.
 - .2 Fabric: 35 percent fibreglass, 65 percent vinyl on fibreglass.
 - .3 Fabric performance requirements:
 - .1 Openness factor: 3 percent.
 - .2 Solar transmittance (Ts): 9 percent.
 - .3 Visible light transmittance (Tv): 7 percent maximum.
 - .4 Solar absorption (As): 47 percent.
 - .5 Solar reflectance (Rs): 44 percent.
 - .4 Colour: As indicated.
 - .5 Mounting: Outside in ceiling pocket where indicated; outside on face of wall above window opening elsewhere.
 - .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 Light-diffusing transparent shades: Soften the light yet still reveal some details to the outside; moderate privacy; Openness factor approximately 3 to 5 percent.
 - .2 Flammability: Compliant with CAN/ULC S109.
- .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: Utilize 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: Thermally sealed fabric pocket covering rectangular aluminum hembar.
- .5 Manual operation for interior shades: Pull wand clutch operating mechanism. Front wand retracts shade, back wand lowers shade. Bi-directional for mounting at right

(standard) or left end of roller; complying with WCMA A100.1 and as follows:

- .1 Wand length: As selected by Contract Administrator from manufacturer's standard range.
- .2 Wand colour: As selected by Contract Administrator from manufacturer's standard range .

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 Ceiling pocket trim: Where roller shades are installed in pocket application, provide mounting trims and closure trims compatible with acoustic ceiling system.
- .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 with 13 mm space between bottom bar and window sill.
 - .2 Horizontal dimensions - Outside mounting: Cover window frames.
- .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. Refer to Drawings.

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 INSTALLATION

- .1 Install in accordance with manufacturer's instructions and approved Shop Drawings, using mounting devices as indicated.
- .2 Installation tolerances:
 - .1 Maximum offset from level: 1.5 mm.
- .3 Replace shades that exceed specified dimensional tolerances at no extra cost to City.
- .4 Adjust level, projection and shade centring from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.3 CLEANING

- .1 Clean soiled shades and exposed components as recommended by manufacturer.
- .2 Replace shades that cannot be cleaned to "like new" condition.

3.4 CLOSEOUT ACTIVITIES

- .1 Demonstration: Demonstrate operation and maintenance of window shade system to City's personnel.

3.5 PROTECTION

- .1 Protect installed products from subsequent construction operations.
- .2 Touch-up, repair or replace damaged products before Date of Substantial Performance.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

- .1 Entrance floor grilles.

1.2 SUBMITTALS

- .1 See Section 01 33 00 Submittal Procedures.
- .2 Product data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
- .3 Shop Drawings: Indicate dimensions and details for recessed frame.
 - .1 For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.
- .4 Samples: Submit two samples, 300 by 300 mm in size illustrating pattern, colour, finish, and frame.
- .5 Maintenance data: Include cleaning instructions, and stain removal procedures.

Part 2 Products

2.1 ENTRANCE FLOOR GRILLES AND GRATINGS

- .1 Grilles: 17.5 mm deep, double-sided reversible treads strips alternating with aluminum extruded aluminum divider bars, running perpendicular to traffic flow. Treads comprised of double-sided 100 percent recycled buffed rubber treads spaced 38 mm oc mechanically secured to tread rails.
 - .1 Tread strip colour: As selected by Contract Administrator from manufacturer's standard range.
 - .2 Frame: Anodized aluminum for embedding in concrete; minimal exposed trim.
 - .3 Basis-of-Design Product:
 - .1 Babcock-Davis BGV340-FLBC EnviRONTread II Rigid Recycled Rubber Grate, complete with BFV34LBC level bed cast-in aluminum frame.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Mounting: Top of non-resilient members level with adjacent floor.
- .3 Structural capacity: Capable of supporting a rolling load of 680 kg per wheel without permanent deformation or noticeable deflection.
- .4 Vibration resistant fabrication: All members welded, riveted, or bolted; no snap or friction connections.

2.2 FABRICATION

- .1 Construct recessed frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.
- .2 Fabricate grilles in single unit sizes; fabricate multiple grilles where indicated on Drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that floor opening for grilles are ready to receive work, and that substrate meets tolerance of 3 mm over 3 metres.
- .2 Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Vacuum clean floor recess.

3.3 INSTALLATION

- .1 Install frames to achieve flush plane with finished floor surface.
- .2 Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.
- .3 Coordinate top of surfaces with doors that swing across surface to provide adequate under door clearance.

3.4 PROTECTION

- .1 Upon completion of frame installations, provide temporary filler of plywood or fiberboard in grille recesses, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near time of Ready for Takeover.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Documents and certain applicable terminology.
- .2 Associated requirements.
- .3 Work expectations.
- .4 Work by other parties.
- .5 Words and terms.
- .6 Examination
- .7 Closeout submittals
- .8 Operation and maintenance manual format.
- .9 Contents each volume.
- .10 Recording actual site conditions.
- .11 Record documents.
- .12 Warranties and bonds.
- .13 Quality Assurance.
- .14 Demonstration and Training
- .15 Conditions for Demonstrations
- .16 Shop drawings and product data.
- .17 Samples.
- .18 Certificates and transcripts.
- .19 Product quality, availability, storage, handling, protection, and transportation.
- .20 Product changes and substitutions.
- .21 Manufacturer's instructions.
- .22 Quality of Work, coordination and fastenings.
- .23 Accessibility of Equipment
- .24 Coordination, work for other trades, electrical requirements, temporary use of equipment.
- .25 Existing facilities.

1.2 Related Sections

- .1 Applicable sections in Division 01, including:
 - .1 Allowances
 - .2 Construction Progress Documentation.
 - .3 Submittal Procedures.
 - .4 Product Exchange Procedures.
 - .5 Substitutions
 - .6 LEED Requirements and Procedures.

.7 Closeout Submittals.

.2 This section describes common work applicable to all Sections within project Divisions 21, 22, 23 and 25.

1.3 Complementary 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.

1.4 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.

1.5 Contract Method

- .1 Construct Work under the Contract requirements in the applicable Division 00 sections.
- .2 Refer to Section 01 21 00 for cash allowances.
- .3 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.

1.6 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 Subcontractor's and their Subcontractors' responsibility.

1.7 Words And Terms

- .1 Conform to definitions and their defined meanings as in The City General Terms.
- .2 Refer to The City General Terms for Specification Grammar.
- .3 Conform to the following definitions and their defined meanings in addition to those referenced in The City General Terms:
 - .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.

1.8 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 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.
- .4 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.
- .5 Verify the locations and inverts of service lines leaving and entering building to ensure their proper function prior to commencing work.

1.9 Closeout Submittals

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Four (4) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals 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 (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals, 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 LEED 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 Pay costs of transportation.

1.10 Operation And Maintenance Manual Format

- .1 Refer also to Section 01 78 00 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
- .2 Organize data in the form of an instructional manual.
- .3 Electronic format: Provide all documentation in electronic PDF format for Contract Administrator review and final submission. Electronic file organization shall represent the printed version.
- .4 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.
- .5 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .6 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .7 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .8 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .9 Text: Manufacturer's printed data, or typewritten data.
- .10 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.11 Contents - Each Volume

- .1 Refer also to Section 01 78 00 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
- .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 Training: Refer to Demonstration and Training in this Section.

1.12 Recording 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.

1.13 Record Documents

- .1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:
 - .1 Drawings:
 - .1 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. Submit for Contract Administrator review.
 - .2 Transfer the reviewed marked up information to AutoCAD and produce an electronic record set in PDF format and AutoCAD DWG format.
 - .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.

1.14 Warranties And Bonds

- .1 Refer also to Section 01 78 00 for Warranties and Bonds.
- .2 Provide written guarantee that complete installation including materials, work and operation of all equipment provide under Mechanical Sections are first class in every respect, subject only to improper usage by The City, and make good forthwith when reported all defects which develop within one year from date of acceptance of building by The City at no additional cost to The City.
- .3 In addition, guarantee heating and cooling systems through one complete heating or cooling season, as applicable.
- .4 Deliver to The City all equipment manufacturer's guarantees specified in excess of one year.

1.15 Environmental And Leed Related Requirements

- .1 All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB), Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113.
- .2 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168 Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

1.16 Fabrication And Workmanship

- .1 Employ skilled mechanics in their respective trades, under competent supervision, and where required by Provincial or Local regulations holder of acceptable qualification certificates.

1.17 Quality 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.

1.18 Demonstration And Training

- .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 (2) 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.

1.19 Conditions For Demonstrations

- .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.

1.20 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 (1) reviewed copy of each submission on site.

1.21 Shop Drawings And Product Data

- .1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 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 ten (10) 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.

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- .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 (1) 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.

1.22 Samples

- .1 Submit for review samples in duplicate or triplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Contract Administrator's business address unless otherwise instructed.
- .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.

1.23 Mock-up

- .1 Erect mock-ups to the requirements of Division 01.

1.24 Certificates And Transcripts

- .1 Submit LEED credit criteria associated with specified products in accordance with LEED requirements.

1.25 Product 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.

1.26 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.

1.27 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.

1.28 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.

1.29 Special Cleaning

- .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 At the end of construction all systems shall be left ready for operation.
- .9 This Section shall be responsible for repair work as may be necessary to remove dents and touch-up of factory finishes.

1.30 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.

1.31 Existing Utilities

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

1.32 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.

1.33 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.

1.34 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.

1.35 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.

1.36 Work For Other Trades

- .1 The Mechanical Subcontractor 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.

1.37 Electrical Requirements

- .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 (4) 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.

1.38 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.

1.39 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.

1.40 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.

1.41 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.

1.42 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.

1.43 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.

1.44 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 Contractor's Association standard form of agreement as basis of responsibilities. Guarantee on complete installation shall not start until acceptance of building by The City.
- .2 All return air grilles/openings shall be equipped with MERV 8 filters to keep return air system clean of dust and dirt if air handling equipment is being used before turnover to The City.

1.45 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.

1.46 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 Subcontractor.
- .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 Subcontractor.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Pipe, fittings, valves, and connections for sprinkler, standpipe and fire hose, combination sprinkler and standpipe systems.
- .2 Back flow prevention

1.2 Related Sections

- .1 Submittal Procedures.
- .2 Product Requirements.
- .3 Closeout Submittals.
- .4 Painting: Preparation and painting of fire protection piping systems.
- .5 Section 21 13 00 - Sprinklers.
- .6 Section 23 05 53 - Mechanical Identification.
- .7 Section 23 05 29 - Supports and Anchors.

1.3 REFERENCES

- .1 ASME Boiler and Pressure Vessel Code Section IX - Welding and Brazing Qualifications.
- .2 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- .3 ASME B16.3 - Malleable Iron Threaded Fittings.
- .4 ASME B16.4 - Cast Iron Threaded Fittings.
- .5 ASME B16.5 - Pipe Flanges and Flanged Fittings.
- .6 ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
- .7 ASME B16.11 - Forged Fittings Socket Welding and Threaded.
- .8 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .9 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .10 ASME B16.25 - Buttwelding Ends.
- .11 ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- .12 ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- .13 ASTM A47/A47M - Ferritic Malleable Iron Castings.
- .14 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- .15 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .16 ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- .17 ASTM B32 - Solder Metal.

- .18 ASTM B75/B75M - Seamless Copper Tube.
- .19 ASTM B88 - Seamless Copper Water Tube.
- .20 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .21 AWS A5.8 - Filler Metal for Brazing and Braze Welding.
- .22 AWS D10.10 - Recommended Practices for Local Heating of Welds in Piping and Tubing.
- .23 AWWA C110 - Ductile-Iron and Gray-Iron Fittings 76 mm through 1219 mm (3 Inch through 48 inch) for Welder.
- .24 AWWA C151 - Ductile Iron Pipe, Centrifugally Cast, for Water.
- .25 NFPA 13 - Installation of Sprinkler Systems.
- .26 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .27 NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances
- .28 NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems
- .29 UL - Fire Resistance Directory.
- .30 UL 262 - Gate Valves for Fire-Protection Service.
- .31 UL 312 - Check Valves for Fire-Protection Service.
- .32 UL 405 - Fire Department Connections.
- .33 Underwriters Laboratories of Canada (ULC)
- .34 NSF/ANSI 61 – Drinking Water System Components – Health Effects
- .35 AWWA C220 – Stainless Steel Pipe 1/2In. (13 mm) and Larger.
- .36 ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- .37 ASTM A779 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

1.4 Submittals For Review

- .1 Section: Procedures for submittals.
- .2 Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- .3 Shop Drawings:
 - .1 Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
 - .2 Indicate hazard levels, and NFPA codes that are applicable to the system.

1.5 Submittals At Project Closeout

- .1 Section: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components and tag numbering.

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- .3 Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.6 Quality 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.

1.7 Regulatory Requirements

- .1 Conform to ULC., 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/ULC 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.

1.8 Delivery, Storage, 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.

1.9 Extra Materials

- .1 Section: Operation and Maintenance Data.
- .2 Provide two of valve stem packings for each size and type of valve installed.

1.10 Design 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 registered in the province of Manitoba 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 in Section 21 13 00.

- .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.

1.11 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 and/or 14.

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 40 black 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 Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.
 - .3 Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM A47.
 - .4 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .5 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 Stainless Steel pipe over 50mm (2"): Schedule 10, type 304/304L or 316/316L. Pipe to meet ASTM 312 or ASTM 778.
 - .1 Fittings:
 - .1 Welded fittings to ASTM A312 or A778 or,
 - .2 Grooved fittings to ANSI/NSF 61 & ANSI/NSF 372 for potable water service.

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 connectons:
 - .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 [1375 kPa/200 psi (FM Approval)]
 - .3 Minimum bend radius: 51 mm (2 inch) cULus Listed [178 mm (7 inch) FM approval]
- .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.
- .3 Over 100 mm (4 Inches):
 - .1 Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

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 Cast or Ductile Iron Body
 - .1 Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and tamper switch rated 10 amp at 115 volt AC.

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.
- .3 100 mm (4 Inches) and Over:
 - .1 Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

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 and NFPA14. Port connection shall not be smaller than 6.4mm. 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 out of metal or rigid plastic
 - .4 As per NFPA 13 & 14

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, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains as applicable.
- .3 Pipe 38mm (1-1/2") and smaller shall be joined by threaded connections.
- .4 Pipe 50mm (2") and larger may be joined by roll groove mechanical joints.
- .5 Flexible sprinkler hoses acceptable where site conditions permit usage.
- .6 Provide galvanized pipe and fittings for dry sprinkler systems.
- .7 All pipe installed so as to be inaccessible shall be joined by welded fittings. Piping in bulkheads or behind drywall shall be considered accessible. Piping in shaft walls or behind fire-rated drywall shall be considered inaccessible.
- .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.
 - .26 Final inspection and testing to conform to NFPA 25.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Wet-pipe sprinkler assembly.
- .2 Dry-pipe sprinkler assembly.
- .3 System design, installation, and certification.
- .4 Fire department connections.

1.2

Related Sections

- .1 Section - Trenching.
- .2 Section - Mechanical Identification.
- .3 Section - Vibration Isolation.
- .4 Section - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 NFPA 13 - Installation of Sprinkler Systems.
- .2 NFPA 15 - Water Spray Fixed Systems for Fire Protection.
- .3 FM - Factory Mutual Approval Guide.
- .4 NFPA 70 - National Electrical Code.
- .5 UL - Fire Resistance Directory.
- .6 UL 199 - Automatic Sprinklers for Fire-Protection Service.
- .7 Underwriters Laboratories of Canada (ULC)

1.4

System Description

- .1 System to provide coverage for entire building.
- .2 Provide system to NFPA 13 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.

1.5

Submittals For Review

- .1 Section: Procedures for submittals.
- .2 Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- .3 Shop drawings:

- .1 Submit working plans for sprinkler systems in accordance with requirements of NFPA 13, this specification, and the Contract drawings. Plans shall include sprinkler locations coordinated with the architectural reflected ceiling plan and with the mechanical drawing set. All plans shall be sealed by a Professional Engineer registered in the province of Manitoba prior to submission to the Contract Administrator for review, regardless of the size of the project.
- .2 The Contract drawings and specifications include project-specific requirements that may exceed the minimum requirements of the NFPA codes. These items shall be included in the fire protection Contractor's work and shown on the working plans.
- .3 Submit calculations in accordance with NFPA 13 requirements.
- .4 Submit to authority having jurisdiction for review and approval prior to submission to Contract Administrator. Submit proof of approval to Contract Administrator.

1.6 Submittals At Project 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.

1.7 Quality 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.
- .4 Design system under direct supervision of a Professional Engineer registered in the province of Manitoba experienced in design of this Work and licensed at the place where the Project is located.

1.8 Regulatory 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.

1.9 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.

1.10 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: Semi-recessed pendant type with matching push on escutcheon plate.
 - .2 Escutcheon Plate Finish: To match sprinkler body.
 - .3 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.
 - .4 Application specific requirements:
 - .1 Wood ceiling: Provide concealed sprinkler complete with satin chrome cover as noted on architectural reflected ceiling plans.
 - .2 Drywall (Gyproc Wall Board – GWB): Provide concealed sprinkler complete with white cover on white ceilings. Provide samples of colours for ceilings painted other than white for selection by architectural.
 - .3
 - .4 All other areas: Enamel, colour White
- .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 Provide heads with white enamel finish in areas where exposed structure is to be painted (ESP) as noted on architectural reflected ceiling plans.
 - .5 Application specific requirements:
 - .1 Brushed/Satin chrome plated finish. Where brushed/satin finish not available from manufacturer, provide alternate request for selection by architectural.
 - .2 Mechanical, Electrical Rooms: Brass
 - .3 All other service areas: Brass
- .3 Guards: Finish to match sprinkler finish.

2.2 PIPING SPECIALTIES

- .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 Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- .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 Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

2.3 Splash Pad

- .1 Provide a splash pad at the point of discharge for the drains outside of the building, if the ground will be disturbed by the flow of water.

Part 3 Execution

3.1 Installation

- .1 Install to NFPA 13.
- .2 Install equipment to manufacturers written instructions.
- .3 Install buried shut-off valves in valve box. Provide post indicator.
- .4 Provide approved double backflow preventer assembly at sprinkler system water source connection as required by authority having jurisdiction.
- .5 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent fire department connectors to allow full swing of fire department wrench handle.
- .6 Coordinate location of outside alarm gong on building wall with Fire Alarm Contractor.
- .7 Place pipe runs to minimize obstruction to other work.
- .8 Place piping in concealed spaces above finished ceilings.
- .9 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.

- .10 Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- .11 Install and connect to fire pump system to Section 21 11 00, NFPA 13.
- .12 Install air compressor on vibration isolators. Refer to Section 23 05 48.
- .13 Flush entire piping system of foreign matter.
- .14 Install guards on sprinklers where indicated and as per NFPA 13.
- .15 Hydrostatically test entire system. Test shall be witnessed by authority having jurisdiction.
- .16 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 piping through wall and provide escutcheon and prime paint all metal surfaces exposed to outdoors.
- .17 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.
- .18 If drilling of structural beams or other load bearing members is required by design or by site conditions for passage of piping, obtain Contract Administrators 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.
- .19 Allow for expansion and Contraction when installing pipe hangers.
- .20 Install horizontal valves with stems upright where space allows.
- .21 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.
- .22 The Project Coordinator shall approve any shutdowns of existing water distribution systems, fire sprinkler systems, domestic water systems or fire alarm systems. Provide advance written notice at least 14 days prior to the shutdown to the Construction Coordinator.
- .23 Application specific sprinklers such as window sprinklers shall be installed in accordance with the listing requirements.

3.2 Interface With Other Products

- .1 Ensure required devices are installed and connected as required to fire alarm system.

3.3 COMMISSIONING

- .1 Inspection of the fire suppression system to include requirements of NFPA 25.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Fire Extinguishers

1.2 Related Sections

- .1 Section 21 05 00 – Submittal Procedures.
- .2 Section 21 05 00 - Product Requirements.
- .3 Section 21 05 00 – Closeout Submittals.
- .4 Section 21 11 00 - Fire Protection Piping.
- .5 Section 21 13 00 - Sprinklers.
- .6 Section 23 05 53 - Mechanical Identification.
- .7 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 FM - Factory Mutual Approval Guide.
- .2 NFPA 10 - Portable Fire Extinguishers.
- .3 NFPA 13 – Installation of Sprinkler Systems
- .4 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .5 NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
- .6 UL - Fire Protection Equipment Directory.
- .7 ITS (Intertek Testing Services) - Certification Listings.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide manufacturer's catalogue sheet for equipment indicating rough-in size, finish, and accessories.
- .3 Shop Drawings: Indicate supports, components, accessories, and sizes.

1.5 Submittals At Project Closeout

- .1 Section 21 05 00: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components.
- .3 Operation Data: Include manufacturer's data.
- .4 Maintenance Data: Include servicing requirements and test schedule.
- .5 Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.6 Quality Assurance

- .1 Perform Work to NFPA 10.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.7 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Deliver and store products in shipping packaging until installation.

Part 2 Products

2.1 MATERIALS

- .1 Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - .1 Sheet: ASTM B 209M (ASTM B 209).
 - .2 Extruded Shapes: ASTM B 221M (ASTM B 221).
- .2 Stainless-Steel Sheet: ASTM A 666, Type 304.

2.2 FIRE EXTINGUISHERS

- .1 Multi-Purpose Dry Chemical: Cartridge operated with hose and shut-off nozzle or integral shut-off nozzle.
 - .1 2.2 kg (5 pound) capacity with 2A:40B:C rating (min.)
 - .2 4.5 kg (10 pound) capacity with 4A:60B:C rating (min.).
 - .3 4.5 kg (10 pound) capacity with K rating for kitchens.
- .2 Carbon Dioxide: Insulated handle, hose and horn discharge assembly, self-closing lever or squeeze grip operated, insulated handle.
 - .1 4.5 kg (10 pound) capacity with 10BC rating.

2.3 Fire Extinguishers Cabinets

- .1 Cabinet Type: Suitable for fire extinguishers.
- .2 Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - .1 Potter Roemer LLC;
 - .1 Fully Recessed FE-R: Alta 7020-HR-DV-6-STEEL-FP, inside box dimensions: 9"x24"x5.75", red lettering, Duo-Vertical Panel w/ 1/8" clear acrylic glazing, flush pull handle
 - .2 Semi-Recessed FE-S: Alta 7022-HR-DV-STEEL-FP, inside box dimensions: 9"x24"x5.75", red lettering, Duo-Vertical panel with tempered safety glass, flush pull handle
 - .3 Semi-Recessed, Fire Rated RFE-S: Alta FRC7022-HR-DV-STEEL-FP, inside box dimensions: 9"x24"x5.75", red lettering, Duo-Vertical panel with tempered safety glass, flush pull handle
 - .4 Surface Mounted (no Cabinet), FE: Wall bracket to mount fire extinguisher.
 - .5 Recessed Lockable FE-L: Alta 7020-STEEL-FS, inside box dimensions: 9"x24"x5.75", flush solid metal door with lock

- .2 Alternate Manufacturers:
 - .1 National Fire Equipment Ltd.
 - .2 J. L. Industries, Inc., a division of Activar Construction Products Group
 - .3 Modern Metal Products, Division of Technico Inc.
 - .4 Moon-American
- .3 Cabinet Construction: 1-hour fire rated where required.
 - .1 Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 1.1 mm- (0.0428-inch-) thick, cold-rolled steel sheet lined with minimum 16 mm- (5/8-inch-) thick, fire-barrier material. Provide factory-drilled mounting holes.
- .4 Cabinet Material: Aluminum or Stainless-steel sheet.
 - .1 Shelf: Same metal and finish as cabinet.
- .5 Recessed Cabinet - Gym and Mini Gym only: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - .1 Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - .2 Door Style: Flush opaque panel, frameless, with no exposed hinges
- .6 Semi-recessed Cabinet – All other areas: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
 - .1 Square-Edge Trim: 32- to 38-mm (1-1/4- to 1-1/2-inch) backbend depth.
 - .2 Rolled-Edge Trim: 64-mm (2-1/2-inch) backbend depth.
 - .3 Door Style: Fully glazed, frameless, backless, acrylic panel
 - .4 Door Glazing (semi-recessed only): Acrylic sheet.
 - .1 Acrylic Sheet Color: Clear transparent acrylic sheet.
- .7 Recessed Cabinet – For sprinkler condensate drains: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - .1 Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - .2 Door Style: Flush metal opaque panel, frameless, with no exposed hinges, with lock
- .8 Cabinet Trim Material: Same material and finish as door.
- .9 Door Material: Aluminum or Stainless-steel sheet.
- .10 Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - .1 Provide recessed door pull and friction latch.
 - .2 Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- .11 Accessories:

- .1 Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- .2 Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
- .3 Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - .1 Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER".
 - .1 Location: Applied to cabinet door.
 - .2 Application Process: Silk-screened.
 - .3 Lettering Color: Red.
 - .4 Orientation: Horizontal.
- .12 Finishes:
 - .1 Manufacturer's standard baked-enamel paint for the following:
 - .1 Exterior of cabinet door and trim except for those surfaces indicated to receive another finish.
 - .2 Interior of cabinet and door.
 - .2 Aluminum: Baked enamel or powder coat.
 - .3 Stainless Steel: No. 2B No. 4 or No. 6

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install to NFPA 10.
- .3 Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal surface) 1675 mm (66 inches) above finished floor.

3.2 Field Quality Control

- .1 Test entire system to NFPA 10 and NFPA 25.
- .2 Test shall be witnessed by authority having jurisdiction.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Disinfection of potable water distribution.
- .2 Testing and reporting results.

1.2

Related Sections

- .1 Section 33 11 16 - Site Water Utility Distribution Piping.
- .2 Section 22 10 00 - Plumbing Piping: Disinfection of building domestic water piping system.

1.3

Price And Payment Procedures

- .1 Unit Prices: Section 01 22 00 - Measurement of quantities and payment procedures affecting this section.
 - .1 Disinfection: By the linear metre (foot). Includes preparing, disinfecting, testing, and reporting.

1.4

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 AWWA C651-05 - Disinfecting Water Mains.

1.5

Submittals For Information

- .1 Section 21 05 00: Submission procedures.
- .2 Test Reports: Indicate results comparative to specified requirements.

1.6

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.

1.7 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 (3) 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.

1.8 Regulatory 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 (12) hours. Repair leaks and re-test.

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 Section Includes

- .1 Pipe, pipe fittings, valves, and connections for piping systems.
 - .1 Sanitary sewer.
 - .2 Domestic water.
 - .3 Storm water.
 - .4 Natural gas.

1.2 Related Sections

- .1 Section 08 31 00 - Access Doors and Frames.
- .2 Section 09 90 00 - Painting.
- .3 Section 23 05 48 - Vibration Isolation.
- .4 Section 23 05 53 - Mechanical Identification.
- .5 Section 23 07 19 - Piping Insulation.
- .6 Section 23 05 16 – Piping Expansion Compensation.
- .7 Section 23 05 29 – Supports and Anchors.
- .8 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- .2 CAN/CSA-B1800 - Thermoplastic non-pressure piping
- .3 NSF/ANSI 14 - Plastics Piping System Components and Related Materials
- .4 ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- .5 ASTM F1412. - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
- .6 ASME B31.9 - Building Services Piping.
- .7 ASME SEC IV - Construction of Heating Boilers.
- .8 ASME SEC IX - Welding and Brazing Qualifications.
- .9 ASME B16.3 - Malleable Iron Threaded Fittings.
- .10 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .11 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .12 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- .13 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- .14 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- .15 NCPWB - Procedure Specifications for Pipe Welding.

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- .16 UL 1479 - Fire Tests of Through-Penetration Firestops.
 - .17 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
 - .18 AWS A5.8 - Filler Metals for Brazing and Braze Welding.
 - .19 ASME B16.22-2001 (R2005) - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .20 ASME B16.26 - Copper Alloy Bronze Fittings for Flared Copper Tubes.
 - .21 ASME B16.4 - Grey Iron Threaded Fittings.
 - .22 AWWA C651 - Disinfecting Water Mains.
 - .23 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - .24 ASTM B42 - Seamless Copper Pipe, Standard Sizes.
 - .25 ASTM B43 - Seamless Red Brass Pipe, Standard Sizes.
 - .26 ASTM B68 - Seamless Copper Tube, Bright Annealed.
 - .27 ASTM B75 - Seamless Copper Tube.
 - .28 ASTM B22.18-03 - Seamless Copper Water Tube.
 - .29 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
 - .30 ASTM B302 - Threadless Copper Pipe, Standard Sizes.
 - .31 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
 - .32 ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
 - .33 ASME B16.32 - Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.
 - .34 ASTM A74 - Cast Iron Soil Pipe and Fittings.
 - .35 ASTM B306 - Copper Drainage Tube (DWV).
 - .36 ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
 - .37 ASTM B32-04 - Solder Metal.
 - .38 CISPI 301 - Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
 - .39 CISPI 310 - Joints with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 - .40 MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
 - .41 MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .42 MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .43 MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
 - .44 ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - .45 ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

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- .46 ASTM D2855-96 (2002) - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 - .47 ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .48 ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - .49 ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .50 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - .51 AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch - 48 inch (350 mm - 1200mm).
 - .52 ASTM C1053 - Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
 - .1 CAN/CSA-B1800 - Thermoplastic non-pressure piping
 - .2 NSF/ANSI 14 - Plastics Piping System Components and Related Materials
 - .3 ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
 - .4 ASTM F1412. - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
 - .5 ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - .6 ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - .7 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe (and Fabricated Fittings), 4 inch - 12 inch (100 mm - 300 mm), for Water Distribution.
 - .8 CSA B137.2 - Polyvinylchloride (PVC) injection-moulded gasketed fittings for pressure applications
 - .9 CSA B137.3 - Rigid polyvinylchloride (PVC) pipe and fittings for pressure applications
 - .10 CSA B137.3.1 - Molecularly oriented polyvinylchloride (PVCO) pipe for pressure applications
 - .11 ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 - .12 AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch - 3 inch (13 mm - 76 mm) for Water Service.
 - .13 ASTM D2447 - Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
 - .14 ASTM D2609 - Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
 - .15 CAN/CSA B137.9-17 - Polyethylene/aluminum/polyethylene (PE- AL-PE) composite pressure-pipe systems
 - .16 ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 - .17 CAN/CSA-B1800-15 - Thermoplastic non-pressure piping.
 - .18 ASME B31.1 - Power Piping.

- .19 CAN/CSA B137.4-17 - Polyethylene (PE) piping systems for gas services
- .20 CAN/CSA B137.4.1-17 - Electrofusion-type polyethylene (PE) fittings for gas services
- .21 CAN/CSA B149.1 – Natural Gas and Propane Installation Code.
- .22 AGA Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- .23 ASME B31.2 - Fuel Gas Piping.
- .24 NFPA 54 - National Fuel Gas Code.
- .25 NFPA 58 - Liquefied Petroleum Gas Code.
- .26 ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- .27 ASTM A47/A47M - Ferritic Malleable Iron Castings.
- .28 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .29 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .30 AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping Systems.
- .1 NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.4 Submittals For Review

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data: Provide data on all valves larger than 50mm (2”), and all backflow prevention devices and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.5 Closeout Submittals

- .1 Section 21 05 00: Submission procedures.
- .2 Record Documentation: Record actual locations of valves on record drawings.

1.6 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.

1.7 Regulatory Requirements

- .1 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements
- .2 Perform natural gas and propane work to the latest version of the CSA B149.1 gas code, Manitoba Gas Notices and local Municipal requirements.
- .3 Conform to applicable code for installation of backflow prevention devices.
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.8 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.

1.9 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 BEYOND 1500 MM (5 FEET) OF BUILDING

- .1 PVC Pipe: SDR 35; CAN/CSA B1800.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM F477, elastomeric gaskets.

2.2 Sanitary Sewer Piping, Buried Within 1500 Mm (5 Feet) Of Building

- .1 Cast-iron mechanical joint or pipe and fittings to CSA B70, Class 4000
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564 and CISPI Standard 310, neoprene gasket system and stainless steel clamp-and-shield assemblies.
- .2 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.3 Sanitary Sewer Piping, Above Grade

- .1 75mm (3") and over - Cast Iron Pipe: CISPI 301, hubless, service weight. Class 4000
 - .1 Fittings: Cast iron.

- .2 Joints: ASTM C564 and CISPI Standard 310, neoprene gasket system and stainless steel clamp-and-shield assemblies.
- .2 Copper Tube: ASTM B306, DWV.
 - .1 Fittings: ASTM B306 with lead-free soldered cast brass drainage fittings to CSA B158.1 or wrought copper fittings to ANSI B16-29
 - .2 Joints: ASTM B32, lead-free solder, Grade 50B.
- .3 Urinal drains: On all cast-iron / copper DWV systems, the drains serving urinals from the fixture outlet to the branch main and the vents from fixture outlet to branch vent shall be PVC DWV pipe. Pipe and fittings with solvent cement socket fittings.
- .4 PVC Pipe with FSR25: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
- .5 PVC Pipe with FSR25/SDC50: CAN/CSA B1800 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.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
 - .3 Manufacturer: IPEX System XFR or equal.

2.4 SEWAGE AND SUMP PUMP DISCHARGE PIPING, ABOVE GRADE

- .1 Copper Tubing: ASTM B88, Type L hard drawn.
 - .1 Fittings: 50-50 solder

2.5 Sewage And Sump Pump Discharge Piping, Below Grade

- .1 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.6 Chemical Resistant Sewer Piping

- .1 Flame Retardant SCH 40 (Blue in color) Polypropylene Pipe: CAN/CSA B1800, NSF 14, ASTM D4101 & ASTM F1412.
 - .1 Fittings: NSF or ASTM F 1673 and ASTM E84.
 - .1 Fittings shall be NSF listed and have an integral heavy gauge, nickel/chrome electrical resistance wire molded in place in the fitting body. Copper wire elements, loose wire or other loose joint components, are prohibited.
 - .2 Fittings shall be Enfield or approved equal.
 - .3 Fittings shall be NSF listed, be of all plastic construction and be designed to lock into a machined groove on the mating piping.
 - .4 All fittings shall have integrally molded union connections. No metallic grab rings or clamps shall be allowed.
 - .5 Fittings containing EVA (ethylene vinyl acetate) are strictly prohibited.
 - .6 Couplings shall not be added to make mechanical joint fittings.
 - .7 Fittings shall be IPEX Labline or approved equivalent
 - .2 Joints:

- .1 Method of joining shall be electro fusion. Control Unit shall be equipped with input and output voltage sensors and temperature sensors to automatically adjust fusion time and audible alarms to indicate cycle interruptions and completion of the joining process. The unit shall be capable of multiple joints simultaneously. Electrofusion process shall be in strict accordance with manufacturer's recommendations.
- .2 Connections between polypropylene and other piping materials shall be made using Enfield adapters according to manufacturer's recommendations.
- .3 All electrofusion machines shall be third party certified by UL and CSA.
- .3 Manufacturer: IPEX ENFIELD or equal
 - .1 Connections between polypropylene pipe and matched fittings shall be made using the manufacturer approved joint..
- .4 Manufacturer: IPEX Labline or equal.
- .5 Pipe and fittings must be supplied by same manufacturer.
- .6 Certified Firestop systems as required, and installed as per manufacturers listings
- .7 Plenum rated installations:
 - .1 Material: Flame retardant with flame spread rating of 25 and a smoke developed classification not exceeding 50.
 - .2 Manufacturer: IPEX Plenumline or equal

2.7 Water Piping, Buried Beyond 1500 Mm (5 Feet) Of Building

- .1 PVC Pipe: AWWA C900.
 - .1 Joints: CSA B137.3 ring gasket joints class 150
- .2 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.

2.8 Water Piping, Buried Within 1500 Mm (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.

2.9 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.

2.10 STORM WATER PIPING, BURIED WITHIN 1500 MM (5 FEET) OF BUILDING

- .1 PVC Pipe: SDR 35; CAN/CSA B1800.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM F477, elastomeric gaskets.

2.11 Storm Water Piping, Above Grade

- .1 Cast Iron Pipe: ASTM A74 extra heavy weight. Class 4000
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564, neoprene gasket system or lead and oakum.
- .2 Cast Iron Pipe: CISPI 301, hubless, service weight. Class 4000
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564 and CISPI Standard 310, neoprene gasket system and stainless steel clamp-and-shield assemblies.
- .3 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
- .4 Non-combustible PVC Pipe: 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.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
 - .3 Manufacturer: IPEX System XFR or equal

2.12 Natural Gas Piping, Buried Within 1500 Mm (5 Feet) Of Building

- .1 Steel Pipe: ASTM A53 Schedule 40 black.
 - .1 Fittings: ASTM A234/A234M, forged steel welding type.
 - .2 Joints: ASME B31.9, welded.
 - .3 Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 0.25 mm (10 mil) polyethylene tape.

2.13 Natural Gas Piping, Above Grade

- .1 Steel Pipe: ASTM A53 Schedule 40 Black.
 - .1 Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
 - .2 Joints: NFPA 54, threaded or welded to ANSI B31.9.

2.14 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.

2.15 GLOBE VALVES

- .1 Construction Up To and Including 80 mm (3 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 150, bronze body, bronze trim, handwheel, bronze, solder ends.
- .2 Construction Up To and Including 80 mm (3 inches), teflon 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, teflon disc, solder ends.
- .3 Construction: 50 mm (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 150, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends.

2.16 BALL VALVES

- .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 MSS SP-110, Class 150, 2760 kPa (400 psi) brass,
 - .2 Two piece body,
 - .3 316 stainless ball and trim, full port, teflon seats and stuffing box ring, 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.

2.17 Plug Valves

- .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, teflon 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, teflon or Buna N packing, flanged ends. Provide lever operator with set screw.

2.18 Flow 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).

2.19 Swing Check Valves

- .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.
- .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.

2.20 Spring Loaded Check Valves

- .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.

2.21 Water Pressure Reducing Valves

- .1 Construction: Up to 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Ames ACV
 - .2 Honeywell International Inc.
 - .3 Watts Regulator
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and double union ends.
- .2 Construction over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Ames ACV
 - .2 Honeywell International Inc.
 - .3 Watts Regulator
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.22 Relief Valves

- .1 Pressure Relief:
 - .1 Manufacturers:
 - .1 Watts
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 AGA Z21.22 certified, bronze body, teflon 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, teflon 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.

2.23 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.

2.24 Fire Stop Systems

- .1 General Purpose Fire Stopping Sealant:
 - .1 Manufacturers:
 - .1 Dow Corning Silicone Elastomer Fire Stop Penetration Seal and/or Dow-Corning liquid silicone elastomer Fire Stop Foam of density, width and depth to maintain assembly fire resistive rating.
 - .2 Hilti.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours per ASTM E814 and UL 1479.
- .2 DWV Plastic Pipe Systems Fire Stopping Sealant:
 - .1 Manufacturers:
 - .1 Hilti FS-ONE Intumescent Firestop Sealant
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Silicone based, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours per ASTM E814 and UL 1479 with metal collars.

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 Groove couplings shall not be used in mechanical rooms.
- .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 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.
- .9 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- .10 Establish elevations of buried piping outside the building to ensure not less than 2.4 m (8 ft) of cover.
- .11 Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- .12 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .13 Provide support for utility meters to requirements of utility companies.
- .14 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- .15 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.
- .16 Excavate to Sections 31 23 18 and 31 23 23 for work of this Section.
- .17 Backfill to Sections 31 23 16 and 31 23 23 for work of this Section.
- .18 Install bell and spigot pipe with bell end upstream.
- .19 Install valves with stems upright or horizontal, not inverted.
- .20 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather-proof hood.
- .21 Install water piping to ASME B31.9.
- .22 Sleeve pipes passing through partitions, walls and floors. Set sleeves in concrete forms for all pipes passing through concrete walls, beams and slabs.
- .23 Install 100 mm (4 inch) concrete curbs around all pipe penetrations in mechanical rooms.
- .24 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).
- .25 Caulk sleeves to provide watertight installation.
- .26 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.

- .27 Install galvanized, oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.
- .28 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.
- .29 Prior to installing sleeves in concrete beams, receive final jobsite approval by Structural Contract Administrator.
- .30 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.
- .31 Chemical resistant piping: buried piping to be electrofused, mechanical joints acceptable where exposed and maintainable.

3.4 Pipe Pressure Testing

- .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 1-½ 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 Cast iron piping systems: water-test each portion of the system for 15 minutes at a head pressure of 10' of water. Test procedure shall be in accordance with CISPI and the manufacturer's recommendations. Compressed air shall not be used for testing.
- .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.

3.5 APPLICATION

- .1 Use grooved mechanical couplings and fasteners only in accessible locations. Grooved couplings shall not be used in mechanical rooms.
- .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 Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .5 Install globe or ball valves for throttling, bypass, or manual flow control services.
- .6 Provide spring loaded check valves on discharge of water pumps.
- .7 Provide plug valves in natural and propane gas systems for shut-off service.
- .8 Provide flow controls in water recirculating systems where indicated.
- .9 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	High-Rise Building	Underground
Combustible Pipe FSR25: (eg. IPEX System 15)	P	N ³	N	N	P
Combustible Pipe FSR25/SDC50: (eg. IPEX XFR, CPVC)	P	P	N	P	P
MJ Grey Coupling	P	P	N	P	N
<ul style="list-style-type: none"> 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
- .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 Disinfection Of Domestic Water Piping System

- .1 Disinfect water distribution system to Section 22 05 81.

3.8 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 1.20 mm (18 gauge) galvanized sheet metal sleeve around service main to 150 mm (6 inch) above floor and 1800 mm (6 feet) minimum below grade. Size for minimum of 50 mm (2 inches) of loose batt insulation stuffing.
- .3 Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 34 kPa (5 psi inch wg). Provide regulators on each line serving gravity type appliances, sized to equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Flexible Pipe Connections.
- .2 Roof and floor drains.
- .3 Downspouts.
- .4 Vent Stack Jack.
- .5 Trap Seal Primers.
- .6 Cleanouts.
- .7 Wall Hydrants
- .8 Washing machine recessed valve assembly.
- .9 Backflow preventers.
- .10 Water hammer arrestors.
- .11 Potable Water Automatic Balancing Valves
- .12 Interceptors (GI, SI)
- .13 Thermostatic mixing valves
- .14 Sump Pits

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work: Product requirements for The City Provided equipment.
- .2 Roofing Section.
- .3 Section 22 10 00 - Plumbing Piping.
- .4 Section 22 42 02 - Plumbing Fixtures.
- .5 Section 22 47 00 - Plumbing Equipment.
- .6 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

- .1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.
- .2 ASME A112.21.1 - Floor Drains.
- .3 ASME A112.21.2 - Roof Drains.
- .4 ASME A112.26.1 - Water Hammer Arrestors.
- .5 ASSE 1011 - Hose Connection Vacuum Breakers.
- .6 ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
- .7 ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- .8 ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

- .9 ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- .10 AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- .11 NSF/ANSI 61 – Drinking Water System Components – Health Effects
- .12 PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .13 PDI WH-201 - Water Hammer Arrestors.
- .14 CSA B125.3 – Plumbing Fittings

1.4 SUBMITTALS FOR REVIEW

- .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.

1.5 CLOSEOUT SUBMITTALS

- .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.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1
- .2 Extra Stock Materials: Supply two (2) loose keys for outside hose bibs.

1.7 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 REGULATORY REQUIREMENTS

- .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.

1.9 DELIVERY, STORAGE, 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 ROOF DRAINS

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Controlled Flow Roof Drain:
 - .1 Assembly: ANSI A112.21.2.
 - .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.
 - .6 Levelling frame.
 - .7 Adjustable extension sleeve for roof insulation.
 - .8 Strainer free area of 43 square inches.
 - .9 Tamperproof strainer and fastening
 - .5 RD-1:
 - .1 Size: 4" (100mm)
 - .2 Flow: 13.25gpm
 - .1 Overflow Drain: Epoxy coated cast iron overflow roof drain with flashing clamp, integral 4" internal standpipe, cast metal dome. 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 Levelling frame.
 - .6 Adjustable extension sleeve for roof insulation.
 - .7 Tamperproof strainer and fastening
 - .2 RD-2:
 - .1 Pipe Connection Size: 6" (150mm)

2.2 DOWNSPOUT NOZZLE

- .1 Manufacturer
 - .1 Zurn Z199
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Downspout nozzle, All nickel bronze body and decorative face of wall flange and outlet nozzle.

2.3 VENT STACK JACKS

- .1 Manufacturer
 - .1 Thaler
 - .2 Substitutions: Refer to Section 21 05 00.

- .2 Flat Roof, no cap, insulated vent stack;
 - .1 13" (330 mm) high [19" (483 mm) high] 0.064" (1.6 mm) mill finish 1100-OT alloy aluminum, 0.031" (0.79 mm) 22 ga. Type 304 stainless steel to CSA B272-93 complete with pre-moulded urethane insulation liner
 - .2 Size to be 2" (51 mm), 3" (76 mm), 4" (102 mm), 5" (127mm), or 6" (152 mm) diameter
 - .3 EPDM Triple Pressure Grommet Seal and EPDM Base Seal, PVC coated deck flange or bituminous painted deck flange, coordinate with roofing contractor.
- .3 Flat Roof, Removable Cap, insulated vent stack;
 - .1 18" (457 mm) high 0.064" (1.6 mm) mill finish 1100-OT alloy aluminum, 0.031" (0.79 mm) 22 ga. Type 304 stainless steel to CSA B272-93 complete with pre-moulded urethane insulation liner and removable cap and stainless steel screws
 - .2 Size to be 2" (51 mm), 3" (76 mm), 4" (102 mm), 5" (127mm), 6" (152 mm), 7" (178 mm), 8" (203mm), or 10" (254mm) diameter
 - .3 EPDM Triple Pressure Grommet Seal and EPDM Base Seal, PVC coated deck flange or bituminous painted deck flange, coordinate with roofing contractor
 - .4 Optional S.S.. vandal proof cap;

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 ANSI A112.21.1,
 - .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 with Surface Membrane
 - .1 Reversible clamping collar,
 - .2 Primary and secondary weep holes,
 - .3 Adjustable 5" (127mm) 7" (178mm) strainer with surface membrane clamp, refer to schedule for type.
 - .8
 - .9 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	Yes
FD-2	Epoxy coated Cast Iron	Nickel Bronze, 4"x9" Funnel	No	No	Yes

FD-3	Cast Iron	Stainless Steel Strainer	No	No	No
FD-5	Epoxy coated Cast Iron	Heavy Duty, Nickel Bronze	No	Yes	Yes
FD-6	Epoxy coated Cast Iron	Nickel Bronze Funnel Hub	No	No	Yes

.10 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 TRAP SEAL PRIMER

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Precision Plumbing Products.
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Pressure drop activated brass trap seal primer
 - .1 Inlet opening of 1/2" (13mm) male N.P.T. and outlet opening of female 1/2" (13mm) N.P.T.
 - .2 Complete with four view holes and removable filter screen.
 - .3 Requires no site adjustments and no air pre-charge.
 - .4 Each trap seal primer shall be installed with brass trap seal primer air gap fitting,
 - .5 Where multiple floor drains are being served install a trap seal primer distribution unit.
 - .6 Primers shall be installed with union directly upstream, and shut off valve.
 - .7 Supply line to primer shall have a reverse bend in it to reduce the change of sediment collecting in primer, refer to manufacturer's installation instructions.

2.6 CLEANOUT COVERS

- .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 Exterior Unsurfaced Areas:
 - .1 Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- .3 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 with or without surface membrane clamp as required to accept floor finish in finished floor areas.
- .4 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.
- .5 Interior Unfinished Accessible Areas:
 - .1 Caulked or threaded type.
 - .2 Bolted stack cleanouts on vertical rainwater leaders.

2.7 EXTERIOR WALL HYDRANTS (WH-1)

- .1 Wall Hydrant:
 - .1 Manufacturers, Watts Model HY-725
 - .1 Mifab
 - .2 Zurn.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Concealed 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.
 - .5 Operating key to be furnished with each hydrant.

2.8 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 Up to 50 mm (2") - bronze connectors constructed of Phosphor corrugated bronze hose and bronze single braid with brass male ends.
 - .2

2.9 BACKFLOW PREVENTERS

- .1 Reduced Pressure Backflow Preventers (RPB):
 - .1 Manufacturers:
 - .1 Zurn.

- .2 Watts.
- .3 Substitutions: Refer to Section 21 05 00.
- .2 ANSI/ASSE 1013 / CSA B64.4,
- .3 Bronze body with bronze internal parts and stainless steel springs,
- .4 Two independently operating, spring loaded check valves,
- .5 Diaphragm type differential pressure relief valve located between check valves,
- .6 Third check valve that opens under back pressure in case of diaphragm failure,
- .7 Non-threaded vent outlet,
- .8 Assembled with two gate valves, strainer, and four test cocks.
- .2 Reduced Pressure Zone Backflow Preventers (RPZ):
 - .1 Manufacturers:
 - .1 Zurn.
 - .2 Watts.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI/ASSE 1013 / CSA B64.4,
 - .3 Bronze body
 - .4 Internal pressure relief valve between to positive seating independent check modules
 - .5 Check modules with captures springs and silicone seats (replaceable)
 - .6 No exposed threads or screws in waterways
 - .7 Single access bronze cover secured with stainless bolts
 - .8 Assembled with two resilient seated isolation valves and four resilient ball valve test cocks and air gap drain fitting.

2.10 GREASE INTERCEPTORS

- .1 Manufacturer: Schier
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .3 Capacity:
 - .1 As per Schedule.
 - .2 Minimum grease removal efficiency: 90% as per ASME A112.14.3.
- .4 Construction:
 - .1 Constructed of seamless, polyethylene. Interceptor shall be furnished for above or below grade installation. Interceptor shall be certified to ASME A112.14.3 (type C) and CSA B481.1, with field adjustable riser system, built-in flow control, built-in test caps and three outlet options. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.
- .5

2.11 WATER HAMMER ARRESTORS

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 ANSI 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.

2.12 POTABLE WATER AUTOMATIC BALANCING VALVES

- .1 Manufacturers:
 - .1 Victaulic/IMI TA (Tour & Andersson) Series 76X
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Construction up to and including 50mm (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 (2-3 psi) or 35-414 kPa (5-60 psi) differential
- .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

2.13 WASHING MACHINE CONNECTION

- .1 WM-1: Clothes Washing Machine Connection Box
 - .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Encased washing machine valve,
 - .3 16 ga type 304 stainless steel preformed rough-in box,
 - .1 Provide rough-in box suitable for fire rated walls where required.
 - .4 Brass single lever valve handle for hot and cold water connections,
 - .5 Socket for 50 mm (2 inch) waste, slip in finishing cover.

2.14 DISHWASHING MACHINE CONNECTIONS

- .1 DW-1: Residential type dishwasher

- .1 Provide domestic hot water supply and drain connections for dishwasher to neighboring sink.
- .2 DW-2: Commercial type dishwasher
 - .1 Provide drain connection for dishwasher to nearby floor drain.
 - .2 Provide tempering valve on drain line complete with cold water connection.
 - .3 Provide domestic hot water supply connection to dishwasher.

2.15 BACK WATER VALVES

- .1 Cast Iron:
 - .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI A112.21.2; lacquered cast iron body and cover, brass valve, 150 mm (6 inch) extension sleeve, and access cover.
- .2 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.
 - .4
 - .5

Part 3 Execution

3.1 INSTALLATION

- .1 Install to manufacturer instructions.
- .2 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.
- .3 All water cross connection and backflow prevention shall comply with City of Winnipeg By-Law 2289 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.
- .4 Expenses for material, installation, testing and approval of cross connection and backflow prevention shall be paid by this division.
- .5 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.

- .6 Backflow preventers shall be sized for the maximum rated flow of the equipment it is serving.
- .7 All testable backflow prevention devices shall be installed in accessible locations as defined by CSA-B64.10-01. If this cannot be accomplished, locate unit with additional piping to accessible location at no extra cost to The City.
- .8 Pipe relief from backflow preventer to nearest drain.
- .9 Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to equipment.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Lavatories.
- .2 Service sinks.
- .3 Sinks.
- .4 Water closets.
- .5 Electric water coolers.

1.2 Related Sections

- .1 Section 21 05 00 – Submittal Procedures.
- .2 Section 01 45 00 - Quality Assurance.
- .3 Section 21 05 00 - Product Requirements.
- .4 Section 21 05 00 - Closeout Submittals.
- .5 Section 06 40 00 - Architectural Cabinetwork:
 - .1 Preparation of counters for sinks,
 - .2 Lavatory tops.
- .6 Section 07 92 00 - Joint Sealants: Seal fixtures to walls and floors.
- .7 Section 23 05 29 - Supports And Anchors.
- .8 Section 22 10 00 - Plumbing Piping.
- .9 Section 22 42 01 - Plumbing Specialties.
- .10 Section 22 47 00 - Plumbing Equipment.
- .11 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 CSA B651 – Barrier-free Design.
- .2 ARI 1010 - Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- .3 ASME A112.6.1 - (Floor Affixed) Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- .4 ASME A112.18.1 / CSA-B125.1-05- Plumbing Fixture Fittings.
- .5 ASME A112.19.1 / CSA B45.2-08 - Enamelled Cast Iron Plumbing Fixtures.
- .6 ASME A112.19.2 / CSA B45.1-08 - Vitreous China Plumbing Fixtures.
- .7 ASME A112.19.3 / CSA B45.4-08- Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- .8 ASME A112.19.4 - Porcelain Enamelled Formed Steel Plumbing Fixtures.
- .9 ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.

- .10 NFPA 70 - National Electrical Code.
- .11 NBCC 2010 - National Building Code of Canada
- .12 NPCC 2010 – National Plumbing Code of Canada
- .13 NFCC 2010 – National Fire Code of Canada

1.4 Submittals For Review

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.5 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.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by CSA as suitable for the purpose specified and indicated.

1.8 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 Fixtures

- .1 Refer to plans for quantities and locations
- .2 Refer to attached cutsheets for model type and performance information.

2.2 Electric Drinking Fountains

- .1 Combination Drinking Fountain & Bottle Filler:
 - .1 Manufacturer: Elkay Model: LZS8WS
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 Construction to: ASME A112.19.3/CSA B45.4, CSA C22.2, NSF 42, NSF 53, NSF 61, NSF 372, UL 399
 - .3 Unit shall provide 8.0 gph of 50°F water at 90°F ambient and 80°F inlet water.

- .4 Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 30-second shut-off timer.
- .5 Shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing.
- .6 Shall include antimicrobial protected plastic components to prevent mold and mildew.
- .7 Hands free operation
- .8 Shall include the WaterSentry® Plus filter, certified to NSF/ANSI 42 and 53 for lead reduction, with visual monitor to indicate when replacement is necessary.
- .9 Bottle Filling unit shall meet ADA guidelines for parallel approach.
- .10 Cooler shall meet ADA guidelines for frontal or parallel approach.
- .11 Motor Compressor: sealed, reciprocating type, 1/5HP, 115VAC, 60Hz single phase. Sealed-in lifetime oil supply.
- .12 Condenser: Fan cooled, copper tube with aluminum fan motor is permanently lubricated.
- .13 Cooling Unit: Combination tube-tank type. Tube portion is continuous coil of copper tubing. Tank is copper, tinned and insulated with EPS foam.
- .14 Refrigerant Control: Refrigerant HFC-134a is controlled by accurately calibrated capillary tube for positively trouble-free operation.
- .15 Temperature Control: Enclosed adjustable thermostat is factory preset. Requires no adjustment other than for altitude requirements.
- .16 Complete with 3 pack replacement filter, and vandal resistant streamSaver bubbler.
- .17 1-1/4" P-trap, SS braided supply with stops.
- .18 Electrical: Maximum 370 W (1/5 hp) compressor,
- .19 2 m (6 foot) cord and plug for connection to electric wiring system including grounding connector.

Part 3**Execution****3.1****Examination**

- .1 Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- .2 Verify that electric power is available and of the correct characteristics.
- .3 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 Tempered domestic water pipe shall run fully concealed within plumbing chase and only penetrate wall directly inline with each faucet. There shall be one penetration per faucet. Domestic water pipe penetration shall be 200mm below counter height. Isolate each fixture with chrome plated stops. Exposed pipe shall be chrome plated copper.
- .7 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.
- .8 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.
- .9 The temperature of water discharging into a bathtub or shower shall be set and tested by the contractor to not exceed 120°F (49°C).
- .10 Install and secure fixtures in place with wall supports or wall carriers (as specified in Part 2 Products) and bolt, washer, nut fasteners.
- .11 Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, colour to match fixture.
- .12 Seal sinks and lavatories to the millwork. Install gasket where supplied or recommended by sink or lavatory manufacturer.
- .13 Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- .14 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.
- .15 Thermally insulate and jacket all exposed drain pipe extensions, traps, and trap arms below barrier-free wall-hung lavatories.
- .16 Transformers serving electronic plumbing fixtures shall be supplied by this section. Coordinate installation with electrical trades. Low voltage wiring by this section. Contractor is responsible for coordinating quantity of transformers required. Transformers shall be installed in nearest fully accessible ceiling space unless noted otherwise on drawings. Coordinate exact location with The City.

3.4 Interface With Other Products

- .1 Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 Adjusting

- .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** **Cleaning**
- .1 Clean plumbing fixtures and equipment.

- 3.7** **Protection Of Finished Work**
- .1 Section 01 78 40: Protecting installed work.
- .2 Do not permit use of fixtures.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Pumps.
 - .1 Sump Pumps.

1.2 Related Sections

- .1 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 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 B51-03 - Boiler, Pressure Vessel, and Pressure Piping Code.
- .4 NFPA 30 - Flammable and Combustible Liquids Code, 2008 Edition.
- .5 NFPA 54 - National Fuel Gas Code, 2006 Edition.
- .6 NFPA 58 - Liquefied Petroleum Gas Code, 2008 Edition.
- .7 UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- .8 UL 174 - Household Electric Storage Tank Water Heaters.
- .9 CSA B64 Definitions, General Requirements, and Test Methods for Vacuum Breakers and Backflow Preventers
- .10 CAN/CSA-C191 - Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
- .11 ANSI Z21.10.3/CSA 4.3 - Gas water heaters - Volume III, Storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous

1.4 Submittals For 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.

1.5 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 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.6 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 American Gas Association (AGA).
 - .2 National Sanitation Foundation (NSF).
 - .3 American Society of Mechanical Engineers (ASME).
 - .4 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - .5 National Electrical Manufacturers' Association (NEMA).
 - .6 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.

1.7 Regulatory Requirements

- .1 Conform to CGA / AGS requirements for water heaters.
- .2 Conform to ASME Section 8D for manufacture of pressure vessels for heat exchangers.
- .3 Conform to ASME Section 8D for tanks.
- .4 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 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.

1.9 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

- .1

2.2 Submersible Sump Pumps

- .1 Manufacturers:
 - .1 Little Giant WS50HM 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 Accessories: Oil resistant 3 m (10 foot) cord and plug with three-prong connector for connection to electric wiring system.
- .9 Controls: Automatic, mercury-free mechanical float switch with separate liquid level control high level alarm.
- .10 Controls:
 - .1 Duplex Alarm System & Pump Control – (Little Giant)
 - .2 Controls the pump and warns of high liquid levels
 - .3 NEMA 4X ultraviolet stabilized thermoplastic enclosure
 - .4 HOA switch allows for "Hand" (manual) "Off" or "Automatic" operation
 - .5 Control/Alarm ON/OFF switch controls power to the control float and circuitry; this and the pump HOA switch provide an additional safety feature when servicing
 - .6 Entire unit UL listed and tested by UL to CSA standards
 - .7 Two sensor floats and an alarm float included
 - .8 Designed to operate with or without optional fourth
 - .9 83-85db audible alarm buzzer
- .11 Performance:
 - .1 Refer to schedule.
 - .2

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 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

Section Includes

- .1 Flexible pipe connectors.
- .2 Expansion joints and compensators.
- .3 Pipe loops, offsets, and swing joints.

1.2

Related Sections

- .1 Section 21 11 00 - Fire Protection Piping.
- .2 Section 22 10 00 - Plumbing Piping.
- .3 Section 23 21 00 - Hydronic Piping.

1.3

References

- .1 MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed.

1.4

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): 10 degrees C (50 degrees F).
 - .2 Hot Water Heating: 99 degrees C (210 degrees F).
 - .3 Domestic Hot Water: 60 degrees C (140 degrees F).
 - .4 Installation Temperature (chilled water): 27 degrees C (80 degrees F).
 - .5 Chilled Water: 7 degrees C (45 degrees F).
 - .6 Safety Factor: 30 percent.

1.5

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data:
 - .1 Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per metre(foot) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - .2 Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- .3 Design Data:
 - .1 Indicate selection calculations.
 - .2 Provide steam piping layout from connection to central plant supply to building entry with measurements including location and size of expansion loops and anchors based on site conditions.
 - .3 Provide piping layout with measurements including location and size of expansion loops and anchors based on site conditions.

- .4 Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.6 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.

1.7 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include adjustment instructions.

1.8 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- .2

1.9 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.

1.10 Warranty

- .1 Warranty: Include coverage for leak free performance of packed expansion joints.

1.11 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two 340 gm (12 ounce) containers of packing lubricant and cartridge style grease gun.

Part 2 Products

2.1

2.2 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: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [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: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [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 up 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: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [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.
- .4 Copper Piping – heating water, chilled water, and condenser water up to and including 50 mm (2”):
- .1 Manufacturers:
 - .1 Hydro Flex.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Inner Hose: 300 series stainless steel.
 - .3 Exterior Sleeve: Braided stainless steel.
 - .4 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].
 - .5 Joint: threaded male ends.
 - .6 Size: Use pipe sized units
 - .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .5 Copper Piping – heating water, chilled water, and condenser water up to over 50 mm (2”):
- .1 Manufacturers:
 - .1 Model G-FLEX.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .1 neoprene and nylon body, cadmium steel flanges, spring wire beading. Where excess vibration and noise is encountered use Model GD-FLEX double sphere.
 - .2 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].

- .3 Joint: As specified for pipe joints.
- .4 Size: Use pipe sized units
- .5 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.

2.3 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: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psig) 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: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psig) WOG and 121 degrees C (250 degrees F)] [1550 kPa (225 psig) and 21 degrees C (70 degrees F)].
 - .3 Maximum Compression: 24 mm (15/16 inch) [32 mm(1-1/4 inch)].
 - .4 Maximum Extension: 8 mm (5/16 inch) [10 mm(3/8 inch)].
 - .5 Maximum Offset: 3 mm (1/8 inch) [8 mm(5/16 inch)] [[_____] mm([_____] 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).
- .3 Low Pressure Compensator for Wall Fin Elements and Baseboard:
 - .1 Manufacturers:
 - .1 HYSPAN Model 8501.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Working Pressure: 550 kPa (80 psig).
 - .3 Maximum Temperatures: 121 degrees C (250 degrees F).
 - .4 Maximum Compression: 12.7 mm (1/2 inch).
 - .5 Maximum Extension: 4.0 mm (5/32 inch).
 - .6 Joint: Soldered
 - .7 Size: Use pipe sized units
 - .8 Application: Copper or steel piping 50 mm (2 inch) and under.
- .4 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 precompressed 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.

3.2 Manufacturer's Field Services

- .1 Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is to manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Positive displacement meters.
- .2 Flow meters.
- .3 Pressure gauges and pressure gauge taps.
- .4 Thermometers and thermometer wells.
- .5 Static pressure gauges.
- .6 Filter gauges.

1.2

Related Sections

- .1 Section 25 50 02 - Digital Control Equipment.
- .2 Section 25 90 00 - Sequence Of Operation.
- .3 Section 23 21 00 - Hydronic Piping: Installation of thermometer wells and pressure gauge tappings.

1.3

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 ASTM E1 - Specification for ASTM Thermometers.
- .4 ASTM E77 - Inspection and Verification of Thermometers.
- .5 AWWA C700 - Cold Water Meters - Displacement Type, Bronze Main Case.
- .6 AWWA C701 - Cold Water Meters - Turbine Type, for Customer Service.
- .7 AWWA C702 - Cold Water Meters - Compound Type.
- .8 AWWA C706 - Direct-Reading, Remote Registration System for Cold-Water Meters.
- .9 AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- .10 ISA RP 3.2 - Flange Mounted Sharp Edged Orifice Plates for Flow Measurement.
- .11 UL 393 - Indicating Pressure Gauges for Fire-Protection Services.
- .12 UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.4

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.

1.5

Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.

- .2 Project Record Documents: Record actual locations of components and instrumentation.

1.6 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.

1.7 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 Gauge: ASME B40.1, 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: 102 mm (4 inch) diameter dial - gauges located up to 3000 mm (10'-0") above finished floor.
 - .4 Size: 152 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.

2.2 Pressure Gauge Tappings

- .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 syphon rated minimum 1723 kPa (250 psig) working pressure.

2.3 Stem Type Thermometers

- .1 Manufacturers:
 - .1 Winters.
 - .2 Trerice.

- .3 Ashcroft.
- .4 Substitutions: Refer to Section 21 05 00.
- .2 Thermometer: ASTM E1, adjustable angle, blue organic fluid, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
- .3 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: 225 mm (9 inch) scale.
 - .2 Window: Clear heavy-duty strength glass or acrylic.
 - .3 Stem: Minimum length 152 mm (6 inch).
 - .4 Accuracy: ASTM E77 2 percent. Calibration: Both degrees F and degrees C.

2.4 Dial Thermometers

- .1 Manufacturers:
 - .1 Winters.
 - .2 Terice.
 - .3 Ashcroft.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
- .3 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: 75 mm (3 inch) diameter dial - thermometers located up to 1500 mm (5'-0") above finished floor.
 - .2 Size: 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 degrees F and degrees C.

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 degrees C (200 degrees F), Nordel core for temperatures up to 176 degrees C (350 degrees F), Viton core for temperatures up to 204 degrees C (400 degrees 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 90 mm (3-1/2 inch) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
- .2 Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.
- .3 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 Install positive displacement meters with isolating valves on inlet and outlet. Provide full line size valved bypass with globe valve for liquid service meters.
- .3 Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- .4 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.
- .5 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.
- .6 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.
- .7 Install thermometers with back or bottom inlet stems, depending on which is better for ease of reading.
- .8 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.
- .9 Where a separable well is mounted in pipe 38mm diam. or less, enlarge pipe to 50mm diam. for well length plus 76mm.
- .10 Install thermometers in air duct systems on flanges.
- .11 Dial thermometers to be installed on air handling units on outside-air ducts, mixed air ducts, and supply-air ducts.
- .12 Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 25 50 01 and/or 25 50 02.
- .13 Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.

-
- .14 Install static pressure gauges at all built-up filter banks, unitary filter sections, and supply fan discharge.
 - .15 Coil and conceal excess capillary on remote element instruments.
 - .16 Provide instruments with scale ranges selected according to service with largest appropriate scale.
 - .17 Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
 - .18 Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
 - .19 Locate test plugs adjacent to control device sockets.
 - .20 Install thermometers on supply and return fluid lines serving air handling unit coils.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Flexible Pipe Connectors
- .2 Expansion tanks.
- .3 Air vents.
- .4 Air-sediment separators.
- .5 Hydraulic Separator
- .6 Strainers.
- .7 Pump suction diffusers.
- .8 Combination fittings.
- .9 Flow indicators, controls, meters.
- .10 Relief valves.
- .11 Glycol specialties.
- .12 Condensate pumps

1.2

Related Sections

- .1 Section 22 42 01 - Plumbing Specialties: Backflow Preventers.
- .2 Section 23 05 29 – Support and Anchors.
- .3 Section 23 07 19 – Piping Insulation.
- .4 Section 23 21 00 - Hydronic Piping.
- .5 Section 23 21 23 – HVAC Pumps.
- .6 Section 23 25 00 - Chemical Treatment For Piping: Pipe Cleaning.

1.3

References

- .1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.
- .2 ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- .3 NBCC 2010 - National Building Code of Canada
- .4 NPCC 2010 – National Plumbing Code of Canada
- .5 NFCC 2010 – National Fire Code of Canada

1.4

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

- .3 Submit inspection certificates for pressure vessels from authority having jurisdiction.
- .4 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittal Procedures.
- .2 Record actual locations of hydronic specialties.

1.6 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.

1.7 Quality Assurance

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 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.

1.9 Maintenance Service

- .1 Provide service and maintenance of glycol system for one (1) 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, Condenser and Chilled Water Systems
 - .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 Replaceable Bladder Type Expansion Tanks

- .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Armtrol
 - .5 Calefactio
 - .6 Substitutions: Refer to Section 21 05 00
- .2 Provide pre-charged, replaceable bladder expansion tanks meeting current ASME and CSA code requirements designed for a minimum working pressure of 860 kPa (125 psi).
- .3 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.
- .4 Air charging valve connection to be .302"-32 (standard tire valve).
- .5 Bladders to be Butyl or EPDM.
- .6 Sizes to be as shown on the drawings and as specified.
- .7 Expansion tanks shall be finish painted
- .8 Hot Water Heating and Chilled Water Systems:
 - .1 Select expansion tank pressure relief valve as noted in schedule.
 - .2 Set pressure reducing valve as noted in schedule.

2.3 Diaphragm-type Expansion Tanks

- .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 Expansion tanks shall be finish painted
- .7 Hot Water Heating and Chilled Water Systems:
 - .1 Select expansion tank pressure relief valve as noted in schedule.
 - .2 Set pressure reducing valve as noted in schedule.

2.4 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.

2.5 Air And Air-sediment Separators

- .1 Small In-line Air Separators on services less than 50mm (2 inches):
 - .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
 - .2 In-line integral weir style separator; heavy duty cast iron construction; tested for 1207 kPa (175 psig) operating pressure and maximum working pressure of 150 degrees C (300 degrees F)
- .2 Coalescing In-line Air Separators on services less than 50mm (2 inches):

- .1 Manufacturers:
 - .1 Spyrotherm
 - .2 Bell and Gossett
 - .3 Taco
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Coalescing style in-line separator; steel body; tested and stamped to ASME SEC 8-D; for 1035 kPa (150 psig) operating pressure.
- .3 Copper tube core with continuous wound copper wire medium.
- .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 Elimination efficiency:
 - .1 Free air – 100%
 - .2 Entrained air – 100%
 - .3 Dissolved air – 99.6%
- .3 Tangential/vortex style In-line Air Separators:
 - .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
 - .2 Tangential/vortex style in-line separator; steel body; tested and stamped to ASME SEC 8-D; for 862 kPa (125 psig) operating pressure.
 - .3 Unit to be complete with internal 304 stainless steel strainer.
 - .4 Unit shall be complete with threaded air vent connection and threaded blowdown connection.
- .4 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.

2.6 Hydraulic Separator

- .1 Manufacturers:
 - .1 Bell and Gossett

- .2 Taco
- .3 Armstrong
- .4 Substitutions: Refer to Section 21 05 00
- .2 Operating Data
 - .1 With Insulation
 - .1 Working Pressure: 150 psi
 - .2 Operating Temperature – Threaded: 32°-210°F
 - .3 Operating Temperature – Flanged: 32°-220°F
 - .2 Without Insulation
 - .1 Working Pressure: 150 psi
 - .2 Operating Temperature – Threaded and Flanged: 32°-230°F
- .3 Threaded Connections: 1", 1-1/4", 1-1/2" FNPT with Unions
- .4 Flanged Connections: 2", 2-1/2", 3" & 4" ANSI 150 CLASS
- .5 Materials:
 - .1 Body: Steel
 - .2 Air Vent: Brass
 - .3 Drain Valve: Brass
 - .4 Insulation – Threaded: PEX
 - .5 Insulation – Flanged: Polyurethane Foam
- .6 Medium: water, glycol solution non-hazardous
 - .1 Percentage of Glycol Maximum: 30% Threaded & 50% Flanged
- .7 Included Accessories
 - .1 Air-vent and check valve assembly
 - .2 Drain valve
 - .3 Insulation

2.7 Strainers

- .1 Manufacturers:
 - .1 Watts
 - .2 Crane
 - .3 Mueller
 - .4 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,
 - .2 1.6 mm (1/16 inch) serving pumps on systems with dirt-air separators,
 - .2 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:
 - .1 0.8 mm (1/32 inch) serving all temperature control valves, automatic flow control devices,
 - .2 3.2 mm (1/8 inch) serving pumps on systems with dirt air separators,

2.8 Pump Suction Diffusers

- .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.

2.9 COMBINATION PUMP DISCHARGE (TRIPLE-DUTY) VALVES

- .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.
 - .1 NO ASBESTOS PERMITTED.

2.10 Manual Flow Controls

- .1 Manufacturers:
 - .1 Griswold Controls
 - .2 Bell and Gossett
 - .3 Watts.
 - .4 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 2750 kPa (400 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.

2.11 Automatic Flow Controls

- .1 Manufacturers:
 - .1 Griswold Controls
 - .2 Nexus
 - .3 Hays.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring.
- .3 Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance.
- .4 All flow control valve cartridges shall be warranted by the manufacturer for five years from date of sale.
- .5 Up to and including 50mm (2 inch):
 - .1 Cast brass body, rated at no less than 1900 kPa (275 psi) at 120 degrees C (250 degrees F),
 - .2 shall be constructed in a one-piece body to include a handle ball valve, a flow control cartridge assembly, 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 which will accept various end pieces,
 - .3 shall include a removable 20 mesh stainless steel strainer,
 - .4 available flow rates shall be from 0.25 GPM to 160.0 GPM,
 - .5 the body design shall allow inspection or removal of cartridge or strainer without disturbing piping connections.
 - .6 the body design shall allow inspection or repair of handle operated stem without disturbing piping connections. The repairable stem shall include two Teflon seals and one EPDM O-ring for protection against chemicals and modulating temperature,
 - .7 the 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.
- .6 50mm to 500mm (2 inch to 20 inch):

- .1 Class 150 Flange End Valves:
 - .1 Shall consist of steel pipe with flange ends, and stainless steel flow control cartridge assembly;
 - .2 rated assembly at 1585 kPa (230 psi) at 150 degrees C (300 degrees F);
 - .3 shall be supplied with dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes;
 - .4 shall have flange ends compatible with ANSI B 16.5-1968 150 lb. Steel flanges;
 - .5 shall be permanently marked to show direction of flow, shall have body tag to indicate model number and flow rate;
 - .6 shall be available in 50mm through 500mm (2 inch through 20 inch) sizes with flow rates from 0.8 L/s to 430 L/s (14.0 GPM to 6,800.0 GPM).
- .2 Class 300 Flange End Valves:
 - .1 Shall consist of steel pipe with flange ends, and stainless steel flow control cartridge assembly;
 - .2 rated assembly at 4515 kPa (655 psi) at 150 degrees C (300 degrees F);
 - .3 shall be supplied with dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes;
 - .4 shall have flange ends compatible with ANSI B 16.5-1968 300 lb. Steel flanges;
 - .5 shall be permanently marked to show direction of flow, shall have body tag to indicate model number and flow rate;
 - .6 shall be available in 2" through 20" sizes with flow rates from 14.0 GPM to 6,800.0 GPM.
- .7 Automatic flow control valve cartridges shall automatically control flow rates with 5 percent accuracy over an operating pressure differential range of at least 14 times the minimum required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 20 kPa (3 PSID) to actuate the mechanism.

2.12 Relief Valves

- .1 Manufacturers:
 - .1 Kunkle
 - .2 Spiraz-Sarco
 - .3 Watts
 - .4 Bell and Gossett
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 AMSE 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 ½ 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.

2.13 Glycol Feed System

- .1 Manufacturers:
 - .1 Axiom.
 - .2 Calefactio
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Glycol systems shall be equipped with a mix-and-fill tank with manual fill capabilities, hose bib from domestic water for tank filling, and tank level alarm. Direct-connect city makeup lines to glycol systems are NOT permitted.
- .3 The entire system to be factory pre-piped and pre-wired with numbered terminal strip for wiring of remote items such as the pressure switch and the contact head meter.
- .4 Unit to be complete with low-level pump cutout float switch, which plugs directly into standard duplex outlet and stops the pump if glycol level is too low.
- .5 The piping system shall be provided with a low-pressure sensor, which shall alarm on the DDC system. On alarm generation, feed system will be manually started after checking for system leaks. This manual operation will avoid feed system from automatically filling and compensating for a system leak. Fully automatic operation can be selected by HOA switch if suitable for system.
- .6 Unit to be complete with low-level remote monitoring panel complete with dry contacts and be connected to DDC system alarm.
MEDIUM SYSTEM
- .7 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.
- .8 System shall be compatible with glycol solutions.
- .9 Pump shall be capable of running dry without damage.
- .10 Power supply: 3-prong plug and cord, 115v/60/1, 0.7 amps.

- .11 Unit shall be completely assembled and certified to CSA standard C22.2 No 68.

2.14 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.
 - .1 Following systems to be filled with aqueous glycol solution. Solution shall be blended up with propylene glycol at percentage indicated and remainder with distilled or de-ionized water concentration. Heat recovery system – 50% (-37°C freeze point).
 - .2 Glycol heating system – 35% (-15°C freeze point)
 - .3 Provide high grade (virgin) industrial inhibited propylene glycol. Recycled glycol or commercially available antifreeze solutions are not acceptable. Also, provide two additional 205 litre (45 gal.) drums of propylene glycol/distilled water solution above quantity required to fill systems. The manufacturer of fluid must provide written documentation stating the fluid passed ASTM standards. The supplier must supply a certificate of analysis that guarantees the content of the product provided.
 - .4 Glycol solution supplier shall provide The City and Contract Administrator with written analysis results of tested product after installation, and also provide free analysis on an annual basis.

2.15 CONDENSATE PUMPS FAN COIL

- .1 Manufacturers:
 - .1 Blue Diamond Maxi Blue
 - .2 Substitutions: none
- .2 Provide where required and as per detail, pipe to condensate drain connection. Unit shall be ULc listed for plenum rated installation. (UL-2043). Pumps shall be capable of running dry and continuously.
- .3 Warrantee – 3 years
- .4 Performance
 - .1 Max flow 3.7 g/hr (14 l/h)
 - .2 Max Head 23 feet (10 PSI)
 - .3 Max Suction 16.5 (7.1 PSI)
 - .4 Sound 21 dba
- .5 Accessories
 - .1 Reservoir Sensor
 - .2 Temperature sensor
 - .3 Drainstick
- .6 Electrical
 - .1 208-230 volt

Part 3 Execution

3.1 Installation

- .1 Install specialties to manufacturer's written instructions.
- .2 Adjust expansion tank pressure to suit design criteria and as directed by the Contract Administrator.
- .3 Install pressure gauge at inlet to tank.
- .4 Provide valved drain connection on tank side of expansion tank isolation valve.
- .5 Provide union connection and isolation valve at each tank to allow removal of tank without disrupting service.
- .6 Where large air quantities can accumulate, provide enlarged air collection standpipes.
- .7 Provide manual air vents at system high points and as indicated.
- .8 For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- .9 On aqueous glycol systems, automatic air vents are not permitted.
- .10 Pipe all air vents on aqueous glycol systems back to glycol fill tank. Piping to be a minimum of 12mm (1/2 inches)
- .11 Provide air separator on suction side of system circulation pump and connect to expansion tank.
- .12 Provide valved drain and hose connection on strainer blow down connection.
- .13 Supply and install strainers ahead of all temperature control valves, pressure reducing valves, pump suction and where indicated on the drawings.
- .14 Provide pump suction fitting on suction side of base mounted centrifugal pumps [where indicated]. Remove temporary strainers after cleaning systems.
- .15 Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps [where indicated].
- .16 Support pump fittings with floor mounted pipe and flange supports.
- .17 Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.
- .18 Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.
- .19 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
- .20 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.
- .21 Pipe relief valve outlet to nearest floor drain.
- .22 Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- .23 Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.

- .24 Feed glycol solution to system through make-up line with pressure regulator, venting system high points.
- .25 Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Pipe and equipment hangers and supports.
- .2 Equipment bases and supports.
- .3 Sleeves and seals.
- .4 Flashing and sealing equipment and pipe stacks.

1.2

Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete: Equipment bases.
- .2 Section 07 84 00 - Firestopping: Joint seals for piping and duct penetration of fire rated assemblies.
- .3 Section 09 90 00 - Painting.
- .4 Section 21 11 00 - Fire Protection Piping.
- .5 Section 23 07 19 - Piping Insulation.
- .6 Section 23 07 16 - Equipment Insulation.
- .7 Section 22 10 00 - Plumbing Piping.
- .8 Section 23 21 00 - Hydronic Piping.

1.3

References

- .1 ASME B31.1 - Power Piping.
- .2 ASME B31.2 - Fuel Gas Piping.
- .3 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .4 ASME B31.9 - Building Services Piping.
- .5 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- .6 CSA 149.1 - Natural gas and propane installation code
- .7 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .8 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .9 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- .10 NFPA 13 - Installation of Sprinkler Systems.
- .11 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .12 UL 203 - Pipe Hanger Equipment for Fire protection Service.

1.4

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.

1.5 Regulatory Requirements

- .1 Conform to applicable code for support of plumbing, hydronic piping.
- .2 Supports for Sprinkler Piping: To NFPA 13.
- .3 Supports for Standpipes: To NFPA 14.

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 Cast Iron DWV Piping:
 - .1 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .2 Hangers for Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .4 Wall Support for Pipe Sizes to 75 mm (3 inches): Cast iron hook.
 - .5 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .6 Vertical Support: Steel riser clamp.
 - .7 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

- .8 Clamping for MJ couplings: Socket-pipe clamps with washers, threaded rod, and nuts (Anvil Fig. 594 & 595 or equal).
- .3 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .4 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 Protection Saddles
 - .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 GSS insulation protection shield to maintain integrity of vapour barrier.
 - .2 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 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 Wall Support for Hot Pipe Sizes 150 mm (6 inches) and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
 - .14 Vertical Support: Steel riser clamp.
 - .15 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .16 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.
 - .17 Floor Support for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
 - .18 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

- .19 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 Protection Saddles
 - .1 On piping 2" and smaller, carry insulation over pipe hangers. On all chilled water piping, and domestic cold water piping over 1-1/4", use oversized clevis hangers and GSS insulation protection shield 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 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 Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable steel yoke, cast iron roll, double hanger.
 - .10 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .11 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.
 - .12 Wall Support for Pipe Sizes to 76 mm (3 inches): Cast iron hook.
 - .13 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .14 Wall Support for Hot Pipe Sizes 150 mm (6 inches) and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 - .15 Vertical Support: Steel riser clamp.
 - .16 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .17 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.

- .18 Floor Support for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 - .19 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - .20 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.
 - .21 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 - .22 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 Refrigerant Piping:
- .1 Conform to ASME B31.5.
 - .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.
- .7 For roof mounted piping, provide supports equivalent to:
- .1 Portable Pipe Hangers model PP 10 strut style with pipe clamp guides, Portable Pipe Hangers Model PSE-2-2 with clevis style hangers, or supports. Install to Manufacture's specifications. Supports to be aluminium with stainless steel clamps and rollers. Membrane pads to be close-cell extruded polystyrene insulation equal to Dow Chemical Roofmate. Pipe shall be a minimum of 8" above finished roof level.
 - .2 MIFAB C-Port Series. Minimum 6 1/2" in 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 galvanized steel channel. All metal work including strut or pipe clamps to be stainless steel.

2.2 Accessories

- .1 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 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.

2.4 Flashing

- .1 Metal Flashing: 0.5 mm thick (26 gauge) galvanized steel.
- .2 Metal Counterflashing: 0.8 mm thick (22gauge) galvanized steel.
- .3 Flexible Flashing: 1.2mm (47 mil) thick sheet butyl; compatible with roofing.
- .4 Caps: Steel, 0.8 mm (22 gauge) minimum; 1.5 mm (16 gauge) at fire resistant elements.

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.

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 Mechanical Division. 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 water, glycol, chilled water, condenser water, and engine exhaust 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 a 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 hangers must be installed in existing concrete slabs, approved expansion type inserts shall be used, or if heavy weights must be supported, a hole shall be drilled through the slab and a 50 mm x 50 mm (2" x 2") washer and nut installed above rough slab before the floor finish is poured.
- .8 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.
- .9 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.
- .10 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.
- .11 Install hangers to provide minimum 13 mm (1/2 inch) space between finished covering and adjacent work.
- .12 Place hangers within 300 mm (12 inches) of each horizontal elbow.
- .13 Use hangers with 38 mm (1-1/2 inch) minimum vertical adjustment.
- .14 Support horizontal cast iron pipe adjacent to each hub, with 1.5 m (5 feet) maximum spacing between hangers.

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- .15 Support all pipe with MJ couplings on both sides of the joint. At multiple fittings or short lengths, support every 300 mm (12").
 - .16 Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub or with pipe clamps on hubless pipe.
 - .17 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 For cast-iron systems, install restraint clamps across all no-hub MJ couplings on piping 125 mm (5") and larger for all horizontal piping, including elbows at the base of a vertical pipe. Clamps shall be socket clamps on either side of the coupling connected with suitably sized threaded rod.
 - .5 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.
 - .6 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.
 - .18 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - .19 Support riser piping independently of connected horizontal piping.
 - .20 Provide copper plated hangers and supports for copper piping.
 - .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 a protection saddle of 16 ga. galvanized sheet steel, rolled to match the outside diameter of the insulation. The saddle 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, the hangers shall be sized to suit the O.D. of the insulation and protection saddles, as described above shall be installed.
- .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 Equipment Bases And Supports

- .1 Provide housekeeping pads of concrete, minimum 100 mm (4 inches) thick and extending 150 mm (6 inches) beyond supported equipment. Refer to Section 03 30 00.
- .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.

3.5 Flashing

- .1 Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- .2 Provide copper flashing for sleeves passing through exterior surfaces or waterproof assemblies.
- .3 Flash floor drains in floors with topping over finished areas with lead, 250 mm (10 inches) clear on sides with minimum 910 x 910 mm (36 x 36 inch) sheet size. Fasten flashing to drain clamp device.
- .4 Seal floor, shower, & mop sink drains watertight to adjacent materials.
- .5 Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed to manufacturer's written instructions for sound control.
- .6 Provide curbs for mechanical roof installations 350 mm (14 inches) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
- .7 Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 Sleeves

- .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 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 Mechanical Division. 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.)
.3	200mm (8") to 300mm (12")	5.4m (18 ft.)
.4	350mm (14") to 450mm (18")	7.2m (24 ft.)
.5	500mm (20") to 600mm (24")	9.0m (30 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.)
.4	100mm (4") to 150mm (6")	3.6m (12 ft.)
.5	200mm (8") to 300mm (12")	4.8m (16 ft.)
 - .5 Cast Iron Pipe
 - .1 Maximum spacing – maximum 5 ft. (1.5m)
 - .2 Support M.J. pipe on both sides of joint. Provide with sway braces and anchors to Contract Administrator's approval. At multiple fittings, or short lengths, support every 300mm (12").
 - .6 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 Section Includes

- .1 Vibration isolation.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete.
 - .1 Placement of isolators in floating floor slabs.
 - .2 Supply of concrete for placement by this section.
- .2 Section 23 05 16 - Piping Expansion Compensation.
- .3 Section 23 05 29 - Supports And Anchors.
- .4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 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 project's structural engineer, the governing building code(s) or the authority having jurisdiction.
- .3 Provide minimum static deflection of isolators for equipment as indicated.
 - .1 Upper Floors, Normal
 - .1 Under 400 rpm: 90 mm (3.5 inch)
 - .2 400 - 600 rpm: 90 mm (3.5 inch)
 - .3 600 - 800 rpm: 50 mm (2 inch)
 - .4 800 - 900 rpm: 25 mm (1 inch)
 - .5 1100 - 1500 rpm: 12 mm (0.5 inch)
 - .6 Over 1500 rpm: 5 mm (0.2 inch)
 - .2 Upper Floors, Critical
 - .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)
- .4 Consider upper floor locations critical unless otherwise indicated.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate inertia bases and 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.
- .5 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of hangers including attachment points.

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] [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 Set concrete inertia bases for 50 mm (2 inch) clearance between housekeeping pad and base.
 - .3 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 ¾" and maximum of 1¼" 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.

3.2 Manufacturer's Field Services

- .1 Examine systems to Section 01 45 00.
- .2 Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Nameplates.
- .2 Tags.
- .3 Stencils.
- .4 Pipe Markers.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Identification painting.

1.3 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.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.
- .3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- .4 Product Data: Provide manufacturers catalogue literature for each product required.
- .5 Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.5 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.
 - .4 200-250 mm (8 to 10 inch) Outside Diameter of Insulation or Pipe: 600 mm (24 inch) long colour field, 65 mm (2-1/2 inch) high letters.
 - .5 Over 250 mm (10 inch) Outside Diameter of Insulation or Pipe: 800 mm (32 inch) long colour field, 90 mm (3-1/2 inch) high letters.
 - .6 Ductwork and Equipment: 65 mm (2-1/2 inch) high letters.
- .2 Stencil Paint: As specified in Section 09 90 00, 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.

2.5 Ceiling Tacks

- .1 Description: Steel with 20 mm (3/4 inch) diameter colour coded head.
- .2 Colour code as follows:
 - .1 Yellow - HVAC equipment
 - .2 Red - Fire dampers/smoke dampers
 - .3 Green - Plumbing valves
 - .4 Blue - Heating/cooling valves

Part 3 Execution

3.1 Preparation

- .1 Degrease and clean surfaces to receive adhesive for identification materials.
- .2 Prepare surfaces to Section 09 90 00 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 90 00.
- .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 air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .8 Identify control panels and major control components outside panels with plastic nameplates.
- .9 Identify thermostats relating to terminal boxes or valves with nameplates.
- .10 Identify valves in main and branch piping with tags.
- .11 Identify air terminal units and with numbered tags.
- .12 Identify external heat tracing on insulated piping.
- .13 Tag automatic controls, instruments, and relays. Key to control schematic.
- .14 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.
- .15 Identify ductwork with stencilled painting. 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.
- .16 Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Testing, adjustment, and balancing of air systems.
- .2 Fire and smoke damper testing & verification.
- .3 Testing, adjustment, and balancing of hydronic systems.
- .4 Measurement of final operating condition of HVAC systems.

1.2

Related Sections

- .1 Section 01 11 00 – Summary of Work
- .2 Section 01 45 00 - Quality Assurance:
 - .1 Testing laboratory services.
 - .2 Employment of testing agency and payment for services.
 - .3 Inspection and testing allowances.
- .3 Section 21 05 00 - Closeout Submittals:
 - .1 Starting of Systems.
 - .2 Testing, Adjusting, and Balancing of Systems.
- .4 Section 23 31 00 - Duct Work
- .5 Section 23 33 00 - Duct Work Accessories

1.3

Allowances

- .1 Work is included in this section and is part of the Contract Sum/Price.

1.4

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 NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- .7 SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.5

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 3-ring binder 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.

1.6 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.

1.7 Quality Assurance

- .1 Perform total system balance to AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

1.8 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 or NEBB.]
- .2 Perform Work under supervision of CAABC or NEBB Certified Test and Balance Supervisor.

1.9 Pre-balancing Conference

- .1 Convene one week prior to commencing work of this section, to Section 21 05 00.

1.10 Sequencing

- .1 Sequence work to Section 01 11 00.
- .2 Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.11 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.

1.12 Project Close-out

- .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. The Mechanical SubContractor 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 Agencies

- .1 Air Movement Services Ltd.
- .2 Airdronics Inc.
- .3 D.F.C. Mechanical Testing & Balancing Ltd.
- .4 AHS Testing & Balancing.

3.2 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.

3.3 Preparation

- .1 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Contract Administrator to facilitate spot checks during testing.
- .2 Provide additional balancing devices as required.

3.4 Installation Tolerances

- .1 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.

- .2 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.
- .3 Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 Adjusting

- .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.
- .5 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by The City.
- .6 Check and adjust systems approximately six months after final acceptance and submit report.

3.6 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 extend 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 Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Any re-adjustments of controls as deemed necessary, shall be made in co-operation with the Control SubContractor.
- .12 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
 - .1 Test and record entering air temperatures (D.B. heating and cooling).
 - .2 Test and record entering air temperatures (W.B. cooling).
 - .3 Test and record leaving air temperatures (D.B. heating and cooling).
 - .4 Test and record leaving air temperatures (W.B. cooling).
- .13 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating. Refer to the maximum and minimum rates on the drawings and schedules.
- .14 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.
- .15 Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- .16 For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- .17 On fan powered VAV boxes, adjust air flow switches for proper operation.
- .18 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.
- .19 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.

3.7 Fire & Smoke Damper Testing & Verification

- .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.

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- .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 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.

3.8 Leak Testing of 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 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.
- .6 Section 23 31 00 shall clean all ducts before testing.

- .7 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).
- .8 Perform preliminary tests and repair all leaks before notifying Contract Administrator of final tests.
- .9 Maintain log book of all tests showing dates, personnel observers' initials.
- .10 Be responsible for any damage resulting from failure of items under test.
- .11 Section 23 31 00 shall repair all leaks in duct systems.
- .12 Retest ductwork after leaks have been repaired.
- .13 Coordinate with Section 23 31 00 to ensure that all ductwork is tested:
 - .1 before ducts are insulated.
 - .2 before ducts are concealed.

3.9 Water System Procedure

- .1 Adjust water systems to provide required or design quantities.
- .2 Coordinate and work with controls contractor to balancing adjust flow of new pump systems and existing pump systems to accommodate added flow for new HVAC equipment. Existing pump systems include, Chilled water pumps P-3/4, glycol loop pumps, P-5/6, terminal unit coil pumps, P-7/8.
- .3 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.
- .4 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.
- .5 Effect system balance with automatic control valves fully open to heat transfer elements.
- .6 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.
- .7 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.

3.10 Schedules

- .1 Equipment requiring testing, adjusting and balancing:
 - .1 Sprinkler Air Compressor
 - .2 Plumbing Pumps
 - .3 Boiler Feedwater Pumps
 - .4 HVAC Pumps
 - .5 Boilers
 - .6 Reciprocating Water Chillers

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- .7 Air Cooled Water Chillers
 - .8 Air Cooled Refrigerant Condensers
 - .9 Computer Room Air Conditioning Units
 - .10 Air Coils
 - .11 Air Handling Units
 - .12 Fans
 - .13 Air Filters
 - .14 Air Terminal Units
 - .15 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 Electric Motors:
 - .1 Manufacturer
 - .2 Model/Frame
 - .3 HP/BHP
 - .4 Phase, voltage, amperage; nameplate, actual, no load
 - .5 RPM
 - .6 Service factor
 - .7 Starter size, rating, heater elements
 - .8 Sheave Make/Size/Bore
 - .5 V-Belt Drive:
 - .1 Identification/location
 - .2 Required driven RPM
 - .3 Driven sheave, diameter and RPM

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- .4 Belt, size and quantity
 - .5 Motor sheave diameter and RPM
 - .6 Centre to centre distance, maximum, minimum, and actual
 - .6 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
 - .7 Combustion Test:
 - .1 Boiler manufacturer
 - .2 Model number
 - .3 Serial number
 - .4 Firing rate
 - .5 Overfire draft
 - .6 Gas meter timing dial size
 - .7 Gas meter time per revolution
 - .8 Gas pressure at meter outlet
 - .9 Gas flow rate
 - .10 Heat input
 - .11 Burner manifold gas pressure
 - .12 Percent carbon monoxide (CO)
 - .13 Percent carbon dioxide (CO₂)
 - .14 Percent oxygen (O₂)
 - .15 Percent excess air
 - .16 Flue gas temperature at outlet
 - .17 Ambient temperature
 - .18 Net stack temperature
 - .19 Percent stack loss
 - .20 Percent combustion efficiency
 - .21 Heat output
 - .8 Air Cooled Condenser:
 - .1 Identification/number
 - .2 Location
 - .3 Manufacturer
 - .4 Model number
 - .5 Serial number
 - .6 Entering DB air temperature, design and actual
 - .7 Leaving DB air temperature, design and actual
 - .8 Number of compressors
 - .9 Chillers:
 - .1 Identification/number

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- .2 Manufacturer
 - .3 Capacity
 - .4 Model number
 - .5 Serial number
 - .6 Evaporator entering water temperature, design and actual
 - .7 Evaporator leaving water temperature, design and actual
 - .8 Evaporator pressure drop, design and actual
 - .9 Evaporator water flow rate, design and actual
 - .10 Condenser entering water temperature, design and actual
 - .11 Condenser pressure drop, design and actual
 - .12 Condenser water flow rate, design and actual
 - .10 Heat Exchanger:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Model number
 - .6 Serial number
 - .7 Steam pressure, design and actual
 - .8 Primary water entering temperature, design and actual
 - .9 Primary water leaving temperature, design and actual
 - .10 Primary water flow, design and actual
 - .11 Primary water pressure drop, design and actual
 - .12 Secondary water leaving temperature, design and actual
 - .13 Secondary water leaving temperature, design and actual
 - .14 Secondary water flow, design and actual
 - .15 Secondary water pressure drop, design and actual
 - .11 Cooling Coil Data:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Air flow, design and actual
 - .6 Entering air DB temperature, design and actual
 - .7 Entering air WB temperature, design and actual
 - .8 Leaving air DB temperature, design and actual
 - .9 Leaving air WB temperature, design and actual
 - .10 Water flow, design and actual
 - .11 Water pressure drop, design and actual
 - .12 Entering water temperature, design and actual
 - .13 Leaving water temperature, design and actual
 - .14 Saturated suction temperature, design and actual
 - .15 Air pressure drop, design and actual
 - .12 Heating Coil Data:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Air flow, design and actual

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- .6 Water flow, design and actual
 - .7 Water pressure drop, design and actual
 - .8 Entering water temperature, design and actual
 - .9 Leaving water temperature, design and actual
 - .10 Entering air temperature, design and actual
 - .11 Leaving air temperature, design and actual
 - .12 Air pressure drop, design and actual
 - .13
 - .13 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
 - .14 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
 - .15 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

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- .16 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
 - .17 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
 - .18 Air Monitoring Station Data:
 - .1 Identification/location
 - .2 System
 - .3 Size
 - .4 Area
 - .5 Design velocity
 - .6 Design air flow
 - .7 Test velocity
 - .8 Test air flow
 - .19 Flow Measuring Station:
 - .1 Identification/number
 - .2 Location
 - .3 Size
 - .4 Manufacturer
 - .5 Model number
 - .6 Serial number
 - .7 Design Flow rate
 - .8 Design pressure drop
 - .9 Actual/final pressure drop
 - .10 Actual/final flow rate
 - .11 Station calibrated setting
 - .20 Terminal Unit Data:
 - .1 Manufacturer

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- .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
 - .21 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 Section Includes

- .1 Duct work insulation.
- .2 Duct Liner.
- .3 Insulation jackets.

1.2 Related Sections

- .1 Section - Roofing: Finishing outdoor insulation jacket.
- .2 Section 09 90 00 - Painting: Painting insulation jackets.
- .3 Section 23 05 53 - Mechanical Identification.
- .4 Section 23 31 00 - Duct Work: Glass fibre duct work.
- .5 Section 23 31 00 - Duct Work: Duct liner.
- .6 Section - Roofing: Installation and finishing of outdoor insulation jacket under roofing.

1.3 References

- .1 Section 01 45 00: Requirements for references and standards.
- .2 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .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.
- .13 NAIMA National Insulation Standards.
- .14 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

- .15 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .16 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 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.

1.6 Regulatory Requirements

- .1 Materials: Flame spread/smoke developed rating of 25/50 to NFPA 255 / UL 723.

1.7 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.

1.8 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 VAPOUR BARRIER EXTERNAL DUCT WRAP, GLASS FIBRE, FLEXIBLE

- .1 Manufacturers:
 - .1 Johns Manville Microlite XG
 - .2 Owens Corning SoftR Duct Wrap.
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: ASTM C553; flexible, noncombustible blanket.

- .1 'ksi' ('K') value: ASTM C518, 0.045 W/m-K at 24 degrees C (0.31 Btu-in/(hr ft²-°F) at 75 degrees F).
- .2 Maximum service temperature: 121 degrees C (250 degrees 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; 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).

2.2 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 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees 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; 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.

2.3 Jackets

- .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 Insulation Jacketing Tape: 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 [Flat/Smooth]
 - .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 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.

2.4 Glass Fibre Duct Liner, Flexible

- .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, [with 28 Gauge Galvanized Steel Perforated Internal Cover.]
 - .1 'ksi' ('K') Value: ASTM C518, maximum 0.045 at 24 degrees C (0.31 at 75 degrees F).

- .2 Maximum Service Temperature: 121 degrees C (250 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C1071 0.30 for 13 mm (1/2 inch) thickness; 0.45 for 25 mm (1 inch) thickness; 0.60 for 40 mm (1-1/2 inches) thickness; 0.70 for 50 mm (2 inch) thickness.
 - .5 Minimum 55% Certified Recycled Content.
- .3 Adhesive:
- .1 Waterproof, ASTM E162 fire-retardant type.
- .4 Liner Fasteners: Galvanized steel, with press-on head.

2.5 GLASS FIBRE DUCT LINER, RIGID

- .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. [with 28 Gauge Galvanized Steel Perforated Internal Cover.]
- .1 'ksi ('K') value : ASTM C518, maximum 0.27 at at 24 degrees C (75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 24.5 m/s (5,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C1071 0.55 for 25 mm (1 inch) thickness; 0.75 for 40 mm (1-1/2 inches) thickness; 0.90 for 50 mm (2 inch) thickness.
 - .5 Minimum 20% Certified Recycled Content.
- .3 Adhesive:
- .1 Waterproof , ASTM E162 fire-retardant type.
- .4 Liner Fasteners: Galvanized steel, with press-on head.

2.6 Glass Fibre 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. [with 28 Gauge Galvanized Steel Perforated Internal Cover.]
- .1 'ksi' ('K') value : ASTM C1071, 0.033 at 24 degrees C (0.23 at 75 degrees F).

- .2 Maximum service temperature: 121 degrees C (250 degrees F).
- .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).

2.7 Elastomeric Cellular Thermal Duct Liner

- .1 Manufacturers:
 - .1 Armacell AP Armaflex Sheets
 - .2 Other acceptable manufacturers offering equivalent products.
- .2 Insulation: Flexible, closed-cell elastomeric insulation in sheet form meeting ASTM C 534,
 - .1 'ksi' ('K') value : ASTM C177, 0.039 at 24 degrees C (0.25 at 75 degrees F).
 - .2 Maximum service temperature: 105 degrees C (220 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C423,
 - .1 0.35 for 25 mm (1 inches) thickness
 - .2 [0.20 for 10 mm (1/2 inch) thickness]
- .3 Elastomeric Foam Adhesive
 - .1 Manufacturers:
 - .1 Armstrong 520 adhesive.
 - .2 Air dried, contact adhesive, compatible with insulation.

2.8 Fire Wrap External Duct Flexible

- .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 degrees C (0.31 at 75 degrees F).
 - .2 Density 96 kg/cu. meter (6 lb/cu. Foot).
- .4 Flammability (ASTM E 84/UL 723)
 - .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
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 Section 01 45 00 - Quality Assurance: Manufacturer's written instructions.
- .2 Install to NAIMA National Insulation Standards.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 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.
- .5 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.
- .6 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.

- .7 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.
- .8 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.
- .9 Where ducts are acoustically lined to the equivalent R-value, no exterior duct insulation is required, except where exposed to outside temperature and weather.
- .10 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.
- .11 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.
- .12 Install Elastomeric Cellular Thermal Duct Liner as per manufacturer's recommendations.
- .13 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 <Inch><mm>	THICKNESS <mm><Inch>
All conditioned air supply ductwork in return plenums or un-conditioned interior space or mechanical rooms or electrical rooms	=< 400 mm (16") per side, or round duct	29mm (1 1/8") Installed 38mm (1 1/2") Nominal
Combustion Air ductwork	all	38mm (1 1/2") Installed 50mm (2") Nominal
Round exhaust ducts, relief ducts from external wall or roof back for length of 3000mm (10 feet) or to insulated damper, whichever is greater	All	57mm (2 1/4") Installed 75mm (3") Nominal
Round duct from insulated damper for length of up the 3000mm (10 feet)	All	38mm (1 1/2") Installed 50mm (2") Nominal
Round outdoor air ducts located in conditioned space to the air handler or mixed air plenum.	All	95mm (3 3/4") Installed 125mm (5") Nominal
Round ducts located outdoors or where exposed to outdoor temperatures (eg. Attics).	Not Permitted	Not Permitted
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 <Inch><mm>	THICKNESS <mm><Inch>
Air conditioning supply plenums, before, including, and after cooling coils	all	50mm (2")
All conditioned air supply ductwork in return plenums or un-conditioned interior space or mechanical rooms or electrical rooms	> 400 mm (16") per side	25mm (1")
Combustion Air ductwork	all	50mm (2")
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")

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
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") or R-value of wall, which ever is greater.
Rectangular ducting to centrifugal exhaust fans on roofs.	All	50mm (2")

3.6 Glass Fibre Duct Liner, Rigid

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All	25mm (1")

3.7 Glass Fibre Duct Liner, Flexible

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All	25mm (1")
Rooftop goosenecks – exhaust (not including laundry or kitchen exhaust)	All	50mm (2")

3.8 Elastomeric Cellular Thermal Duct Liner

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <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

Section Includes

- .1 Equipment insulation.
- .2 Covering.

1.2

Related Sections

- .1 Section 09 90 00 - Painting: Painting insulation covering.
- .2 Section 23 05 53 - Mechanical Identification.
- .3 Section 22 10 00 - Plumbing Piping: Placement of hangers and hanger inserts.
- .4 Section 23 21 00 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3

References

- .1 ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .4 ASTM C195 - Mineral Fibre Thermal Insulating Cement.
- .5 ASTM C240 - Testing Cellular Glass Insulation Block.
- .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 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .10 ASTM C552 - Cellular Glass Thermal Insulation.
- .11 ASTM C553 - Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .12 ASTM C592 - Mineral Fibre Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
- .13 ASTM C612 - Mineral Fibre Block and Board Thermal Insulation.
- .14 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .15 ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- .16 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .17 ASTM E96 - Water Vapour Transmission of Materials.

- .18 NAIMA National Insulation Standards.
- .19 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- .20 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

1.5 Submittals For Information

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.6 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 with minimum three years documented experience.

1.7 Regulatory Requirements

- .1 Materials: Flame spread/smoke developed rating of 25/50 to NFPA 255 //UL 723.

1.8 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.

1.9 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 GLASS FIBRE, FLEXIBLE

- .1 Manufacturers:
 - .1 Johns Manville Microlite XG
 - .2 Owens Corning SoftR Duct Wrap.
 - .3 Other acceptable manufacturers offering equivalent products.

- .1 Knauf.
- .2 Insulation: ASTM C553; flexible, noncombustible blanket.
 - .1 'ksi' ('K') value: ASTM C518, 0.045 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum moisture absorption: 0.20 percent by volume.
 - .4 Density 72 kg/cu. meter (4.5 lb/cu. Foot).
- .3 Vapour Barrier Jacket:
 - .1 ASTM C921, Kraft paper reinforced with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture vapour transmission: ASTM E96; 0.02 perm.
 - .3 Secure with self-sealing longitudinal laps and butt strips.
 - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Tie Wire: 1.22 mm (0.048 inch) stainless steel with twisted ends on maximum 300 mm (12 inch) centres.

2.2 GLASS FIBRE, RIGID

- .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 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum moisture absorption: 0.20 percent by volume.
 - .4 Density: 72 kg/cu m (4.5 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; 0.04 perm.
 - .3 Secure with self-sealing longitudinal laps and butt strips.
 - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Facing: 25 mm (1 inch) galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .5 Vapour Barrier Lap Adhesive:
 - .1 Compatible with insulation.
- .6 Insulating Cement/Mastic:
 - .1 ASTM C195; hydraulic setting on mineral wool.

2.3 Cellular Glass

- .1 Insulation: ASTM C552.
 - .1 'ksi' ('K') Value: 0.039 at 24 degrees C (0.35 at 75 degrees F).
 - .2 Maximum Service Temperature: 482 degrees C (900 degrees F).
 - .3 Maximum Water Vapour Transmission: 0.1 perm.
 - .4 Maximum Moisture Absorption: ASTM C240, 0.2 percent by volume.
 - .5 Density: 128 kg/cu m (8.0 lb/cu ft).

2.4 Cellular Foam

- .1 Insulation: ASTM C534; flexible, cellular elastomeric, moulded or sheet.
 - .1 'ksi' ('K') Value: ASTM C177; 0.032 at 24 degrees C (0.25 at 75 degrees F).
 - .2 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .3 Maximum Service Temperature: 104 degrees C (220 degrees F).
 - .4 Maximum Moisture Absorption: ASTM D1056; 1.0 percent by volume.
 - .5 Moisture Vapour Transmission: ASTM E96; 0.05 perm-inches.
 - .6 Connection: Waterproof vapour barrier adhesive.
- .2 Elastomeric Foam Adhesive:
 - .1 Air dried, contact adhesive, compatible with insulation.

2.5 Jackets

- .1 PVC Plastic:
 - .1 Jacket: ASTM C921, Sheet material, off-white colour.
 - .1 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .2 Maximum Service Temperature: 66 degrees C (150 degrees F).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.002 perm-inches.
 - .4 Thickness: 0.25 mm (10 mil).
 - .5 Connections: Brush on welding adhesive.
 - .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 Compatible with insulation.
- .3 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 [Flat/Smooth]
 - .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.
- .4 Aluminum Jacket: ASTM B209.
 - .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.

- .5 Stainless Steel Jacket: ASTM A167 Type 304 stainless steel.
 - .1 Thickness: 0.25 mm (0.010inch).
 - .2 Finish: Smooth.
 - .3 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.015 mm thick stainless steel.

Part 3**Execution****3.1****Examination**

- .1 Section 01 70 00 - Examination and Preparation: Verification of existing conditions before starting work.
- .2 Verify that equipment has been tested before applying insulation materials.
- .3 Verify that surfaces are clean and dry, with foreign material removed.

3.2**Installation**

- .1 Section 01 45 00: Manufacturer's written instructions.
- .2 Factory Insulated Equipment: Do not insulate.
- .3 Exposed Equipment: Locate insulation and cover seams in least visible locations.
- .4 Apply insulation close to equipment by grooving, scoring, and bevelling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- .5 Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapour barrier cement.
- .6 Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- .7 Apply insulation to pump casings to match form of pump.
- .8 Fibre glass insulated equipment containing fluids below ambient temperature: Provide vapour barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapour barrier adhesive.
- .9 For hot equipment containing fluids 60 degrees C (140 degrees F) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- .10 For hot equipment containing fluids over 60 degrees C (140 degrees F), insulate flanges and unions with removable sections and jackets. Jackets to be suitable for the service temperature.
- .11 Fibre glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapour barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- .12 Inserts and Shields:
 - .1 Application: Equipment 50 mm (2 inches) diameter or larger.
 - .2 Shields: Galvanized steel between hangers and inserts.

- .3 Insert location: Between support shield and equipment 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.
- .13 Finish insulation at supports, protrusions, and interruptions.
- .14 Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish unless otherwise indicated.
- .15 For exterior piping applications, provide vapour barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- .16 Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- .17 Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 Schedules

- .1 Plumbing Systems:
 - .1 Domestic Hot Water Storage Tanks: Glass Fibre, Flexible Insulation: 50 mm (2 inches) thick.
- .2 Domestic Cold Water Booster Pump Bodies: Cellular Foam Insulation: 12 mm (1/2 inch) thick. Heating Systems:
 - .1 Plate-type heat exchanger: not required.
 - .2 Air Separators: Glass Fibre, Flexible Insulation: 25 mm (1 inches) thick.
 - .3 Hot Thermal Storage Tanks: Glass Fibre, Flexible Insulation: 50 mm (2 inches) thick.
 - .4 Radiant Panels: See section 23 82 00 Terminal Heat Transfer Units for requirements.
- .3 Cooling Systems:
 - .1 Pump Bodies: Cellular Foam Insulation: 12 mm (1/2 inch) thick.
 - .2 Air Separators: Cellular Foam Insulation: 12 mm (1/2 inch) thick.
 - .3 Chiller Cold Surfaces (Not Factory Insulated): Cellular Foam Insulation: Minimum 19 mm (3/4 inch) thick, or match chiller supplier's specific requirements if more stringent.
 - .4 Cold Thermal Storage Tanks: Cellular Foam Insulation: 19 mm (3/4 inch) thick.
 - .5 Plate and Frame Heat exchangers: See section 23 57 00 Heat Exchangers for insulation requirements.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Piping insulation.
- .2 Jackets and accessories.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Painting insulation jacket.
- .2 Section 22 10 00 - Plumbing Piping: Placement of hangers and hanger inserts.
- .3 Section 23 05 53 - Mechanical Identification.
- .4 Section 23 21 00 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3 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 C449/C449M - Mineral Fibre Hydraulic-setting Thermal Insulating and Finishing Cement.
- .6 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .7 ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- .8 ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .9 ASTM C547 - Mineral Fibre Pipe Insulation.
- .10 ASTM C552 - Cellular Glass Thermal Insulation.
- .11 ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.
- .12 ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- .13 ASTM C591 - Unfaced Preformed Cellular Polyisocyanurate Thermal Insulation.
- .14 ASTM C610 - Moulded Expanded Perlite Block and Pipe Thermal Insulation.
- .15 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .16 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- .17 ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- .18 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- .19 ASTM E84 - Surface Burning Characteristics of Building Materials.

- .20 ASTM E96 - Water Vapour Transmission of Materials.
- .21 CAN/ULC-S102-M88 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .22 NFPA 255 - Surface Burning Characteristics of Building Materials.
- .23 UL 723 - Surface Burning Characteristics of Building Materials.

1.4 Quality Assurance

- .1 Materials: Flame spread/smoke developed rating of 25/50 or less to ASTM E84: NFPA 255; UL 723.

1.5 Qualifications

- .1 Applicator: Company specializing in performing the work of 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 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.

1.7 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 WITH 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 degrees C (0.24 at 75 degrees F).
 - .2 Minimum Service Temperature: -28.9 degrees C (-20 degrees F).
 - .3 Maximum Service Temperature: 454 degrees C (850 degrees 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 CELLULAR FOAM

- .1 Manufacturers:
 - .1 Armacell AP Armaflex.
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Insulation: ASTM C534; flexible, cellular elastomeric, moulded or sheet.
 - .1 'ksi' ('K') Value: ASTM C177 or C518; 0.04 at 24 degrees C (0.27 at 75 degrees F).
 - .2 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .3 Maximum Service Temperature: 104 degrees C (220 degrees F).
 - .4 Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
 - .5 Moisture Vapour Transmission: ASTM E96; 0.20 perm inches.
 - .6 Maximum Flame Spread: ASTM E84; 25.
 - .7 Maximum Smoke Developed: ASTM E84; 50.
 - .8 Connection: Waterproof vapour barrier adhesive.
- .3 Elastomeric Foam Adhesive
 - .1 Manufacturers:
 - .1 Armstrong 520 adhesive.
 - .2 Air dried, contact adhesive, compatible with insulation.
 - .3 Outdoor insulation shall be covered with Armstrong Armaflex finish.

2.3 Jackets

- .1 PVC Plastic
 - .1 Jacket: ASTM C921, One piece moulded type fitting covers and sheet material, off white colour.
 - .1 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .2 Maximum Service Temperature: 66 degrees C (150 degrees F).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.002 perm inches.
 - .4 Maximum Flame Spread: ASTM E84; 25.
 - .5 Maximum Smoke Developed: ASTM E84; 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 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.
- .4 Aluminum Jacket: ASTM B209.
 - .1 Thickness: 0.40 mm (0.016 inch) sheet.
 - .2 Finish: Embossed.
 - .3 Joining: Longitudinal slip joints and 50 mm (2 inch) laps.
 - .4 Fittings: 0.4 mm (0.016 inch) thick die shaped fitting covers with factory attached protective liner.
 - .5 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.38 mm (0.015 inch) thick aluminum.
- .5 Stainless Steel Jacket: Type 304 stainless steel.
 - .1 Thickness: 0.25 mm (0.010 inch).
 - .2 Finish: Smooth.
 - .3 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.25 mm (0.010 inch) thick stainless steel.

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 Use of aluminum self-adhering jacketing may be substituted for PVC, canvas and aluminum jacketing where the self-adhering jacketing performance meets the operating conditions of the installed condition.
- .4 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.
- .5 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.
- .6 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.
- .7 Finish insulation at supports, protrusions, and interruptions.
- .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 or cold 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 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.
- .5 On vertical runs, insulation support rings shall be used as required.
- .9 For pipe exposed in mechanical equipment rooms, finish with canvas jacket or self-adhering adhesive jacket sized for finish painting.
- .10 For all pipe in exposed in occupied areas, finish with canvas jacket or self-adhering adhesive jacket sized for finish painting. All piping to be painted.
- .11 For exterior piping applications, provide metal or self-adhering vapour barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Cover with aluminum jacket or self adhering jacket with seams located on bottom side of horizontal piping.
- .12 On outdoor chilled water and refrigerant lines, the insulation system shall be completely vapor sealed before the weather-resistant jacket is applied. 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. Piping 38mm (1-1/2 inches) and less shall have UV resistant PVC or self adhering jacket. Pipes larger than 38mm (1-1/2 inches) shall have aluminium or self adhering jacket.
- .13 For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- .14 For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- .15 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.
- .16 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.
- .17 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.
- .18 **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 <Inch><mm>	THICKNESS <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, medical gas piping	=< 2" (50mm)	1" (25mm)
	Domestic Cold Water, medical gas piping	> 2" (50mm)	1 ½" (38mm)
	Roof Drain Bodies	all	2" (50mm)
	Roof Drain piping above floor within 10 Feet (3 Metres) of the Exterior. Entire length of pipe where not trapped.	all	2" (50mm)

	PIPING SYSTEMS	PIPE SIZE <Inch><mm>	THICKNESS <Inch><mm>
	Plumbing Vents Within 10 Feet (3 Metres) of the Exterior	all	2" (50mm)
Heating Systems			
	Heating water & glycol supply and return	=< 2" (50mm)	1" (25mm)
	Heating water & glycol supply and return,	> 2" (50mm)	1-1/2" (38mm)
	High Pressure Steam	all	3" (75mm)
Cooling Systems			
	Chilled water & glycol	all	1" (25mm)
	Condenser water	all	1" (25mm)
	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)
	Refrigerant Liquid	all	3/4" (19mm)
	Refrigerant Hot Gas	all	3/4" (19mm)
Other Systems			
	Piping Exposed to Freezing with heat tracing	all	3" (75mm)

3.5

3.6

3.7 Cellular Foam Pipe Insulation Schedule

	PIPING SYSTEMS	PIPE SIZE <Inch><mm>	THICKNESS <Inch><mm>
	Refrigerant Liquid	all	3/4" (19mm)
	Refrigerant Hot Gas	all	3/4" (19mm)

3.8

3.9

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Pipe and pipe fittings for:
 - .1 Heating water piping system.
 - .2 Glycol water piping system.
 - .3 Chilled water piping system.
 - .4 Equipment drains and overflows.
- .2 Valves:
 - .1 Gate valves.
 - .2 Globe or angle valves.
 - .3 Ball valves.
 - .4 Plug valves.
 - .5 Butterfly valves.
 - .6 Check valves.

1.2 Related Sections

- .1 Section 08 31 00 - Access Doors And Frames.
- .2 Section 09 90 00 - Painting.
- .3 Section 23 05 16 – Piping Expansion Compensation.
- .4 Section 23 05 20 - Hydronic Specialties.
- .5 Section 23 05 29 – Supports and Anchors.
- .6 Section 23 05 48 - Vibration Isolation.
- .7 Section 23 05 53 - Mechanical Identification.
- .8 Section 23 07 19 - Piping Insulation.
- .9 Section 23 25 00 - Chemical Treatment For Piping.
- .10 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ASME -Welding and Brazing Qualifications.
- .2 ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.
- .3 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .5 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .6 ASME B31.9 - Building Services Piping.
- .7 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .8 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .9 ASTM B32 - Solder Metal.

- .10 ASTM B88 - Seamless Copper Water Tube.
- .11 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- .12 AWS A5.8 - Filler Metals for Brazing and Braze Welding.
- .13 AWS D1.1 - Structural Welding Code - Steel.
- .14 AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- .15 AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3 inch - 48 inch (76 mm - 1219 mm), for Water and Other Liquids.
- .16 AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Pressure Pipe and Fittings.
- .17 AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water.

1.4 System Description

- .1 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.
- .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 Supply and install check valves on condensate pump discharges and also where indicated on the drawings.
- .6 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.
- .7 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.
- .8 Grooved mechanical couplings and fasteners may only be used in accessible locations outside of mechanical rooms.
- .9 All piping within mechanical rooms shall be welded or threaded pipe.
- .10 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.
- .11 Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- .12 Provide pipe hangers and supports to ASTM B31.9 unless indicated otherwise.
- .13 Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .14 Use globe or butterfly valves for throttling, bypass, or manual flow control services.

- .15 Use spring loaded check valves on discharge of pumps.
- .16 Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- .17 Use butterfly valves in 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.
- .18 Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.
- .19 Use lug end butterfly valves to isolate equipment.
- .20 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.

1.5 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- .3 Welders Certificate: Include welders certification of compliance with ASME SEC 9 and applicable provincial labour regulations.
- .4 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.6 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of valves.

1.7 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.

1.8 Qualifications

- .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 labour regulations.

1.9 Regulatory Requirements

- .1 All pressure piping systems for use in Manitoba shall be designed and constructed in accordance with the applicable ANSI/ASME Piping Codes and the Manitoba Labour and Immigration, Steam and Pressure Plants Act.
- .2 Conform to ASME B31.9 code for installation of piping system.
- .3 Welding Materials and Procedures: Conform to ASME SEC 9 and applicable provincial labour regulations.
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.10 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.

1.11 Environmental Requirements

- .1 Do not install underground piping when bedding is wet or frozen.

1.12 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 HEATING WATER AND GLYCOL PIPING, ABOVE 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.
 - .3 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- .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.

2.2 CHILLED WATER PIPING, ABOVE GRADE

- .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.
 - .3 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- .2 Copper Tubing: ASTM B88, Type L hard drawn.
 - .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). Diameters 63mm (2-1/2") to 100mm (4"): Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 640 - 805 degrees C (1190 - 1480 degrees F).

2.3 EQUIPMENT DRAINS AND OVERFLOWS

- .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 Grooved and Shouldered Pipe End Couplings:
 - .1 Housing Clamps: Malleable iron to engage and lock, designed to permit some angular deflection, contraction, and expansion.
 - .2 Sealing Gasket: C-shape elastomer composition for operating temperature range from -34 degrees C (-30 degrees F) to 110 degrees C (230 degrees F).
 - .3 Accessories: Steel bolts, nuts, and washers.
- .4 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
Rising Stem, Union Bonnet, Solid Wedge Disc
150: Threaded: 42, 42T Soldered: 43
Threaded: 37 Soldered: Use Adaptors
Class 300: Kitz
 - .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
 - .4 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 Globe Or Angle Valves

- .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 Valves

- .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, [or gear drive handwheel for sizes 250 mm (10 inches) and over,] 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, [40 percent] [70 percent] [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, [40 percent] [70 percent] [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 Spring Loaded Check Valves

- .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 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 Install heating water, glycol, chilled water, and condenser water piping to 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 Install piping to conserve building space, and not interfere with use of space.
- .5 Group piping whenever practical at common elevations.
- .6 Sleeve pipe passing through partitions, walls and floors.
- .7 Slope piping and arrange to drain at low points.
- .8 Provide piping on glycol systems from air vents to associated glycol fill tank.
- .9 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .10 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.
- .11 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.
- .12 Overhead radiant panel branch connections:
 - .1 Copper soft temper tubing shall be used only for interconnecting panels in each individual room and for branch connections from valves to panels.
 - .2 Use 95-5 tin antimony solder at all joints. Fittings to be Emco smooth bore fittings.
- .13 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- .14 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .15 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- .16 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 90 00.
- .17 Install valves with stems upright or horizontal, not inverted.
- .18 All hydronic equipment, manifolds, and headers shall be provided with isolation valves at all connections, complete with unions or flanges.

3.3 Pressure Testing

- .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.

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- .4 Hydronic pipe testing shall be in accordance with the applicable ASME piping code, the Contractor's registered Quality Assurance Program (for systems where applicable), and all requirements of the Department of Labour .
 - .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 Subject piping to a hydrostatic pressure of at least that 1-½ 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.
 - .8 Register pressures at the highest system point.
 - .9 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

Section Includes

- .1 In-line circulators.
- .2 Vertical in-line pumps.
- .3 Close coupled pumps.
- .4 Side-stream filters.

1.2

Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete.
- .2 Section 23 05 13 - Motors.
- .3 Section 23 05 48 - Vibration Isolation.
- .4 Section 23 07 19 - Piping Insulation.
- .5 Section 23 07 16 - Equipment Insulation.
- .6 Section 23 21 00 - Hydronic Piping.
- .7 Section 23 05 20 - Hydronic Specialties.
- .8 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 UL 778 - Motor-Operated Water Pumps.

1.4

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.

1.5

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.

1.6

Project Record Documents

- .1 Section 21 05 00: Procedures for submittals.
- .2 Record actual locations of hydronic pumps.

1.7 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.

1.8 Quality Assurance

- .1 Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three (3) years documented experience.
- .2 Alignment: Align base mounted pumps by qualified millwright.
- .3 Impeller trimming: Trimming of impeller by qualified millwright

1.9 Regulatory 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.

1.10 Extra Materials

- .1 Section 21 05 00: Procedures for submittals.
- .2 Provide one set of mechanical seals for each pump.
- .3 Provide 2 sets of cartridges for each side-stream filter.

Part 2 Products

2.1 MANUFACTURERS

- .1 Bell & Gossett
- .2 Armstrong
- .3 Taco
- .4 Substitutions: Refer to Section 21 05 00.

2.2 SYSTEM LUBRICATED CIRCULATORS

- .1 Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 1035 kPa (150 psig) maximum working pressure, 107 degrees C (225 degrees F) maximum water temperature.
- .2 Casing: Cast iron with flanged pump connections.
- .3 Impeller: Noryl
- .4 Shaft : Ceramic.
- .5 Bearings: Metal Impregnated carbon (graphite) and ceramic.
- .6 Motor: Impedance protected, speed.
- .7 Performance:
 - .1 See Schedule

- .8 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

2.3 SYSTEM LUBRICATED CIRCULATORS (Cast Iron Heating and Cooling)

- .1 Type: Horizontal shaft, single stage, direct connected with speed controlled wet rotor motor for in-line mounting, for 1207 kPa (175 psig) maximum working pressure, 110 degrees C (230 degrees F) maximum water temperature.
- .2 Casing: Cast iron with flanged pump connections.
- .3 Impeller: Stainless Steel
- .4 Shaft : Stainless Steel
- .5 Bearings: Metal Impregnated carbon sleeve
- .6 Motor:
 - .1 ECM
 - .2 Class F insulation
 - .3 Integrated motor protection shall be verified by UL to protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).
 - .4 On-board thermal overload protection.
- .7 Control
 - BACnet
 - Analog inputs for pressure and temperature control
- .8 Performance:
 - .1 See Schedule
- .9 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

2.4 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, EPT Tungsten/Carbide seal, 120 degrees C (250 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.

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- .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.
- .9 Close Coupled Pumps
- .1 Armstrong Design Envelope Sensorless 4380 Closed Coupled Type Vertical In-Line Centrifugal pumping unit. The pump shall be radially split, single stage centrifugal type with BF casing with equal size suction and discharge flanges and having separate tapped flush line and pressure gauge connections, Bronze (BS1400 Grade LG1) dynamically balanced impeller, 316SS shaft sleeve, inside type mechanical seal, with carbon rotating face, Sintered Silicon Carbide stationary seat, and EPDM secondary seal. The pump is to be fitted with a factory installed flush line.
 - .2 Supply in the flush line to the mechanical seal, a 50 micron cartridge filter alternatively, a cyclone separator when pump differential pressure exceeds 30 PSIG) and floating ball type sight flow indicator suitable for the working pressure encountered. The mechanical subcontractor shall change the filters after the system has been flushed and on a regular basis until the pumps are turned over to The City. The driving motor shall be an industry standard, vertical solid shaft, squirrel cage induction type with TEFC enclosure.
 - .3 Type: Horizontal shaft, single stage, close coupled, radially split casing, for vertical or horizontal installation, operations at 107 degrees C (225 degrees F) and 1205 kPa (175 psig) working pressure. Working pressures shall not be de-rated at temperatures up to 120 degrees C (250 degrees F).
 - .4 Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
 - .5 Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
 - .6 Furnished and installed with capacities as shown on plans. Pumps shall be in-line type, close-coupled single stage design, for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.
 - .7 The pump internals shall be capable of being services without disturbing piping connections.
 - .8 Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components.
 - .9 Pump should be designed to allow for true back pull-out access to the pump's working components for ease of maintenance.
 - .10 The pumps shall have a solid alloy stainless steel shaft that is integral to the motor. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.
 - .11 Pump shaft shall connect to a brass impeller. Impeller shall be hydraulically and dynamically balanced, keyed to the shaft and secured by a stainless steel locking capscrew or nut.
 - .12 The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.

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- .13 Seal: Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Seal assembly shall have a brass housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face. .
- .14 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
- .15 Pump volute: cast iron design, rated for 1205 kPa (175 psig) with integral cast iron flanges drilled for 125# ANSI companion flanges and shall include gauge ports at nozzles, and vent and drain ports.
- .16 Motor: Complete with integral VFD:
- .1 The driving motor shall be an industry standard, vertical solid shaft, squirrel cage induction type with TEFC enclosure. The variable frequency drive & controls shall be rated UL Type 12 or UL Type 4X and be an integral component of the pumping unit with a TEFC, 575/3/60, motor efficiency NEMA Prem (12.12).
 - .2 The integrated VFD shall be of the VVC-PWM type providing near unity displacement power factor ($\cos \phi$) without the need for external power factor correction capacitors at all loads and speeds. The VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents and to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. RFI filters will be fitted as standard to ensure the VFD meets low emission and immunity requirements.
 - .3 VFD and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over-voltage, under-voltage, motor over-temperature, inverter overload, over-current.
 - .4 Where selected, VFD shall have Sensorless control software to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor. The default operating mode under Sensorless control shall be Quadratic Pressure Control (QPC) whereby head reduction with reducing flow will be according to a quadratic control curve, the head at minimum flow being 40% of the design duty head. Control mode setting and minimum/maximum head setpoints shall be user adjustable via a built-in programming interface.
 - .5 If the quantity of pumps in a system is 2 to 4-maximum, including any standby, a Sensorless controller shall be added to a pumping unit and set up at the factory to operate in parallel Sensorless mode. The pump controls, which will be linked on site by the control contractor, will automatically stage the units, as appropriate, to maintain the best efficiency pumping and minimum operating cost. The standby unit will be brought into the rotation to exercise and equalize wear. The sequence of controls and staging points will be submitted to the Contract Administrator for approval at the time of order.
 - .6 The VFD shall have the following additional features:
 - .1 Sensorless override for BAS/BMS control signal
 - .2 Manual pump control or closed loop PID control

- .3 Programmable skip frequencies and adjustable switching frequency for noise and vibration control
- .4 Auto alarm reset
- .5 Four programmable digital inputs, two analog inputs, one programmable analog / digital output
- .6 One volt-free contact
- .7 One RS485 port for serial communications to building management systems
- .8 Standard serial communication protocols BACnet MS/TP
- .7 Environmental Ratings
 - .1 Temperature: 14°F to 113°F up to 3300 ft (-10°C to 45°C up to 1000 m)
 - .2 Max Relative Humidity: 0 to 95%
- .10 Split Coupled Pumps
 - .1 Supply and install as shown on plans and specifications, Armstrong Series 4300 Design Envelope IVS pumps. The pumps shall be single stage, single or double suction type, vertical inline design with integrated controls. The seal shall be serviceable without disturbing the motor or the piping connections. The capacities and characteristics shall be as outlined in the plans and specifications. The complete pump unit shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108.
 - .2 Pump casing shall be constructed of ASTM A48 class 30 cast iron with ANSI 125 / PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (66°C) and ASTM A536 ductile iron with ANSI 250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (66°C). The casing shall be hydrostatically tested to 150%maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line.
 - .3 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.
 - .4 The impeller shall be bronze, fully enclosed type. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.
 - .5 The pump shaft shall be stainless steel.
 - .6 The coupling is to be rigid spacer type constructed of high tensile aluminum alloy. The coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.

- .7 The pump shall be fitted with an outside balanced type mechanical seal, with Viton elastomers and antimony carbon (or resin-bonded carbon for potable water applications) vs. silicon carbide faces rated up to 250°F (121°C) A 316 stainless steel gland plate shall be provided with a factory installed flush line with manual vent.
- .8 All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.
- .9 If required to improve seal chamber cleanliness, supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered.
- .10 Alternately, supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator for pump differential pressures exceeding 30 psig (or 200 kPa).
- .11 The motor frame shall be NEMA TC type. Motor enclosure is to be ODP or TEFC with NEMA Premium Efficiency 12.12 rating. Acceptable motor insulation for variable speed operation is NEMA MG-1 Part 31.
- .12 The variable frequency drive & controls shall be rated UL Type 12 or UL Type 4X and be an integral component of the pumping unit with a 15 hp, TEFC, 575/3/60.
- .13 The integrated VFD shall be of the VVC-PWM type providing near unity displacement power factor ($\cos \phi$) without the need for external power factor correction capacitors at all loads and speeds. The VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents and to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. RFI filters will be fitted as standard to ensure the VFD meets low emission and immunity requirements.
- .14 VFD and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over-voltage, under-voltage, motor over-temperature, inverter overload, over-current.
- .15 Where selected, VFD shall have Sensorless control software to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor. The default operating mode under Sensorless control shall be Quadratic Pressure Control (QPC) whereby head reduction with reducing flow will be according to a quadratic control curve, the head at minimum flow being 40% of the design duty head. Control mode setting and minimum/maximum head setpoints shall be user adjustable via a built-in programming interface.
- .16 If the quantity of pumps in a system is 2 to 4-maximum, including any standby, a Sensorless controller shall be added to a pumping unit and set up at the factory to operate in parallel Sensorless mode. The pump controls which will be linked on site by the control contractor, will automatically stage the units, as appropriate, to maintain the best efficiency pumping and minimum operating cost. The standby unit will be brought into the rotation to exercise and equalize wear. The sequence of controls and staging points will be submitted to the Contract Administrator for approval at the time of order.
- .17 The VFD shall have the following additional features:
 - .1 Sensorless override for BAS/BMS control signal
 - .2 Manual pump control or closed loop PID control

- .3 Programmable skip frequencies and adjustable switching frequency for noise and vibration control
- .4 Auto alarm reset
- .5 Four programmable digital inputs, two analog inputs, one programmable analog / digital output
- .6 One volt-free contact
- .7 One RS485 port for serial communications to building management systems
- .8 Standard serial communication protocol BACnet Native (default)
- .18 Environmental Ratings
 - .1 Temperature: 14°F to 113°F up to 3300 ft (-10°C to 45°C up to 1000 m)
 - .2 Max Relative Humidity: 0 to 95%

- .11 Parallel Sensorless Pump Controller
 - .1 Mechanical and Electrical Details
 - .1 For Sensorless IVS pumping units, 4380 series operating in parallel, the pump logic controller shall be Armstrong Parallel Sensorless Pump Controller (PSPC). The PSPC pump logic controller shall be specifically designed for the control of multiple pumps in HVAC hot and/or chilled water systems that involve up to 4-variable speed pumps, with Sensorless Control, in parallel, staged, sequenced, and standby configurations.
 - .2 The PSPC pump logic controller shall allow field adjustments of control parameters as described below.
 - .1 The PSPC controller shall be capable of accepting, processing and displaying appropriate signals from the individual pump controls for the following values;
 - .1 System Status
 - .2 Total Sensorless flow
 - .3 Sensorless head
 - .4 Total power
 - .5 Pumps speed
 - .6 Alarm
 - .7 Wire to water efficiency (calculated)
 - .8 Number of pumps running
 - .9 Lead pump number
 - .2 Individual Pump Status
 - .1 Speed Ref (%)
 - .2 Speed (%) (rpm)
 - .3 Run time (hrs)
 - .4 Fault Nbr
 - .5 Run status (running/stopped)
 - .3 Individual Pump IVS-102 control status
 - .1 Current (Amps)

- .2 Volts (VAC)
- .3 Power (kW)
- .4 Head
- .5 Flow
- .3 The PSPC pump logic controller shall be suitable for indoor or outdoor applications and shall be capable of being integrated with Design Envelope IVS pumping units for pumping packages approved to UL 778 & CSA STD C22.2 No 108 standards and also suitable for wall mounting with separate Armstrong IVS pumping units and stand-alone IVS102 pump controls.
- .4 The PSPC controller shall have 3-levels of password security, first level to view only (No password required); the second level is for field adjustable parameters and the third level for factory/commissioning setup parameters.
- .5 The PSPC controller shall stage the pumping units to ensure optimum pumping energy usage and shall sequence the pumps starting order, including any standby unit.
- .6 The PSPC controller shall be fed with a power supply from each pumping unit controls in the control 'daisy-chain' so that a loss of power to any pump unit controls will not affect the PSPC controller pumping operation. Should the PSPC controller go off-line, all pumps in auto-mode will operate together to provide the correct system flow needs. Staging of the units will resume as the PSPC controller is brought back online.
- .7 The PSPC integrated controller shall be capable of being easily integrated on any other pumping unit should the need occur. Simple mounting in pre-designed location and wiring will be all that is required.
- .2 Performance and Operating Logic
 - .1 The PSPC pump logic controller shall determine the most efficient combination of operating pumps, and pump operating speed based from the individual pump controls input.
 - .2 The PSPC pump logic controller shall respond to the system load flow needs by adjusting either the number of operating pumps, or the speed of the operating pumps.
 - .3 The PSPC pump logic controller shall continuously monitor the system requirements and ensure that the operating point is maintained on the PSPC control curve to meet the system needs with optimized pumping energy usage.
 - .4 The PSPC pump logic controller shall sequence the pumps based on a field adjustable interval of operating hours. The controls shall incorporate embedded logic to prevent hunting, pump flow surge, and motor overloading. The controller logic shall incorporate an adjustable PID control loop.
 - .5 Should any pumping unit or pumping unit controller fail, the appropriate alarm signal shall be activated. In the place of the failed assembly, a standby pumping unit shall be operated in variable speed mode, or the next pump will start if there is no standby.

- .6 The PSPC controller shall have hand-off-automatic (H-O-A) control and should provide the option for a remote on/off signal by a BMS communication signal.
- .7 The PSPC pump logic controller shall be self-prompting. All messages shall be displayed in plain English. The operator interface shall have multi-fault memory and recall on-screen help functions, and separate user screens for overview, pump and setup.
- .8 The PSPC pump logic controller shall automatically disable any flow signals that are not within limits and alert the operator of a possible control failure.
- .9 The PSPC pump logic controller shall have the system design flow, system design head and minimum head limit entered as field adjustable parameters, factory loaded. The default for the minimum head is 40% of the design head.
- .3 Operator Screens
 - .1 Source of control: local or remote.
 - .2 PSPC status: on/off.
 - .3 Pump information: running/off/alarm, HOA status, pump ID 1, pump ID 2, stand-by, etc.
 - .4 Individual pump controls information: speed, amps, power, volts AC, flow and head
 - .5 Set point and error of flow and head
 - .6 Individual cumulative pump hours of operation
 - .7 System set-point and error
- .4 Alarm Screens
 - .1 Alarms with time stamp
 - .2 Alarm help
 - .3 Diagnostic indicating status (ok or bad) of PLC, memory, network and communication, PLC Software version
- .5 Setup Screens
 - .1 Level 0. No password, allows view only access
 - .2 Level 1. Allows modification of all parameters, except pump PID and BMS setup. Allows Restoring previously saved values
 - .3 Level 2. Allows modification of all parameters. Allows saving and restoring all parameters
 - .4 Levels 1 & 2 are password protected
- .6 BMS communication
 - .1 The PSPC shall be capable of serial communication with a BMS with the following protocol:
 - .1 BACnet MS/TP
 - .2 The following points will be available through the communication protocol:
 - .1 Total Sensorless flow
 - .2 Sensorless head
 - .3 Total real-time power consumption
 - .4 Pump speed
 - .5 Individual pump run status
 - .6 Alarm

- .7 Wire to water system efficiency
- .8 Number of pumps operating
- .9 Lead pump ID
- .10 Remote start/stop
- .11 PSPC on/off status
- .12 Pump controls information: running/off/alarm, HOA, duty 1, duty 2, stand-by, etc.
- .13 Pump controls information: speed, current, power, Volts AC, flow and head
- .14 Pump hours of operation
- .15 Head and flow Set point

2.5 Side-stream Filtration System

- .1 Manufacturers:
 - .1 General Filtration
 - .2 3M (Cuno).
 - .3 Sumco.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 System: Flow indicator, filter housing with cartridge filter, shut-off valves, and flow control valve.
- .3 Performance: Design flow 0.25 L/s (4 gal/min) with maximum pressure drop of 25.6 kPa (4 psig), based on water.
- .4 Hot Water and Glycol Filter Housing: Stainless steel housing suitable for 105 degrees C (220 degrees F) and 1380 kPa (200 psig) operating conditions.
- .5 Chilled Water Filter Housing: Stainless steel housing suitable for 52 degrees C (125 degrees F) and 860 kPa (125 psig) operating conditions.
- .6 Cartridges: Stringwound cartridge filters, 0.03 mm (30 micron) for start-up and 0.005 mm (5 micron) for system operation.

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, pump suction fitting 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 a minimum of 5x suction diameter of pipe on pump suction of pipe size shown on drawings
- .7 Provide air cock and drain connection on horizontal pump casings.
- .8 Provide drains for bases and seals, piped to and discharging into floor drains or, in the case of glycol, to a suitable container.
- .9 Provide drain lines with ball valves from strainers and filters to nearest floor drain or, in the case of glycol, to a suitable container.
- .10 Manufacturer approved millwright or agent to check, align, and certify alignment of base mounted pumps prior to start-up.
- .11 Lubricate pumps before start-up.
- .12 Provide side-stream filtration system for systems as shown on schematic diagrams Install across pump with flow from pump discharge to pump suction from pump tappings. Refer to 23 25 00 – Chemical Treatment for Closed Systems.
- .13 Provide flow measurement ports as shown on drawings, on piping schematics, and in locations as directed by the water balancing specialist.
- .14 Provide any pump impeller modifications as recommended by Division 23 05 93 – Testing Adjusting and Balancing.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Cleaning of pipe and fittings.
- .2 Chemical feed equipment.
- .3 Chemical treatment.

1.2

Related Sections

- .1 Section 25 30 00 - Instruments And Control Elements.
- .2 Section 23 21 00 - Hydronic Piping: Placement of water coupon rack, by-pass (pot) feeder.
- .3 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- .3 Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- .4 Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
- .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.

1.4

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.

1.5

Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data:
 - .1 Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs.
 - .2 Include step by step instructions on test procedures including target concentrations. Provide with manufacturer's logging record book or sample sheet.
 - .3 Include record of water and glycol tests at building turn-over to The City.
 - .4 Provide all MSDS information for chemicals supplied.

1.6 Qualifications

- .1 Vendor: Specified Technical Sales
- .2 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.
- .3 Installer: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.7 Regulatory 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.

1.8 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.

1.9 Maintenance Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide sufficient chemicals for treatment and testing during warranty period.

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)

2.3 BY-PASS (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: Pal LMO-10 ¾" filter housing, STS ¾" Filtermate flow indicator, provide (40) 10 micron filter cartridges
- .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, 0.03 mm (30 micron) for start up and 0.005 mm (5 micron) 0.010 mm (10 Micron) for system operation.
 - .1 Provide 20 40 cartridges to the project.

2.5 Test Equipment

- .1 Closed System (Hot or Chilled Water): Provide a L6213 molybdate test kit.

Part 3 Execution

3.1 Preparation

- .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 Cleaning Sequence

- .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 System Treatment

- .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 Change side stream filter cartridges as required or indicated by the flow indicator.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Metal duct work.
- .2 Casing and plenums.
- .3 Kitchen hood duct work.
- .4 Duct cleaning.

1.2 Related Sections

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 03 30 00 - Cast-in-place Concrete.
- .3 Section 09 90 00 - Painting: Weld priming, weather resistant, paint or coating.
- .4 Section 11 40 00 - Food Service Equipment: Supply of kitchen range hoods for placement by this Section.
- .5 Section 23 05 29 - Supports And Anchors: Sleeves.
- .6 Section 23 05 93 - Testing, Adjusting, And Balancing.
- .7 Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- .8 Section 23 33 00 - Duct Work Accessories.
- .9 Section 23 36 00 - Air Terminal Units.
- .10 Section 23 37 00 - Air Outlets And Inlets.

1.3 References

- .1 ASTM A36/A36M - Carbon Structural Steel.
- .2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- .3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

- .6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
- .8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
- .9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .10 AWS D9.1 - Sheet Metal Welding Code.
- .11 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyester Chemical Resistant Process Equipment.
- .12 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .13 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
- .14 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.
- .15 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .16 SMACNA - HVAC Air Duct Leakage Test Manual.
- .17 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .18 UL 181 - Factory-Made Air Ducts and Connectors.
- .19 South Coast Air Quality Management District (SCAQMD)

1.4 Rule 1168 – Adhesive And Sealant Applicationsperformance 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.

1.5 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data for kitchen hood ductwork including penetrations.

1.6 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.

1.7 Quality Assurance

- .1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .2 Maintain one copy of document on site.

1.8 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.

1.9 Regulatory Requirements

- .1 Construct commercial kitchen exhaust duct work to NFPA 96 standards.

1.10 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.
- .3 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168 Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

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 Steel Ducts: ASTM A1008, A568.
- .3 Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.
- .4 Insulated Flexible Ducts:
 - .1 Manufacturers:
 - .1 Thermaflex G-KM
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Thermally insulated flexible duct with acoustically rated black CPE core permanently bonded to a coated spring steel wire helix, with fibreglass insulation over fibreglass scrim and polyethelyne vapour barrier. Pressure

- rating of 6" W.G. (positive) for 4" – 20" I.D. Temperature range -20 °F to 200 °F continuous, R-value R-4.2.
- .3 The ductwork shall meet NFPA Pamphlet 90A paragraph 113 (a) for flame spread and smoke rating and to meet Underwriter's Laboratories of Canada requirements.
 - .4 Flexible air ducts shall conform to UL-181 Standard and NFPA 90A. Flexible air ducts shall have a fire rating of at least one-half hour as measured by UL-181 Standard, paragraph No. 7, Flame Penetration Test.
 - .5 Stainless Steel Ducts: ASTM A167, Type 304 and 316
 - .6 Fasteners: Rivets, bolts, or sheet metal screws.
 - .7 Sealant:
 - .1 Manufacturers:
 - .1 Duro-Dyne
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
 - .8 Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 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.

2.3 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.

2.4 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 servery 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.
- .5 Horizontal ducting support systems for nonlisted grease duct systems 600 mm (24 inches) and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 363 kg (800 lbs) at any point in the duct systems.

2.5 Kitchen Dishwasher Exhaust Duct Work

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- .2 Constructed 0.80 mm (22 gauge) stainless steel, using continuous external welded joints to provide a watertight seal.

2.6 LABORATORY FUME HOOD EXHAUST DUCT WORK

- .1 All fume hood exhaust ductwork shall be constructed of 316 stainless steel ga. and shall be all welded construction. All welds shall be clean and watertight.

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 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.
- .9 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.
- .10 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.
- .11 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.
- .12 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .13 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.
- .14 Use only threaded rod for duct support in exposed areas. Strapping not allowed.

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- .15 Use double nuts and lock washers on threaded rod supports.
 - .16 Insulated Flexible ductwork: Maximum installed horizontal length: One continuous length at 1500 mm (5'-0"). Use standard sheet-metal elbows at drop points to outlets. Use of the flexible duct in lieu of an elbow at the diffuser drop point is not permitted. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
 - .17 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.
 - .18 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.
 - .19 Where interior of duct is visible through grilles, registers or diffusers, paint interior of duct with flat black Tremco paint formulated for galvanized surfaces.
 - .20 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.
 - .21 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.
 - .22 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 (1½") above the bottom of the duct.
 - .23 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.
 - .24 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.
 - .25 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 Duro-Dyne S-2 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.
 - .26 All ductwork located outdoors shall have seams and joints sealed with grey TREMCO 555 acrylic sealant applied with gun and levelled with putty knife. Use material in accordance with manufacturer's printed recommendations.
 - .27 Stainless steel ductwork exposed in finished rooms shall not have duct tape application.
 - .28 Install ductwork free from pulsation, chatter, vibration or objectionable noises.

- .29 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.

3.2 Cleaning

- .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.
- .2 Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into duct work for cleaning purposes.

3.3 Schedules

3.4 DUCT WORK MATERIAL SCHEDULE

	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
	Combustion Air	Steel
	Kitchen Hood Exhaust	Steel, 304 Stainless Steel
	Dishwasher Exhaust	Steel, 304 Stainless Steel
	Laboratory Fume Hood Exhaust	316 Stainless Steel
	Clothes Dryer Exhaust	Aluminum

3.5 Duct Work Pressure Class Schedule

	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)
	Combustion Air	125 Pa (1/2 inch)
	Dishwasher Exhaust	250 Pa (1 inch)
	Kitchen Hood Exhaust	
	Fume Hood Exhaust	750 Pa (3 inch)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Duct silencers.
- .2 Cross-talk silencers.
- .3 Acoustic housings.
- .4 Duct work lagging.
- .5 Acoustical louvres.

1.2 RELATED SECTIONS

- .1 Section 07 92 00 - Joint Sealants.
- .2 Section 23 07 13 – Duct Insulation.
- .3 Section 23 31 00 - Duct Work: Connections to silencers.
- .4 Section 23 33 00 - Duct Work Accessories: Flexible duct connections.

1.3 References

- .1 AABC - National Standards for Total System Balance.
- .2 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .3 AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .4 AMCA 302 - Application of Sone Ratings for Non-Ducted Air Moving Devices.
- .5 AMCA 303 - Application of Sound Power Level Ratings for Fans.
- .6 ANSI S1.1 - Acoustical Terminology.
- .7 ANSI S1.8 - Preferred Reference Quantities for Acoustical Levels.
- .8 ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
- .9 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- .10 ARI 575 - Measuring Machinery Sound Within an Equipment Space.
- .11 ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.
- .12 ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.
- .13 ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.
- .14 ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
- .15 ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".
- .16 ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission loss of Building Partitions and Elements.

- .17 ASTM E477 - Method of Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- .18 ASTM E596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
- .19 NEBB - Procedural Standards for Measuring Sound and Vibration.
- .20 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.4 Definitions

- .1 Submittals and Report: Conform to ANSI S1.1.

1.5 PERFORMANCE REQUIREMENTS

- .1 Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.
- .2 Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook.
 - .1 Offices
 - .1 Executive: 25
 - .2 Conference rooms: 25
 - .3 Private: 30
 - .4 Open-plan areas: 35
 - .5 Computer/business machine areas: 40
 - .6 Public circulation: 40
 - .2 Schools
 - .1 Lecture and classrooms: 25
 - .2 Open-plan classrooms: 30
 - .3 Libraries: 30
 - .4 Shop: 40

1.6 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.
- .3 Product Data: Provide catalogue information indicating, materials, dimensional data, pressure losses, and acoustical performance. Acoustical performance shall be obtained in accordance with ASTM E477.
- .4 Design Data: Provide engineering calculations, referenced to specifications and noted standards indicating that maximum room sound levels are not exceeded.
- .5 Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.
- .6 Manufacturer's Field Reports: Indicate installation is complete and to instructions.

1.7 PROJECT RECORD DOCUMENTS

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of acoustic housings. duct work lagging.

1.8 Quality Assurance

- .1 Perform Work to AMCA 300 standards and recommendations of ASHRAE 68.
- .2 Maintain one copy of each document on site.

1.9 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.10 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for sound levels at property line.

Part 2 Products

2.1 ABSORPTIVE DUCT SILENCERS

- .1 Manufacturers:
 - .1 Price.
 - .2 VAW Industries
 - .3 Vibro-Acoustics
 - .4 Vibron Limited
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Configuration: Rectangular with lined splitters with radiused nose and contoured tails. Contour and radius to be designed for flow velocity requirements (low, medium, high velocity as noted in schedule).
- .4 Materials:
 - .1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, slip joints on both ends. Screws or other mechanical fastening systems not acceptable.
 - .2 Outer Casing: Minimum [1.6 mm (16 gauge)] [3.5 mm (10 gauge)] thick galvanized steel stiffened as required, with welded seams, slip joints on both ends. Screws or other mechanical fastening systems not acceptable.
 - .3 Inner Casing and Splitters: Minimum 0.5 mm (26 gauge) thick perforated galvanized steel.

- .4 Fill: shot-free inorganic glass fibre with long, resilient fibers, bonded with thermosetting resin. Glass fibre shall be packed with a minimum 10% compression to eliminate voids and settling; 64 kg/cu m (4 lb/cu ft) density.
- .5 Fill Liner: Bonded glass fibre matting. [0.0254 mm (1 mil) polymer film.]
- .5 Performance ratings as per the schedule. Provide, at a minimum, the following sample submittal information with manufacturer's data:
 - .1 ASTM E477 Insertion Loss and Maximum Generated Noise for specific face velocity. Indicate the related pressure drop across silencer, Pa (inches w.g.):

	Octave Band Centre Frequency (Hz)
	63 125 250 500 1000 2000 4000 8000
Insertion Loss (dB)	[] [] [] [] [] [] [] []
Generated Noise (dB)	[] [] [] [] [] [] [] []

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Support duct silencers independent of duct work with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet.

3.2 MANUFACTURER'S FIELD SERVICES

- .1 Prepare and start systems to Quality Assurance clauses in Section 21 05 00.
- .2 Inspect installation periodically to Quality Assurance clauses in Section 21 05 00.
- .3 Provide services of AABC testing agency to take noise measurement. Use meters meeting requirements of ASA 47 (ANSI S1.4).
- .4 After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations, as directed.
- .5 Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements.
- .6 Submit complete report of test results including sound curves.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Air turning devices/extractors.
- .2 Backdraft dampers.
- .3 Barometric relief dampers.
- .4 Fire Dampers
- .5 Combination fire and smoke dampers.
- .6 Duct access doors.
- .7 Duct test holes.
- .8 Flexible duct connections.
- .9 Volume control dampers.
- .10 Ceiling Fans
- .11 Dryer Vent Stack Jack

1.2

Related Sections

- .1 Section 23 05 48 - Vibration Isolation.
- .2 Section 23 31 00 - Duct Work.
- .3 Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.
- .4 Section 25 30 00 – Instrument and Control Elements
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .2 NFPA 92A - Smoke-Control Systems.
- .3 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .5 CAN/ULC-S112 Standard Method of Fire Test of Fire-Damper Assemblies
- .6 UL 33 - Heat Responsive Links for Fire-Protection Service.
- .7 UL 555 - Fire Dampers.
- .8 UL 555S - Smoke Dampers.
- .9 CAN/ULC-S112.2, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.

1.4

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of access doors.

1.6 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 Regulatory 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.

1.8 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 TURNING 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 Barometric Relief Dampers

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Ruskin
 - .3 Nailor
- .2 Ratings
 - .1 Dampers shall have a maximum differential pressure rating of 2 in.wg (500Pa) and a maximum velocity rating of 2000 fpm (10m/s).
- .3 Construction
 - .1 Frame: Frame shall be 16ga. Galvanized steel.
 - .2 Blades: damper blades shall be .063in thick aluminium.
 - .3 Seals:
 - .1 Blades edge: Seals shall be Vinyl.

- .2 Jamb: Seals shall be EPDM.
- .4 Linkage: External, steel tie bars.
- .5 Axles: Plated steel stub axles.
- .6 Bearings: Galvanized Steel press fit.
- .7 Mill finish
- .8 Counterbalance: Blade mounted with adjustable weights
- .9 Mounting: Refer to drawings.

2.4 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.

2.5 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;

2.6 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 N.B.C.
 - .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 [100] [____] degrees C, (160 [212] [____] degrees F) with adjustable link straps for combination fire/balancing dampers.
- .9 Fire dampers in stainless steel exhaust duct systems shall have #316 stainless steel blades, shafts, linkage and casing. Refer to clause 'Stainless Steel Exhaust Ductwork' in this section.

2.7 FLEXIBLE DUCT CONNECTIONS

- .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.

2.8 COMBINATION FIRE SMOKE DAMPERS

- .1 Manufacturers:
- .1 Price.
 - .2 Nailor.
 - .3 Ruskin.

- .4 Substitutions: Refer to Section 21 05 00.
- .2 Fabricate to NFPA 90A and UL 5555, and ULC S 112.
- .3 Dampers: UL Class 1 multiple blade type fire damper, normally closed, automatically operated by electric actuator.
- .4 Electro Thermal Link: Fusible link melting at 74 degrees C (165 degrees F); 120 volts, single phase, 60 Hz; UL listed and labeled.
 - a. Provide position Indicator Switch Package to all smoke dampers to allow damper status be monitored at FACP.

2.9 Volume Control Dampers.

- .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.

2.10 Remote Balancing Dampers

- .1 Manufacturer: Greenheck
 - .1 Model: RBDR-50
 - .2 Model: RBD-10
- .2 Dampers shall have a maximum differential pressure rating of 1 in.wg.
- .3 Dampers shall have a maximum velocity rating of 2,000 fpm.
- .4 Construction
 - .1 Frame and Sleeve:
 - .1 The damper frame and sleeve shall be one piece design, made with 20 ga. Galvanized steel, 6 3/8 inch depth, and a groove for added strength.
 - .2 Blades:

- .1 Galvanized steel 20 ga.
- .3 Axles: Minimum ¾ in. dia.
 - .1 Plated steel
- .4 Bearings:
 - .1 Axle bearings shall be synthetic (acetal) sleeve type
- .5 Actuator:
 - .1 Actuator shall be a 9 volt actuator
- .5 Accessories:
 - .1 Wall Plates
 - .1 Stainless Steel
 - .1 6 port
 - .2 Provide
- .6 Refer to HVAC floor plans for locations and quantities of dampers and wall plates.
- .7 EZ Balance Remote
- .8 Plenum Rated Cable
 - .1 Provide all cabling required to connect all dampers to appropriate wall plate as indicated.
- .9 Installation
 - .1 Install dampers in accordance with manufacturer's Installation Instructions.
 - .2 Install dampers square and free from racking.
 - .3 Do not compress or stretch the damper frame into the duct or opening.
 - .4 Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft.
 - .5 Install all cable and connections to actuators as specified in Division 23 as applicable.

2.11 Ceiling Fans

- .1 Canarm CP56 HPWP
- .2 56" blade sweep.
- .3 Variable speed motors (all motors are thermally protected PSC type variable speed with permanently lubricated bearings).
- .4 "MC" series speed controls Painted steel blades with curved ends deliver maximum airflow over wide areas.
- .5 Furnished with MC series speed controllers able to control multiple units.
- .6 Furnished with industrial fan guard.
- .7 Supplied by Division 23 installed by Division 26.

2.12 Dryer Vent Stack Jack

- .1 Thaler EVF-1, slotted collar for use with dryer vents
 - .1 Aluminum alloy
 - .2 Pre-molded urethane insulation collar
 - .3 Condensation free design
 - .4 Coordinate roof-tie in details with architectural.

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 Access doors shall be located:
 - .1 At the base of all main risers.
 - .2 In front of and behind turning vanes, silencers and duct mounted coils.
 - .3 At fire, smoke and motorized dampers.
 - .4 At locations having an internally mounted piece of equipment or device
 - .5 Such that any section of duct is not more than 15 m (50 ft) from a point of access.
 - .6 At not more than 3 m (10 ft) intervals on supply air ductwork installed downstream of a HEPA filter.
- .5 Generally access doors at heating coils shall approximate width of coil for ease of cleaning.
- .6 At smoke detectors, provide 450mm x 450mm (18 x 18 inch) access doors.
- .7 Provide duct test holes where indicated and required for testing and balancing purposes.
- .8 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.
- .9 Install smoke dampers and combination smoke and fire dampers to NFPA 92A. Coordinate electrical requirements with Electrical Division.
- .10 Demonstrate re-setting of fire dampers to The City's representative.
- .11 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.
- .12 Use splitter dampers only where indicated.
- .13 Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00.

-
- .14 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.
 - .15 Do not locate single blade volume dampers immediately behind diffusers and grilles. This application does not allow uniform airflow across the outlet face.
 - .16 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

Section Includes

- .1 General Fan Components:
 - .1 Wheels and Inlets:
 - .2 Housings
 - .3 Bearings and Drives
 - .4 Electrical Components
- .2 Utility Set
- .3 Roof Exhauster/Ventilator
- .4 Cabinet and Ceiling Exhaust Fans
- .5 Inline Fans
- .6 Residential Range Hoods
- .7 Fan Accessories.

1.2

Related Work

- .1 Section 23 05 13 - Motors.
- .2 Section 23 05 48 - Vibration Isolation.
- .3 Section 23 05 53 - Mechanical Identification.
- .4 Section 23 05 93 – Testing, Adjusting, And Balancing.
- .5 Section 23 07 13 - Duct Insulation.
- .6 Section 23 07 16 – Equipment Insulation.
- .7 Section 23 31 00 - Duct Work.
- .8 Section 23 33 00 - Duct Work Accessories: Backdraft dampers.
- .9 Section 23 73 23 - Air Handling Units.
- .10 Section 25 50 02 - Digital Control Equipment.
- .11 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 AMCA 99 - Standards Handbook.
- .4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .6 AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.

- .7 ISO 1940 – Mechanical Vibration. Balance quality requirements for rotors in a constant (rigid) state.
- .8 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .9 UL/cUL 762 - Power Roof Ventilators For Restaurant Exhaust Appliances
- .10 UL/cUL 705 – Power Ventilators
- .11 UL/cUL 793 - Automatically Operated Roof Vents for Smoke and Heat

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate assembly of centrifugal fans 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 Product Data: Provide data on centrifugal fans 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.
- .4 Manufacturer's Installation Instructions.

1.5 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 .Protect motors, shafts, and bearings from weather and construction dust.

1.7 Environmental Requirements

- .1 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two sets of belts for each belt driven fan.

Part 2 Products

2.1 MANUFACTURERS

- .1 Greenheck
- .2 Loren Cook
- .3 Substitutions: Refer to Section 21 05 00

2.2 GENERAL FAN COMPONENTS

- .1 Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- .2 Sound Ratings: AMCA 301, tested to AMCA 300 ,and bear AMCA Certified Sound Rating Seal.
- .3 Fabrication: Conform to AMCA 99.
- .4 Performance Base: Sea level conditions.
- .5 Temperature Limit: Maximum 150 degrees C (300 degrees F).
- .6 Static and Dynamic Balance: Balance all wheels to balance grade G6.3 per ANSI S2.19 (ISO 1940). Eliminate vibration or noise transmission to occupied areas.
- .7 Performance Requirements on Schedules.
- .8 Wheel And Inlet: Refer to individual sections.
- .9 Housing
 - .1 Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .10 Bearings And Drives
 - .1 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard.
 - .2 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 - .3 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- .11 Electrical Characteristics And Components
 - .1 Refer to schedule
 - .2 Motor: Refer to Section 23 05 13.

2.3 Utility Set

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Loren Cook
 - .3 Substitutions: Refer to Section 21 05 00
- .2 General:
 - .1 Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.

- .2 Each fan shall be belt drive in AMCA arrangement 3 only according to drawings.
 - .3 Fans are to be equipped with lifting lugs.
 - .4 After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc.
 - .5 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
 - .6 Unit shall be equipped with extended exhaust for minimum 2100 mm discharge point above roof level and tapered cone discharge for all laboratory exhaust.
- .3 Wheel and inlet:
- .1 The fan wheel shall be of the non-overloading double or single width centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
 - .2 The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency
 - .3 Refer to schedule for wheel blade style:
 - .1 Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
 - .2 Forward Curved: Galvanized steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, welded to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
 - .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
- .4 Housing
- .1 Fan housing shall be designed to accommodate the width wheel.
 - .2 Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - .3 Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
 - .4 An OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).
 - .5 Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
 - .6 Provide bolted construction with horizontal flanged split housing .
- .5 Bearings And Drives

- .1 Bearings: AFBMA 9, L-10 life at 80,000 hours heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 L-10 life at 120,000 hours pillow block type, self-aligning, grease-lubricated roller bearings.
- .2 Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil, and shaft guard and sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
- .3 Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
- .4 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
- .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW (15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW (20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
- .6 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm (12 gauge) thick, 20 mm (3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- .7 Bearings shall have Zerk fittings to allow for lubrication.
- .6 Electrical Characteristics And Components
 - .1 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

2.4 Roof Exhausters

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Loren Cook
 - .3 Delhi
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Product Requirements:
 - .1 Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
 - .2 Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
 - .3 Fabrication: Conform to AMCA 99.
 - .4 UL Compliance: UL listed and labeled, designed, manufactured, and tested to UL 705.
 - .5 Kitchen hood exhaust fans:
 - .1 UL 762 compliance

- .2 Grease trap spout with cleanable bucket
- .3 Tiltable fan access for grease duct cleaning.
- .3 Fan Unit: V-belt or direct driven as indicated; forward curved galvanized steel wheel; painted galvanized steel cabinet; resilient mounted motor; 13 mm (1/2 inch) mesh, 2 mm(16 gauge) aluminum birdscreen; square base to suit roof curb with continuous curb gaskets.
- .4 Electrical Characteristics and Components
 - .1 Electrical Characteristics:
 - .1 See Schedule
 - .2 Motor: Refer to Section 23 05 13. Induction VFD rated motor where controlled by VFD operation.
 - .3 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
 - .4 Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor solid state speed controller on all direct drive units with option for 0-10 V speed control input.
 - .5 Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings.
 - .6 Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

2.5 Inline Exhaust Fans

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Loren Cook
 - .3 Substitutions: Refer to Section 21 05 00
- .2 Centrifugal Fan Unit:
 - .1 General Description:
 - .1 Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - .2 Fans are to be equipped with lifting lugs.
 - .3 After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc.
 - .4 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
 - .2 Wheel:
 - .1 Non-overloading, backward inclined centrifugal wheel
 - .2 Constructed of aluminum

- .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05
- .4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
- .5 Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.
- .3 Electronically Commutated Motor
 - .1 Motor enclosures: Open type
 - .2 Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - .3 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - .4 Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
 - .5 Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by a 0-10 VDC signal.
 - .6 Motor shall be a minimum of 85% efficient at all speeds.
- .3 Bearings And Drives (fan drive)
 - .1 Bearings: AFBMA 9, L-10 life at 50,000 hours heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 L-10 life at 120,000 hours pillow block type, self-aligning, grease-lubricated roller bearings.
 - .2 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard and sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
 - .3 Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
 - .4 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
 - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 - .6 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle

- frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- .7 Bearings shall have Zerk fittings to allow for lubrication.
- .8 Housing/Cabinet Construction
 - .1 Construction material: Galvanized
 - .2 Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars
 - .3 Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.
- .9 Housing Supports and Drive Frame:
 - .1 Housing supports are constructed of structural steel with formed flanges
 - .2 Drive frame is welded steel which supports the motor
- .10 Disconnect Switches:
 - .1 NEMA rated: 1
 - .2 Positive electrical shut-off
 - .3 Wired from fan motor to junction box
- .11 Duct Collars:
 - .1 Square design to provide a large discharge area
 - .2 Inlet and discharge collars provide easy duct connection
- .12 Access Panel:
 - .1 Two sided access panels, permit easy access to all internal components
 - .2 Located perpendicular to the motor mounting panel
- .13 Options/Accessories:
 - .1 Dampers:
 - .1 Types: Gravity
 - .2 Galvanized frames with prepunched mounting holes
 - .3 Balanced for minimal resistance to flow
 - .2 Finishes:
 - .1 Coating type: Permator
 - .3 Inlet Guards:
 - .1 Constructed of expanded metal mounted in a steel frame to provide protection for non-ducted installations
 - .4 Insulated Housing
 - .1 Thickness: 25mm (1 inches)
 - .2 For noise reduction and condensation control
 - .3 Constructed of fiberglass liner
 - .5 Isolation:
 - .1 Type: Neoprene/Rubber Mount

- .2 Sized to match the weight of each fan
- .6 Motor Cover:
 - .1 Constructed of galvanized steel
 - .2 Covers motor and drives for safety
 - .3 Standard on unit specified with UL
- .14 Wiring Pigtail:
 - .1 Direct hook-up to the power supply
- .4 Electrical Characteristics and Components
 - .1 See Schedule.

2.6 RANGE HOODS

- .1 Manufacturer Broan SahaleBKDF130SS
 - .1 Fan Tech
 - .2 Substitutions: Refer to Section 21 05 00
- .2 Performance
 - .1 Sound level to be no greater than 3 sones (at normal speed); 6 sones (high speed). Air and sound ratings to be certified by HVI. Unit shall be U.L. and c.U.L. listed.
- .3 Construction:
 - .1 Range hood shall no sharp edges.
 - .2 Stainless steel finish.
 - .3 Fully-enclosed bottom and dishwasher-safe full filters.
 - .4 Hood to be convertible between 3¼" x 10" and 7" round ducted (using washable aluminum filters). Duct connectors must be adjustable to accommodate off-center ductwork.
 - .5 Axial blade centrifugal blower
 - .6 Two level LED lights, lamps by mechanical subcontractor where not included.
 - .7 Unit complete with blower and light operation using an adjustable 3-speed rocker, located in face of hood.

2.7 ACCESSORIES

- .1 Belt automatic tensioner.
- .2 Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.
- .3 Inlet/Outlet Screens: Expanded metal mounted in a welded steel frame..
- .4 Belt Guard: Factory produced painted steel belt guard designed to meet supplied fan belts and drives.
- .5 Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.
- .6 Shaft Seal: Aluminum, rub ring to seal the housing around the shaft.
- .7 Isolation Packages: Manufacturer standard for application.

- .8 Weatherhood: Constructed of painted steel. Shall completely cover motor and drive compartments, be provided with appropriate vents for motor cooling and meet UL 705 requirements.
- .9 Field installed factory supplied extended lubrication lines.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48.
- .3 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.
- .4 Install fan restraining snubbers as required. Refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- .5 Provide fixed sheaves required for final air balance. Speed controller on all direct drive fans.
- .6 Provide safety screen where inlet or outlet is exposed.
- .7 Provide backdraft dampers on discharge of exhaust fans and as indicated. Refer to Section 23 33 00.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Diffusers.
- .2 Registers/grilles.
- .3 Louvers.
- .4 Louvered penthouses.
- .5 Roof hoods.
- .6 Goosenecks.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Painting of duct work visible behind outlets and inlets.
- .2 Section 08 71 00: Placement of door grilles.

1.3 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.

1.4 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.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of air outlets and inlets.

1.6 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

1.7 Qualifications

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

Part 2 Products

2.1 MANUFACTURERS

.1 Unless otherwise listed:

- .1 Price Industries.
- .2 Nailor Industries
- .3 Titus
- .4 Ventex.

.2 Substitutions: Refer to Section 21 05 00.

2.2 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.

2.3 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.

2.4 Ceiling Slot Diffusers

.1 Type: Continuous slot, with adjustable vanes for left, right, or vertical discharge. Refer to schedule for slot width and number of slots.

.2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.5 Nozzle Diffuser

.1 Construction:

- .1 Diffusers shall be aluminum construction with a durable powder coat finish.
- .2 The diffuser shall have a curved intake featuring superior aerodynamic and acoustical properties, and shall be housed in a hemispheric casing with opposite swivel bearings.
- .3 The nozzle shall be manually adjustable from the diffuser face to produce a swivel range of +/- 35 degrees and rotatable 360 degrees.

.2 Finish: Refer to schedule

- .1 Mounting Frame:
- .2 The diffuser shall be supplied with a frame suitable for installation shown on the schedule.

- .3 Damper: The diffuser shall be supplied with an aperture style volume flow damper. The damper shall be manually adjustable from the diffuser face.

2.6 Wall Supply 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.

2.7 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.

2.8 Linear Wall Registers/grilles

- .1 Type: Narrow Spacing Streamlined blades with 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 Type: Wide Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 12 mm (1/2 inch) centres. Refer to schedule for deflection angle.
- .3 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.9 Linear Floor Supply 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 Type: Wide Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 12 mm (1/2 inch) centres. Refer to schedule for deflection angle.
- .3 Type: Pencil-proof Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 11 mm (7/16 inch) centres. Refer to schedule for deflection angle.
- .4 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.10 Door Grilles

- .1 Type: V-shaped louvers of 0.90 mm (20 gauge) thick steel, 25 mm (one inch) deep on 13 mm (1/2 inch) centres.
- .2 Frame: 0.90 mm (20 gauge) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.
- .3 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.11 Louvers

- .1 100 mm (4 inch) Fixed Blade Louver:
- .1 Type: 100 mm (4 inch) deep with blades on 39 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 Mounting: Refer to schedules for mounting options.
- .2 150 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 Mounting: Refer to schedules for mounting options.

2.12 Penthouse Louver

- .1 100 mm (4 inch) Fixed Blade Louver:
 - .1 Type: All welded assembly with 100 mm (4 inch) deep with blades on 39 degree slope, mitred or boxed 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.
- .2 150 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.

2.13 Roof Intake Or Relief Hoods

- .1 Manufacturers:
 - .1 Cook
 - .2 Greenheck
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Manufactured air inlet or exhaust hoods to meet SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Product Requirements:
 - .1 Bolted and welded construction utilizing corrosion resistant fasteners.
 - .2 Hood construction: minimum 18 gauge aluminum, bolted to a minimum 8 gauge aluminum support structure.
 - .3 A radius throat must be provided for optimum performance.
 - .4 Lifting lugs shall be provided to help prevent damage from improper lifting.
 - .5 A rain gutter shall be provided to prevent rain infiltration.
 - .6 The base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 1/2" galvanized mesh shall be mounted in the hood.

- .4 Curb:
 - .1 Factory-supplied or field-constructed roof curb to match.
 - .2 Minimum 18 gauge galvanized steel or 0.080 aluminum, c/w wood nailers, continuously welded corners, 75 mm (3 inch) cant, 38 mm (1-1/2 inches) thermal insulation.
- .5 Mount unit on minimum 300 mm (12 inch) high curb base with insulation between duct and curb. Curb height to ensure minimum 450 mm (18") clear from roof surface to intake. Refer to drawings for additional curb height requirements.

2.14 Goosenecks

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, of minimum 1.20 mm (18 gauge) galvanized steel.
- .2 Mount on minimum 300 mm (12 inch) high curb base.
- .3 Provide internally insulated liner except on kitchen and dryer exhausts.
- .4 Provide backdraft dampers on all exhausts where no motorized damper is indicated on drawing.

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 air tight 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 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.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Indirect fired make-up air heater.
- .2 Cooling coil section and compressor-condenser unit.
- .3 Service platform.
- .4 Controls.

1.2

Related Sections

- .1 Section 22 10 00 - Plumbing Piping: Natural gas connections.
- .2 Section 23 33 00 - Duct Work Accessories.
- .3 Section 23 34 16 - Centrifugal Fans: Supply Fans.
- .4 Section 25 50 02 - Digital Control Equipment: Control components, time clocks.
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- .2 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- .3 ARI 520 - Positive Displacement Condensing Units.
- .4 ASHRAE 14 - Methods of Testing for Rating Positive Displacement Condensing Units.
- .5 ASHRAE - 90A - Energy Conservation in New Building Design.
- .6 CSA B149.1 – Natural Gas and Propane Code
- .7 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .8 UL 207 - Refrigerant - Containing Components and Accessories, Non-electrical.
- .9 UL 303 - Refrigeration and Air-Conditioning Condensing, and Air-Source Heat Pump Equipment.

1.4

Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
- .3 Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

1.5

Submittals For Information

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of components.
- .3 Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- .4 Warranty: Submit manufacturers warranty and ensure forms have been filled out in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 Regulatory Requirements

- .1 Conform to CSA B149.1
- .2 Entire unit shall be ETL Certified per ANSI Z83.4 or ANSI Z83.18 and bear an ETL mark. Alternate certifiers recognized by the AHJ are acceptable.
- .3 Coils shall be Recognized Components for ANSI/UL 1995, CAN / CSA C22.2 No 236.05. DX and water coils shall be AHRI Certified per standard 410-2001.
- .4 Indirect gas-fired heaters shall be ETL Certified as a component of the unit.

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.

1.10 Maintenance Service

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide service and maintenance of units for one year from Date of Substantial Completion.

1.11 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two sets of filters.

Part 2 Products

2.1 MANUFACTURERS

- .1 Greenheck
- .2 Engineered Air
- .3 Bousquet
- .4 Substitutions: Refer to Section 21 05 00.

2.2 MANUFACTURED UNITS

- .1 Unit: Outdoor unit with refrigeration package.
- .2 Construction and Ratings: To ARI 210/240 , and UL 207 and UL 303. Testing: ASHRAE 14.

2.3 Fabrication

- .1 Casing and Components:
 - .1 Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation.
 - .2 Outside casing: 1.27 mm (18 ga.), galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Base rail is 2.75 mm (12 ga.), galvanized (G90) steel. Components that receive a painted finish per A/E specification shall be painted with a polyester urethane powder coat.
 - .3 Internal assemblies: 0.70 mm (24 ga.), galvanized (G90) steel except for motor supports which shall be minimum 2.0mm (14 ga.) galvanized (G90) steel.
- .2 Observation Port: On burner section for observing main and pilot flames.
- .3 Insulation:
 - .1 Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
 - .2 Thickness: 25 mm (1 inches).
 - .3 Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
 - .4 Location and application: Floor of each unit shall be insulated with 1 inch thick rigid fiberglass insulation, covered on one surface with integral aluminum foil. Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified
- .4 Suspended Installations: Service platforms complete with handrails and access ladder.
- .5 Outdoor Installation: Weatherproofed casing, with intake louvre or hood.
- .6 Access panels:
 - .1 Unit shall be equipped with insulated removable and hinged access panels to provide easy access to all major components.
 - .2 Access panels shall be fabricated of 1.27 mm (18 ga.) galvanized G90 steel.
 - .3 Removable access panels shall incorporate a formed drip edge.

2.4 Filters

- .1 Filter: Removable 50 mm(2 inches) thick high velocity glass fibre disposable filters in metal frames.

2.5 Indirect Gas-fired Furnace:

- .1 Shall be ETL Certified or other certifier as recognized by the AHJ as a component of the unit.

- .2 Shall have an integral combustion gas blower.
- .3 Shall be ETL Certified for installation downstream of a cooling coil.
- .4 Shall be designed for natural gas
- .5 Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
- .6 Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.
- .7 Heat exchanger shall have a 5 year extended warranty.
- .8 Furnace control shall be single furnace 4:1 electronic modulating.
- .9 Shall be encased in a weather-tight metal housing with intake air vents. Large, metal lift-off or hinged door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly and exhaust blower.
- .10 Shall have solid state controls permitting stand-alone operation or control by building controllers.

2.6 Fan

- .1 General:
 - .1 Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - .2 Each fan shall be belt drive in AMCA arrangement 3 only according to drawings.
 - .3 Fans are to be equipped with lifting lugs.
 - .4 After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc.
 - .5 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
- .2 Wheel and inlet:
 - .1 The fan wheel shall be of the non-overloading double or single width centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
 - .2 The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency
 - .3 Refer to schedule for wheel blade style:
 - .1 Backward Inclined: Steel [or aluminum] construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron [or cast steel] hub riveted to back plate and keyed to shaft with set screws.
 - .2 Forward Curved: Galvanized [enameled] steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, welded to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.

- .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron [or cast steel] hub riveted to back plate and keyed to shaft with set screws.
- .3 Housing
 - .1 Fan housing shall be designed to accommodate the width wheel.
 - .2 Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - .3 Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
 - .4 An OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).
 - .5 Heavy gauge steel, spot welded [for AMCA 99 Class I and II fans, and continuously welded for Class III], adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .4 Bearings and Drives:
 - .1 Bearings: AFBMA 9, [L-10 life at 50,000 hours] [L-50 life at 100,000 hours] heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 [L-10 life at 120,000 hours] [L-50 life at 400,000 hours] pillow block type, self-aligning, grease-lubricated roller bearings.
 - .2 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard and sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
 - .3 Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
 - .4 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
 - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 - .6 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - .7 Bearings shall have Zerk fittings to allow for lubrication.
- .5 Electrical Characteristics:
 - .1 Refer to schedule.
 - .2 Refer to Section 26 05 80.
- .6 Motor: Refer to Section 23 05 13.

2.7 Controls

- .1 Controls: Pre-wire unit for connection of power supply. Field wiring from unit to remote control panel makes unit operative. Control integration to be provided for BMS system operation including but not limited to enable/disable, temperature reset, heat/cool changeover, fan enable/disable. Refer to DIV 25 control sequences.
- .2 Remote Control Panel: On-off -auto switch, indicating lights for supply fan, exhaust fan, pilot operation, burner operation, clogged filter indication and lockout indication.
- .3 Interlocks: Unit to start when exhaust fan is running. Burner to operate when flow switch located in exhaust duct proves flow.
- .4 Fan Discharge Thermostat: Controls modulating gas valve to maintain supply air temperature. Thermostat by DIV 25, manufacturer to provide output in coordination with DIV 25 requirements. Timer: Operates fan system off or at low volume at night. Safety Controls: Sense correct air flow before energizing pilot and sense pilot ignition before activating main gas valve.
- .5 Manual Reset Low and High Limit Controls: Maintain supply air temperature between set points and shut fan down if temperatures are exceeded.
- .6 Sensors to be provided with the unit
 - .1 Room / Space Temperature Sensors
 - .2 Heating Inlet Air Sensor
 - .3 Cooling Inlet Air Sensor
 - .4 Dirty Filter Sensor
 - .5 Fire Stat Type III
 - .6 Freeze Stat
 - .7 120V/24V Smoke Detector

2.8 Condensate Drainage

- .1 Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.
- .2 P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices. Route to nearest to discharge onto roof.

2.9 Cooling Coil

- .1 Direct Expansion Cooling Coil (DX Coil):
 - .1 Coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system.
 - .2 Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame.
 - .3 If two The City-supplied compressors are used as components of the MAU, then the DX coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

- .4 DX coil shall be optimized for refrigerant type: R-410A.
- .5 Suction line(s) are to be stubbed through the side of the MAU.
- .6 Liquid Line(s) are to be capped and readily accessible behind an access panel.
- .7 Provide Thermal Expansion Valve.

2.10 Refrigeration Package

- .1 Packaged DX: Unit shall be equipped with a Packaged DX system to include compressor(s), evaporator and condenser coil(s), condenser fans and all appurtenant controls as specified elsewhere in this section. The Packaged DX system is to be an integral module, incorporated into the unit. Stand-alone Packaged DX systems that are connected to the unit or systems that require hardware or equipment that is not integral to the unit are not acceptable.

2.11 Factory Provided Curb Assembly

- .1 Engineered curb assembly in lieu of an The City-supplied rail system shall be provided by the factory for assembly and installation as part of this division.
- .2 Constructed of 14 gauge galvanized steel, complete with insulation of 50 mm (2 inches).
- .3 The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air.
- .4 Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit.
- .5 Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration
- .6 Contractor shall provide and install appropriate insulation for the curb assembly.

2.12 Dampers

- .1 Motorized dampers / Intake Air: Motorized damper of insulated low leakage type shall be factory installed.

2.13 PERFORMANCE

- .1 Performance Ratings: Energy Efficiency Rating (EER) not less than requirements of Canadian National Energy Code for Buildings.
- .2 Heating and Cooling Capacity:
 - .1 Refer to schedule

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install to NFPA 90A.
- .3 Install to CSA B149.1 Natural Gas Code. Provide connection to fuel gas system; refer to Section 22 10 00.
- .4 Provide flexible duct connections on inlet and outlet from unit; refer to Section 23 33 00.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Unit heaters.
- .2 Fan-coil units.
- .3 Fan-coil units – horizontal
- .4 Hydronic Radiant Panels

1.2 Related Sections

- .1 Section 23 05 13 - Motors.
- .2 Section 23 05 20 - Hydronic Specialties.
- .3 Section 23 21 00 - Hydronic Piping.
- .4 Section 25 90 00 - Sequence Of Operation.
- .5 Section 26 05 80 - Equipment Wiring:
 - .1 Electrical characteristics and wiring connections.
 - .2 Installation of room thermostats.
 - .3 Electrical supply to units.

1.3 References

- .1 AFBMA 9—Load Ratings and Fatigue Life for Ball Bearings
- .2 AMCA 99—Standards Handbook
- .3 AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes
- .4 AMCA 300—Test Code for Sound Rating Air Moving Devices
- .5 AMCA 500—Test Methods for Louver, Dampers, and Shutters
- .6 AHRI 430—Central-Station Air-Handling Units.
- .7 AHRI 435—Application of Central-Station Air-Handling Units
- .8 ASTM B117—Standard Practice for Operating Salt Spray Apparatus
- .9 NEMA MG1—Motors and Generators
- .10 CSA C22.1 – Canadian Electrical Code
- .11 SMACNA—HVAC Duct Construction Standards - Metal and Flexible
- .12 UL 723—Test for Surface Burning Characteristics of Building Materials
- .13 UL 900—Test Performance of Air Filter Units
- .14 UL 1995—Standard for Heating and Cooling Equipment
- .15 UL 94—Test for Flammability of Plastic Materials for Parts in Devices and Appliances

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide typical catalogue of information including arrangements.

- .3 Shop Drawings:
 - .1 Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - .2 Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
 - .3 Indicate mechanical and electrical service locations and requirements.,

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 21 05 00: Submittals for information.
- .2 Manufacturer's Instructions: Indicate installation instructions and recommendations.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- .3 Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- .4 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 Regulatory 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.

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.

1.10 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 UNIT HEATERS

- .1 Manufacturer: Rittling Model Regency RH/RV series.
 - .1
- .2 Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

- .3 Casing: 1.2 mm (0.0478 inch) steel with threaded pipe connections for hanger rods.
- .4 Finish: Factory applied textured gray epoxy powder coating.
- .5 Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- .6 Air Outlet: Adjustable pattern diffuser on projection models and two way louvres on horizontal throw models.
- .7 Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.
- .8 Control:
 - .1 BMS on/off control via BMS thermostat signal, coordinate with DIV 25.
- .9 Capacity: As scheduled
- .10 Electrical Characteristics:
 - .1 As scheduled.
 - .2 Refer to Section 26 05 80.

2.2 Fan-coil Units

- .1 Manufacturer: Refer to schedule
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .3 Fan Coils
 - .1 Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 1380 kPa (200 psi) and 104 degrees C (220 degrees F). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.
 - .2 Cabinet: 1.5 mm(0.0598 inch) steel with exposed corners and edges rounded, easily removed panels, glass fibre insulation [and integral air outlet] [and integral air outlet and inlet grilles].
 - .3 Finish: Factory apply baked enamel, manufacturer's standard colour on visible surfaces of enclosure where located in non-visible locations. Manufacturer's standard colour selection by architect for visible applications.
 - .4 Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
 - .5 Motor: electronically commutated motor (ECM) with sleeve bearings, resiliently mounted.
 - .6 Control: Multiple speed switch, factory wired, located in cabinet.
 - .7 Filter: Easily removed 25 mm(1 inch) thick glass fibre throw-away type, located to filter air before coil.
 - .8 Mixing Dampers: Where indicated, mixing sections with dampers. Refer to Section 25 90 00 for operating sequence.
 - .9 Capacity: As Scheduled, based on 18°C (65°F) entering air temperature
 - .10 Electrical Characteristics:
 - .1 Refer to schedules.
 - .2 Refer to Section 26 05 80.

2.3 Hydronic Radiant Heaters

- .1 Manufacturers:
 - .1 TWA
 - .2 Price Industries
 - .3 Engineered Air
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00
- .3 Extruded Ceiling Panels:
 - .1 Constructed of modular 150 mm (6 inch) wide aluminum extruded planks with interlocking edges;
 - .1 Planks are to be manufactured and assembled to configurations indicated on plans, exact dimensions to be confirmed with Contract Administrator prior to shop drawings;
 - .2 Some panels may be special, requiring field cutting. Manufacturer shall cut back tubing to accommodate field cutting but allow maximum heating output from remaining section of panel;
 - .3 Some sections may be filler panels without piping;
 - .2 Tube saddle incorporated into plank extrusion;
 - .3 Tubing to be clipped to saddle, clips to be non-conducting, dielectric;
 - .4 Cross brace entire assembly with structural members, aluminium support channel to be provided from factory;
 - .5 Provide with extruded frame for installation in drywall or suspended ceiling application.
- .4 Pipe Coil:
 - .1 16 mm (5/8 inch) O.D. copper tube
 - .2 Tubing to be thermally bonded to extrusion with non-hardening heat conductive thermal paste
 - .3 Provide return bends for two water connections to each panel. Provide coil setup and prepared conditions for interconnected panels where indicated.
- .5 Insulation
 - .1 Insulation is to be supplied by mechanical subcontractor;
 - .2 Minimum 25mm (1.0 inches) thick;
 - .3 ASTM C1071; flexible, inorganic glass fibre bonded by a thermosetting binder, non-combustible blanket, with no edge coating;
 - .1 'C' Value: ASTM C177, maximum 1.42 at 24 degrees C (0.24 at 75 degrees F).
 - .2 Maximum Service Temperature: 121 degrees C (250 degrees F).
 - .3 Minimum 50% Certified Recycled Content.
 - .4 Does not exceed 25 Flame and 50 Smoke spread ratings when tested in accordance with ASTM E 84, CAN/ULC S102-M88, NFPA 255 and UL 723
 - .5 Adhesive:
 - .1 ASMT C916 compliant
 - .2 Waterproof, ASTM E162 fire-retardant type.
- .6 Configure panels within T-bar ceiling module
- .7 Configure panels within dry wall as per drawings.

- .8 Heating Capacity: As scheduled, based on 60°C supply water temperature, 21 degrees C (70 degrees F) space temperature.
- .9 Accessories:
 - .1 Provide with hose kits, 450 mm (18") minimum length:
 - .1 Return side hose: control valve, shutoff valve, manual air vent, and automatic balancing valve;
 - .2 Supply side hose: shutoff valve, and strainer with blowdown and pressure tap.
 - .3 Connection to radiant panel by threaded or sweat connections.
 - .2 Provide "pig tail" looped connection or other flexible connection between radiant panels.
 - .3 Provide access panel sections to conceal and provide access to isolation and control valves in all zones.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- .4 Fan-Coil Units: Install as indicated. Coordinate to assure correct recess size for recessed units.
- .5 Hydronic Units: Provide with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For cabinet unit heaters, fan coil units, and unit heaters, provide float operated automatic air vents with stop valve.
- .6 Hydronic Radiant Panels:
 - .1 Install with hose kits to supply/return piping.
 - .2 Install radiant panel level and plumb. Maintain sufficient clearance for normal services, maintenance, or in accordance with construction drawings.
 - .3 Complete installation and startup checks according to manufacturer's written instructions and perform pressure testing.
 - .4 Coordinate installation with acoustic tile ceiling grid. Where panel is installed against wall surfaces, provided with grid track.
 - .5 Completely cover exposed topside of panel with insulation blanket. Cut insulation around upturned piping connectors.
 - .6 Suspend panels with hanger wire from deck above.
- .7 Units with Cooling Coils: Connect drain pan to condensate drain.

3.2 Cleaning

- .1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

- .2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.
- .3 Install new filters.

3.3 Schedules

- .1 Refer to schedules on drawings.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Water coils.
- .2 Glycol coils.
- .3 Refrigerant coils.

1.2 Related Sections

- .1 Section 23 05 20 - Hydronic Specialties.
- .2 Section 23 07 19 - Piping Insulation.
- .3 Section 23 31 00 - Duct Work: Installation of duct coils.
- .4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ARI 410 - Forced-Circulation Air-Cooling and Air- Heating Coils.
- .2 SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

1.4 Submittals For 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.

1.5 Submittals For 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.

1.6 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.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.8 Regulatory 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.

1.9 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.

1.10 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide five (5) year manufacturer warranty for all coils.

Part 2 Products

2.1 WATER HEATING COILS

- .1 Manufacturer:
 - .1 Engineered Air
 - .2 Carrier
 - .3 Daikin
- .2 Tubes: 5/8 inch (16 mm) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- .3 Fins: Aluminum continuous plate type with full fin collars.
- .4 Casing: Die formed channel frame of 1.6 mm (16 gauge) galvanized steel with 9.5 mm (3/8 inch) mounting holes on 150 mm (6 inch) centres. Provide tube supports for coils longer than 900 mm (36 inches).
- .5 Headers: Seamless copper tube with silver brazed joints.
- .6 Testing: Air test under water to 2200 kPa (320 psig) for working pressure of 1725 kPa (250 psig) and 149 degrees C (300 degrees F)
- .7 Configuration: Drainable, with threaded plugs in headers for drain and vent. Refer to Coil Schedule for further detail.
- .8 Fin Spacing: Fin Spacing to meet or exceed performance requirements. Refer to Coil Schedule.

2.2 Glycol Heating Coils

- .1 Manufacturer:
 - .1 Trane
 - .2 Carrier
 - .3 Daikin
 - .4 Greenheck.
- .2 Other acceptable manufacturers offering equivalent products.
- .3 Tubes: 5/8 inch (16 mm) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- .4 Fins: Aluminum [or copper] continuous plate type with full fin collars.

- .5 Casing: Die formed channel frame of 1.6 mm (16 gauge) galvanized steel with 9.5 mm (3/8 inch) mounting holes on 150 mm (6 inch) centres. Provide tube supports for coils longer than 900 mm (36 inches).
- .6 Headers: Seamless copper tube with silver brazed joints.
- .7 Testing: Air test under water to 2200 kPa (320 psig) for working pressure of 1725 kPa (250 psig) and 149 degrees C (300 degrees F)
- .8 Configuration: Drainable, with threaded plugs in headers for drain and vent. Refer to Coil Schedule for further detail.
- .9 Fin Spacing: Fin Spacing to meet or exceed performance requirements. Refer to Coil Schedule.

2.3 Water Cooling Coils

- .1 Engineered Air
- .2 Carrier
- .3 Daikin
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00
- .3 Tubes: 16 mm (5/8 inch) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- .4 Fins: Aluminum [continuous plate type with full fin collars] [or] [individual helical finned tube type wound under tension]. [Solder coat copper fin coils.]
- .5 Casing: Die formed channel frame of 1.6 mm (16 gauge) galvanized steel with 9.5 mm (3/8 inch) mounting holes on 75 mm (3 inch) centres. Provide tube supports for coils longer than 900 mm (36 inches).
- .6 Headers: Seamless copper tube with silver brazed joints.
- .7 Testing: Air test under water to 1380 kPa 200 psig) for working pressure of 1380 kPa 200 psig) and 104 degrees C (220 degrees F).
- .8 Configuration: Drainable, with threaded plugs [in headers] for drain and vent; threaded plugs in return bends and in headers opposite each tube.
- .9 Fin Spacing: 3.1 mm on centre (8 fins per inch)

Part 3 Execution

3.1 Installation

- .1 Install to manufacturers written instructions.
- .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.

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- .4 Install coils level. Make connections to coils with unions and flanges.
 - .5 Hydronic Coils:
 - .1 Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
 - .2 Provide shut-off valve on supply and return pipe.
 - .3 Locate water supply at bottom of supply header and return water connection at top.
 - .4 Provide manual air vents at high points complete with stop valve.
 - .5 Ensure water coils are drainable and provide drain connection at low points.
 - .6 Refer to Section 23 05 20.
 - .6 Cooling Coils:
 - .1 Provide drain pan and drain connection. Pipe drain pans individually to floor drain [with water seal trap].
 - .7 Insulate headers located outside air flow as specified for piping. Refer to Section 23 07 19.

3.2 Schedules

- .1 Refer to drawings.

END OF SECTION

Instrumentation and Control Devices for HVAC

Actuators and Operators

- A. General Requirements
 - 1. Actuators shall be electronic or pneumatic, or both, as detailed in the following sections.
 - 2. The manufacturer shall be ISO 9001 certified.
- B. Electronic Damper Actuators
 - 1. Spring Return Actuators:
 - a. Spring Return Actuators shall be manufactured, brand labelled and distributed by Johnson Controls or an approved equivalent.
 - b. Spring Return Actuators shall comply with the following regulatory agency listings: cULus, CSA C22.2 No24-93, and CE marked. Asia Pacific (APAC) actuators shall be excluded from this regulatory information.
 - c. Spring Return Actuators shall be of direct-coupled design and require no crank arm or linkage for mounting to a shaft.
 - d. Spring Return Actuators shall offer a coupling method which requires a toothed V-bolt clamp and nuts with toothed cradle.
 - e. Spring Return Actuators shall be configured for reversible mounting which provides either clockwise or counter clockwise operation.
 - f. Spring Return Actuators power failure operation shall configure upon a loss of electric power to the actuator, a mechanical spring return system shall drive the actuator to the failsafe home position. Other forms of internal energy storage for power failure operation shall not be acceptable.
 - g. Spring Return Actuators shall utilize the following motor technology:
 - i. Modulating types: Microprocessor-controlled brushless DC motors
 - ii. On/Off types: DC brush motor
 - h. Spring Return Actuators shall be furnished with Electronic Stall Detection which protects the actuator from overload at all angles of rotation without the need for end switches.
 - i. Spring Return Actuators shall comply with enclosure ratings of NEMA type 2 or IP54 mounted in any orientation.
 - j. Spring Return Actuators shall eliminate the need for electrical ground wires for double-insulated construction.
 - k. Spring Return Actuators shall be furnished with integral cables with colored and numbered conductors for simplified wiring.
 - l. Spring Return Actuators shall be sized for the torque required to seal the damper at load conditions.
 - m. Spring Return Actuators shall be available in parallel operation that are capable of being mechanically or electrically paralleled.

-
- n. Proportional actuators shall be user configurable without the use of external computer software or programming tools. Calibration, input signal range selection, and control logic reversal shall be selectable with an external mode selection switch.
 - o. Spring Return Actuators shall operate in the following temperature ranges:
 - i. For a 70 lb-in. torque actuator range must be -40°F to 140°F (-40°C to 60°C)
 - ii. For a 177 lb-in. torque actuator range must be -40°F to 131°F (-40°C to 55°C)
 - p. Spring Return Actuators shall be provided with the following power requirements:
 - i. Modulating types:
 - a) A torque of 27 lb-in. has a 6VA maximum
 - b) A torque of 70 lb-in. has an 8VA maximum
 - c) A torque of 177 lb-in. has a 16VA maximum
 - ii. Two-position types:
 - a) A torque of 27 lb-in. has a 6VA maximum
 - b) A torque of 70 lb-in. has an 8VA maximum
 - c) A torque of 177 lb-in. has a 25VA maximum
2. Non-Spring Return Actuators
- a. Non-Spring Return (NSR) actuators shall be manufactured, brand labelled or distributed by Johnson Controls or an approved equivalent. The NSR actuators are manufactured under International Standards Organization (ISO) 9001 Quality Control Standards to ensure quality.
 - b. NSR actuators shall comply with the following regulatory agency listings: cULus, CSA C22.2 No 24-93, and CE marked. APAC actuators are excluded from this regulatory information.
 - c. NSR actuators shall be provided with a 5 year warranty from the date of sale. Actuators sold in the APAC region shall comply with an 18 month warranty policy.
 - d. NSR actuators shall be of direct-coupled design and require no crank arm or linkage for mounting to a shaft.
 - e. NSR actuators shall be of a design that converts the damper version to the valve version without the use of special tools.
 - f. NSR actuators shall be configured for direct mounting and will not require any damper linkage. Actuators can be mounted directly with a universal clamp to the following:
 - i. Round damper shaft from 3/8 in. (10mm) up to 1 in. to 1/16 in. (27mm)
 - ii. Square damper shaft from 3/8 in. (10mm) up to 3/4 in. (19mm)
 - g. NSR actuators shall feature an optional NEMA 4X/IP66 weather shield for applications in harsh environments
 - h. NSR actuators shall be furnished such that the actuator complies with the following control signals:

- i. The NSR actuators shall be available in models that accept input signal controls for on/off, floating, and proportional control.
 - ii. The NSR actuators shall operate with an automatic signal input detection which allows automatic recognition of input signals for on/off, floating and proportional control. They shall be equipped with adjustable span automatic controls that require no special tools.
 - iii. In proportional mode, the actuator shall respond to control signals DC 0 V to 10 V or DC 2 to 10 V.
 - iv. When a 500 ohm resistor is added in proportional mode, the actuator shall respond to a 0 mA to 20 mA or 4 to 20mA signal. A feedback signal of DC 0 V to 10 V or DC to 10 V indicates position.
- i. NSR actuators shall be available in line voltage On/Off and floating models to offer reduced total installation cost by avoiding installation of external power supply adapters.
 - j. NSR actuators shall be available in high speed On/Off and floating models for applications in loop that require a quick response time.
 - k. NSR actuators shall offer optional auxiliary switches to provide the following:
 - i. Two line-voltage-capable single-pole, double-throw (SPDT) switches with continuously adjustable switch points
 - ii. An auxiliary potentiometer kit provides and potentiometer feedback options for improving the safety, interface and signal
 - l. NSR actuators shall be furnished with the option of backward compatible to produce a seamless retrofit without the need to replace the controller.
 - m. NSR actuators shall have the option to be furnished with a plenum-rated cable which are specially configured for installation in spaces used for environmental air-handling purposes, other than ducts and plenums, as specified in National Fire Protection Association (NFPA) 70: National Electrical Code section 300.22(C), Other Space Used for Environmental Air.
 - n. NSR actuators shall have a constant runtime which is independent of supply voltage frequency and load.
 - o. NSR actuators for Floating and On/Off models for line voltage (AC 85 to 264 V) for standard speed applications shall operate with AC 85 to 264 V and provide the rated torque. The actuators shall be designed to provide constant runtime, independent of supply voltage frequency and load.
 - p. NSR actuators for Floating and On/Off models for AC/DC 24 V for high speed applications shall have an 8-second constant runtime, independent of supply voltage frequency and load.
 - q. NSR actuators shall be furnished with electronic stall detection which protects the actuator from overload at all angles of rotation. The actuator may be stalled anywhere in its rotation range without the need for mechanical end switches.
 - r. NSR actuators shall be equipped with microprocessor-controlled brushless DC motors which provides constant runtime independent of torque and increases the actuators lifecycle by reducing water.

- s. NSR Actuators shall have the option of a bottom-mounted coupler which simplifies short shaft damper applications.
- t. NSR actuators shall offer multiple shaft coupling methods:
 - i. For units above 80 lb-in a toothed V-bolt clamp and nuts with a toothed cradled shall be used.
 - ii. For units 80 lb-in. and below use a single-cup-point set screw and toothed cradle shall be used.
- u. NSR actuators shall be furnished with a Minimum IP (ingress protection) enclosure ratings as follows:
 - i. Actuator for types with covered wiring terminals shall be furnished as NEMA type 2/IP42 mounted in any orientation.
 - ii. Actuators for types without a covered wiring terminal shall be furnished with a NEMA type 1/IP30 or IP40.
 - iii. Actuators for types with integrated cables shall be furnished as NEMA type 2/IP42 mounted in any orientation.
 - iv. NSR actuators shall be furnished with a minimum IP (ingress protection) rating of no lower than IP42, but also be available in NEMA5/IP54.
- v. NSR actuators shall be able to operable in a temperature range of -4°F to 122°F (-20°C to 50°C) except for VAV and similar indoor applications in which 32°F to 122°F (0°C to 50°C) is acceptable
- w. NSR actuators shall be provided with the following power requirements:
 - i. 24 V with models available for both 24 VAC and 24 VDC operation (maximum)
 - ii. For NSR actuators above 80 lb-in. a maximum of 7.5 VA at 24 VAC
 - iii. For NSR actuators 80 lb-in. or below a maximum of 3.5 VA at 24 VAC
- x. NSR actuators shall be sized for the torque required to seal the damper at load conditions. For NSR actuators in parallel operation, actuators shall be available that are capable of being mechanically or electrically paralleled automatically.
- y. NSR proportional actuators shall be user configurable without requiring the use of external computer software or programming tools.
- z. NSR actuators shall also be furnished with the option of backward compatible auxiliary switch kits and auxiliary potentiometers which allow for a seamless retrofit without the needs to replace the controller.

Sensors and Transmitters

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements. Exact OEM equivalents of specified sensors and transmitters shall be acceptable if clearly identified in submittals.

B. Temperature Sensors

1. General Requirements

- a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
- b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD. Thermistor sensors of 10,000 or 2,250 ohms resistance may be substituted based on the application.
- c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion.

Point Type	Accuracy
Chilled Water	+ .5°F
Room Temp	+ .5°F
Duct Temperature	+ .5°F
All Others	+ .75°F

- 2. Room Temperature Sensors
 - a. Room sensors shall be constructed for either surface or wall box mounting.
 - b. Room sensors shall have the following options when specified:
 - i. Setpoint warmer/cooler
 - ii. Individual heating/cooling setpoint
 - iii. Momentary override request for activation of after-hours operation
 - iv. Analog thermometer

3. Room Temperature Sensors with Integral Display
 - a. Room sensors shall be constructed for either surface or wall box mounting.
 - b. Room sensors shall have an integral LCD display and the following capabilities when specified:
 - i. Display room air temperatures
 - ii. Display and adjust room comfort setpoint
 - iii. Display and adjust fan operation status
 - iv. Setpoint override request via setpoint adjust dial or buttons
 - v. Timed override request via occupancy override with status indication for activation of after-hours setpoint operation
 - vi. Occupancy sensor status
 - vii. Toggle between Degrees F and Degrees C
 - viii. Toggle between temperature and humidity where specified
4. Thermowells
 - a. Thermowell manufacturer shall have models available in stainless steel, brass body, and copper bulb.
 - b. When thermowells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and sensor.
 - c. Thermowells shall be pressure rated and constructed in accordance with the system working pressure.
 - d. Thermowells and sensors shall be mounted in a direct mount (no adapter) offering faster installation or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
 - e. Thermowells constructed of 316 stainless steel shall comply with Canadian Registration Number (CRN) pressure vessel rating.
5. Outside Air Sensors
 - a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall be provided with a solar shield.
 - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
 - c. Temperature transmitters shall be of NEMA 3R (IP54) or NEMA 4 (IP65) construction and rated for ambient temperatures.
 - d. The outdoor sensor shall be capable of being mounted on a roof, pole or side of a building utilizing its preassembled mounting bracket.
 - e. Outside air relative humidity sensors 0-100% full range of accurate measurement. Operating temperature -4 to 140°F (-20 to 60°C).
 - f. Outside air temperature sensors operating temperature range -40 to 140°F, +/- .55°F (+/- .3°C).

6. Duct Mount Sensors

- a. Duct mount sensors shall mount in an electrical box through a hole in the duct, positioned to provide ease of accessibility for repair or replacement.
- b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
- c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be provided.

7. Averaging Sensors

- a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
- b. For plenum applications, such as mixed air temperature measurements, a continuous averaging sensor or a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
- c. Capillary supports at the sides of the duct shall be provided to support the sensing string.

8. Acceptable Manufacturers: Johnson Controls, Minco.

C. Humidity Sensors

1. The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH at 77°F unless specified elsewhere.
4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R (IP54) or NEMA 4 (IP65) enclosure with sealite fittings.
5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
7. Acceptable Manufacturers: Johnson Controls and Vaisala

D. CO₂ Sensors

1. Where shown on the drawings, CO₂ sensors shall have the following features:
 - a. Jumper selectable: 0-20mA, 4-20mA & 0-10 VDC output
 - b. Liquid Crystal Display (LCD)
2. The CO₂ sensors shall have the ability to monitor and output the following variables as required by the systems sequence of operations:
 - a. Zone CO₂

3. The CO₂ shall transmit the information back to the controller via jumper selectable 0-20mA, 4-20mA & 0-10 VDC output signals:
 - a. The CO₂ sensors shall provide a maximum output current of 25mA; Maximum output voltage of 12.5V.
 - b. The CO₂ sensors shall be FCC compliant to CFR47 Part 15 subpart B Class A.
4. The CO₂ sensors shall be available with:
 - a. CO₂ response time (0-63%) of 1 minute
 - b. Less than 0.083% of full scale/°F temperature dependence of CO₂ output
 - c. Long term CO₂ stability ±5% of full scale for 5 years
 - d. CO₂ measurement accuracy of ±(40ppm + 2.0% of reading)
 - e. CO₂ non-linearity of less than 1.0% of full scale
5. The CO₂ sensors may include the following items:
 - a. Relay output module
 - b. LCD module
 - c. Analog temperature module with linear 0-10 VDC output for 32-122F

E. Differential Pressure Transmitters

1. General Air and Water Pressure Transmitter Requirements:
 - a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and The City permanent, easy-to-use connection.
 - d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
2. Low Differential Water Pressure Applications (0" - 20" WC):
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - i. .01-20" WC input differential pressure range

- ii. 4-20 mA output
 - iii. Maintain accuracy up to 20 to 1 ratio turndown
 - iv. Reference Accuracy: +0.2% of full span
 - c. Acceptable Manufacturers: Setra and Mamac
- 3. Medium to High Differential Water Pressure Applications (Over 21" WC):
 - a. The differential pressure transmitter shall meet the low-pressure transmitter specifications with the following exceptions:
 - i. Differential pressure range 10" WC to 300 PSI
 - ii. Reference Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability)
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - c. Acceptable Manufacturers: Setra and Mamac
- 4. Building Differential Air Pressure Applications (-1" to +1" WC):
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - i. -1.00 to +1.00 WC input differential pressure ranges. (Select range appropriate for system application)
 - ii. 4-20 mA output
 - iii. Maintain accuracy up to 20 to 1 ratio turndown
 - iv. Reference Accuracy: +0.2% of full span
 - v. Acceptable Manufacturers: Johnson Controls or approved equal

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5. Low Differential Air Pressure Applications (0" to 2.5" WC):
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications.
 - i. (0.00 - 1.00" to 5.00") WC input differential pressure ranges. (Select range appropriate for system application)
 - ii. 4-20 mA, 0-5 VDC, 0-10 VDC output
 - iii. Maintain accuracy up to 20/1 ratio turndown
 - iv. Reference Accuracy: +0.25%, or 0.5% of full span
 - c. Acceptable Manufacturers: Johnson Controls and Ruskin
 6. Medium Differential Air Pressure Applications (5" to 21" WC):
 - a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements.
 - i. Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability
 - ii. Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 psig)
 - iii. Thermal Effects: <+.033 F.S./Deg. F. over 40°F to 100°F (calibrated at 70°F)
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - c. Acceptable manufacturers: Johnson Controls and Ruskin
- F. Power Monitoring Devices
1. Current Measurement (amps)
 - a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.
 - b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.
 - i. Operating frequency – 50 - 400 Hz
 - ii. Insulation – 0.6 Kv class 10Kv BIL
 - iii. UL recognized
 - iv. Five amp secondary
 - v. Select current range as appropriate for application

- vi. Acceptable manufacturers: Setra
- c. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
 - i. 6X input over amp rating for AC inrushes of up to 120 amps
 - ii. Manufactured to UL 1244
 - iii. Accuracy: +.5%, Ripple +1%
 - iv. Minimum load resistance 30kOhm
 - v. Input 0-20 amps
 - vi. Output 4-20 mA
 - vii. Transducer shall be powered by a 24 VDC regulated power supply (24 VDC +5%)
 - viii. Acceptable manufacturers: Setra
- G. Smoke Detectors
 - 1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 26, Fire Alarm System.
- H. Status and Safety Switches
 - 1. General Requirements
 - a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the Building Management System (BMS) when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.
 - 2. Current Sensing Switches
 - a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
 - b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
 - c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
 - d. Acceptable manufacturers: Johnson Controls or approved equal
 - 3. Air Filter Status Switches
 - a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
 - b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.

- c. Provide appropriate scale range and differential adjustment for intended service.
 - d. Acceptable manufacturers: Johnson Controls, Cleveland Controls
 - 4. Air Flow Switches
 - a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
 - b. Acceptable manufacturers: Johnson Controls, Cleveland Controls
 - 5. Air Pressure Safety Switches
 - a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
 - b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
 - c. Acceptable manufacturers: Johnson Controls, Cleveland Controls
 - 6. Water Flow Switches
 - a. Water flow switches shall be equal to the Johnson Controls P74.
 - 7. Low Temperature Limit Switches
 - a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
 - b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
 - c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
 - d. The low temperature limit switch shall be equal to Johnson Controls A70.
- I. Control Relays
 - 1. Control Pilot Relays
 - a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 - b. Mounting Bases shall be snap-mount.
 - c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 - d. Contacts shall be rated for 10 amps at 120VAC.
 - e. Relays shall have an integral indicator light and check button.
 - f. Acceptable manufacturers: Johnson Controls, Lectro
 - 2. Lighting Control Relays
 - a. Lighting control relays shall be latching with integral status contacts.
 - b. Contacts shall be rated for 20 amps at 277 VAC.

- c. The coil shall be a split low-voltage coil that moves the line voltage contact armature to the On or Off latched position.
 - d. Lighting control relays shall be controlled by:
 - i. Pulsed Tristate Output – Preferred method.
 - ii. Pulsed Paired Binary Outputs.
 - iii. A Binary Input to the Facility Management System shall monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the “dry-contact” type.
 - e. The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state.
Example: Multiple Off command pulses shall simply keep the contacts in the Off position.
- J. Electronic Signal Isolation Transducers
- 1. A signal isolation transducer shall be provided whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
 - 2. The signal isolation transducer shall provide ground plane isolation between systems.
 - 3. Signals shall provide optical isolation between systems.
 - 4. Acceptable manufacturers: Advanced Control Technologies
 - 5. Acceptable manufacturers: Johnson Controls, Mamac
- K. Thermostats – Electric
- 1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer’s standard finish.
 - 2. Acceptable Manufacturers: Penn, Emerson, Honeywell

Control Valves

- A. Ball Valves, 1/2 through 2 in.
- 1. Ball Valves shall have forged brass bodies.
 - 2. Valves shall have available either Chrome Plated Brass Balls or 300 Series Stainless Steel Balls in all sizes.
 - 3. Valves shall have available either Nickel Plated Brass Stems or 300 Series Stainless Steel Stems with a blow-out proof stem design in all sizes.
 - 4. Valves shall have Graphite reinforced Polytetrafluoroethylene (PTFE) seats with Ethylene Propylene Diene Monomer (EPDM) O-ring backing.
 - 5. Stem seals shall be double EPDM O-rings.

6. Flow Characterization Disk shall be manufactured from Amodel AS-1145HS Polyphthalamide Resin and rated for 50 psi maximum differential pressure and shall be inserted against the casting of the valve.
 7. All ball valves with internal pipe thread end connections shall be rated to 580 psi maximum static pressure at 203°F (95°C) fluid temperature.
 8. All ball valves with sweat end connections or press end connection shall be rated to 300 psig maximum static pressure at 203°F (95°C) fluid temperature.
 9. All valves shall be rated for service with hot water, chilled water and 50% glycol solutions.
 10. Ball Valves with stainless steel balls and stems shall be rated for use with 15 psig saturated steam.
 11. Flow Characteristics shall be equal percentage on the control port. Bypass port on three-way valves shall have linear flow characteristics.
 12. Valves shall have a maximum leakage specification of 0.01% of maximum flow for the control port, ANSI/FCI 70-2, Class 4 and 1% of maximum flow, bypass port.
 13. Valves shall be maintenance free.
 14. Valves shall be provided with a 5 year equipment warranty.
 15. Valves shall be rated for 200 psi differential closeoff pressure.
 16. Valve actuators shall be UL-recognized or CSA-certified.
 17. Valves shall be Johnson Controls VG1000 Series ball valves or approved equal.
- B. Ball Valves, ½ in. to 1 in. with integrated controller
1. Ball valves shall have forged brass bodies.
 2. Valves shall be available in either chrome plated brass balls or 300 series stainless steel balls in all sizes.
 3. Valves shall be available in all sizes with either a nickel plated brass stems or 300 series steel stems with a blow-out proof stem design.
 4. Valves shall have graphite reinforced PTFE seats with EPDM O-ring backing.
 5. Stem seals shall be double EPDM O-rings.
 6. Flow characterization disks shall be manufactured from Amodel AS-1145HS Polyphthalamide Resin and rated for 50 psid maximum differential pressure and shall be inserted against the casting of the valve. The valves shall be installed in any flow direction because of the non-directional disk design.
 7. Flow characteristics shall be of equal percentage on the control port. Bypass port on three-way valves shall have linear flow characteristics.
 8. Valves with internal pipe thread end connections shall be rated to 580 psi maximum static pressure at 203°F (95°C) fluid temperature.
 9. Valves with sweat end connections or press end connection shall be rated to 300 psig (kPa) maximum static pressure at 203°F (95°C) fluid temperature.
 10. Valves shall be rated for service with hot water, chilled water and 50% glycol solutions.

11. Ball valves with stainless steel balls and stems shall be rated for use with 15 psig (103 kPa) saturated steam.
 12. Ball valves shall have a maximum leakage specification of 0.01% of maximum flow for the control port, ANSI/FCI 70-2, Class 4 and 1% maximum flow, bypass port.
 13. Ball valves shall be maintenance free.
 14. Ball valves shall be provided with a 5 year warranty from the date of sale. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 15. Ball valves shall be rated for 200 psid (1,378 kPa) close off pressure.
 16. Ball valves shall be UL-recognized or CSA-certified. APAC valves shall be excluded from this regulatory information.
 17. Ball valves shall be Johnson Controls VG1000 Series Ball Valves or approved equal.
- C. Ball valves ½ in. through 1 in with integrated controllers and actuators
- The specifications apply to Ball valves ½ in. through 1 in. with integrated controller or actuators.
1. The actuator or controller shall provide both standalone and networked direct digital control of terminal units.
 2. The actuator or controller shall be BACnet Testing Labs (BTL) listed/certified and carry the BTL Label.
 3. The actuator or controller shall tested and certified as a BACnet Application Specific Controller (B-ASC).
 4. A BACnet Protocol Implementation Conformance Statement shall be provided for the actuator or controller.
 5. The actuator or controller shall communicates over the Field Controller Bus (FC Bus) using BACnet Standard protocol SSPC-135, Clause 9.
 6. The actuator or controllers shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications. An externally mounted isolation transformer shall not be acceptable.
 7. The actuator/controller shall be a configurable digital controller. All components shall be connected and mounted as a single assembly that can be removed as one piece. With ball valve linkage for use on the Johnson Controls VG-1000 1/2 inch to 1 inch valves.
 8. The actuator or controller shall be assembled in a plenum-rated plastic housing with flammability rated to UL95-5VB or the controller is designed and suitable for use in other environmental air spaced (plenums) in accordance with Section 300.252© of the National Electrical Code.
 9. Each controller shall continuously and adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. This shall reduce commissioning costs and eliminated the maintenance costs of manually re-tuning loops to compensate for load changes.
 10. The controller shall provide the ability to download and upload configuration files, both locally and through the communications network. Controllers shall be able to be loaded

individually or as a group using a zone schedule generated spreadsheet of controller parameters.

11. Control set point changes initiated over the network shall be written to the actuator or the controller's non-volatile memory to prevent the loss of set point changes and to prove consistent operation in the event of a communication failure.
 12. The controller firmware shall be flash-upgradeable remotely through the communications bus to minimize the cost of feature enhancements.
 13. Inputs:
 - a. Analog inputs with user defined ranges shall monitor the following analog signals, with only the equipment in the terminal controller cabinet:
 - i. 0 VDC to 10 VDC Sensors
 - ii. 1000 ohm RTDs
 - iii. NTC Thermistors
 - b. Binary inputs shall monitor dry contact closures. Filtering shall eliminate false signals resulting from input 'bouncing'.
 - c. The inputs shall be isolated from power, communications, and output circuits for noise immunity.
 - d. Provide side loop application for humidity control.
 14. Outputs:
 - a. Analog output shall provide a 0 VDC to 10 VDC control output
 - b. Binary outputs shall provide a SPST Triac output rated for 500 mA at 24 VAC
 - c. For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.
 15. The actuator or controller shall be configured with a software tool that provides a question and answer format for developing and downloading applications.
 16. Sensor support:
 - a. The actuator or controller shall communicate over the Sensor-Actuator Bus (SA Bus) with a Network Sensor.
 - b. The actuator or controller shall support an LCD display room sensor.
 - c. The actuator or controllers shall support standard room sensors as defined by analog input requirements.
 - d. The actuator or controllers shall support humidity sensors defined by the AI side loop.
- D. Ball Valves, 2 in. to ½ in. through 4 in. Flanged
1. Ball valves shall have forged brass bodies with ASME Class 150 ductile iron flanges.
 2. Valves shall be manufactured from 300 series stainless steel balls and the flanges shall rotate independently until tightened down which is an advantage during installation.
 3. Valves shall have 300 series steel stems with a blow-out proof stem design.

4. Stem seals shall have double EPDM O-rings.
 5. Valves have graphite reinforced PTFE seats with EPDM O-ring backing.
 6. Flow characterization disk shall be manufactured from Amodel AS-1145HS Polyphthalamide Resin and rated for 50 psid maximum differential pressure.
 7. Flow characteristics shall be of equal percentage on the control port. Bypass port on three-way valves shall have linear flow characteristics.
 8. Valves shall be rated for service with hot water, chilled water and 50% glycol solutions and are rated for use with 25 psig (kPa) saturated steam.
 9. Two-way valves shall be rated for 100 psid close off pressure and three-way valves shall be rated for maximum of 50 psid close off pressure.
 10. Valves shall have a maximum leakage specification of 0.01% of maximum flow for the control port, ANSI/FCI 70-2, Class 4 and 1% of maximum flow, bypass port.
 11. Valves shall be maintenance free.
 12. Valves shall be provided with a 5 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 13. Valves shall be CE marked as Johnson Controls declares these valves are in compliance with essential requirements and other relevant provisions of the Pressure Equipment Directive (PED). APAC actuators shall be excluded from this regulatory information.
 14. Valves shall be Johnson Controls VG1000 Series ball valves or approved equal
- E. Butterfly Valves, 2 through 20 in. resilient seat ASME Class 125/150 Flanged
1. Butterfly valves shall have cast iron bodies meeting ASTM A126 Class B requirements, meet ASME class 125/150 flange requirements and shall be fully lugged.
 2. Valves seats shall be EPDM.
 3. Valves disks shall be ductile iron with Nylon 11 coating.
 4. Valves stems shall be stainless steel.
 5. Flow characteristics shall be of equal percentage up to 70 degrees of disk rotation.
 6. Valves shall be rated for service with hot water, chilled water and 50% glycol solutions.
 7. Valves shall be maintenance free.
 8. Valves shall be provided with a 3 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 9. Valves shall be UL-recognized and CSA-certified. Valves sold in the APAC region shall be excluded from this regulatory information.
 10. Valves shall be Johnson Controls VF series butterfly valves or approved equal.
- F. Butterfly Valves, High Performance 2-1/2 through 16 in.
1. Butterfly valve shall have bodies manufactured from carbon steel, ASTM A216 GR WCB/A516 GR 70 and shall be fully lugged per ASME Class 150 or ASME Class 300.
 2. Valve seat assemblies shall be RPTFE (reinforced polytetrafluorethylene) and the seat retainer shall be carbon steel, ASTM A516 GR 70.

3. Valve disks shall be stainless steel, ASTM A 351 GR CF8M.
 4. Valve stems shall be 17-4 PH stainless steel, ASTM A564-Type 630.
 5. Stem seals shall be one carbon fibre ring and three TFE rings.
 6. Flow characteristics shall be equal percentage up to 70° of disk rotation.
 7. Valves shall be rated for service with hot water, chilled water, 50% glycol solutions and 50 psig (kPa) saturated steam in modulating service or 150 psig (kPa) saturated steam in two position service.
 8. Valves shall meet the performance requirements of the ASMA Class 150 and Class 300.
 9. Valves shall be maintenance free.
 10. Valves shall be provided with a 3 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 11. Valves shall be UL-recognized or CSA-certified. APAC valves shall be excluded from this regulatory information.
 12. Valves shall be Johnson Controls VF Series Butterfly Valves or approved equal.
- G. Globe Valves, Brass, 1/2 through 2 in.
1. Globe valve stems shall be manufactured from 300 series stainless steel.
 2. Valves with brass plugs and seats shall have stem seals with self-adjusting Ethylene Propylene Rubber (EPR) Ring Pack U-Cups.
 3. Valves with stainless steel plugs and seats shall have valve stem seals with spring loaded PTFE and Elastomer V-Rings.
 4. Flow characteristics shall be of equal percentage for two-way valves and linear for three-way valves.
 5. Valves shall meet the pressure and temperature requirements of ANSI B16.15, Class 250.
 6. Valves with brass trim shall have a maximum leakage specification of 0.01% of maximum flow per ANSI/FCI 70-2, Class 4.
 7. Valves with stainless steel trims shall have a maximum leakage of 0.05% of maximum flow.
 8. Valves shall be serviceable without being removed from the pipe.
 9. Valves shall be provided with a 3 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 10. Valve bodies shall be manufactured from a RoHS compliant brass.
 11. Valves electric actuators shall be UL-recognized or CSA-certified. APAC valves shall be excluded from this regulatory information.
 12. Globe valves shall be Johnson Controls VG7000 Series Globe Valves or an approved equal.
- H. Globe Valves, Cast Iron, 2-1/2 through 6 in.
1. Globe valve bodies shall be manufactured from cast iron.
 2. Valve stems shall be manufactured from 316 series stainless steel.
 3. Valves shall have stem seals with Ethylene Propylene Terpolymer (EPT) Ring Pack U-Cups.

4. Flow characteristics shall be equal modified linear.
 5. Valves shall meet the pressure and temperature requirements of ANSI B16.15, Class 125.
 6. Valves shall have a maximum leakage specification of 0.01% of maximum flow per ANSI/FCI 70-2, Class 3.
 7. Valves shall be serviceable without being removed from the pipe.
 8. Valves shall be provided with a 3 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 9. Valve electric actuators shall be UL-recognized or CSA-certified. APAC valves shall be excluded from this regulatory information.
- I. Valves Electric Zone Valves, 1/2 through 1-1/4 in.
1. Electric zone valves shall have bodies manufactured from forged brass.
 2. Valve stems shall be manufactured from hard chrome plated brass.
 3. Modulating valves flow characteristics shall be of equal percentage.
 4. Valves shall be rated for service with hot water, chilled water and 50% glycol solutions.
 5. Two position valves shall have models available rated for use with 15 psig saturated steam.
 6. Valves shall be replaceable without being removed from the pipe.
 7. Valves are provided with a 2 year warranty. Valves sold in the APAC region comply shall with an 18 month warranty policy.
 8. Valves shall be UL, cUL listed or CSA certified. APAC valves shall be excluded from this regulatory information.
 9. Valves shall be Johnson Controls J Series electric zone valves or an approved equal.

Pressure-Independent Valves

- A. Pressure-Independent Ball Valves NPS 2 in. (DN 50) and smaller
1. Pressure-Independent Ball Valves shall have bodies manufactured from Dezincification resistant (DZR) forged brass, or cast iron.
 2. Valves balls shall be manufactured from chrome plated-brass.
 3. Valve ball seats shall be manufactured from PTFE.
 4. Valves stem seal shall be PTFE packing ring stem seals with EPDM.
 5. Valves stem and stem extensions shall be manufactured from brass with a blowout-proof design.
 6. Pressure-independent ball valves shall have a pressure rating of 360 psig (2482 kPa) for NPS 1/2 to 1-1/4 (DN 15 to 32) and 230 psig (1585 kPa) for NPS 1-1/2 to NPS 2 (DN 38 to DN 50).
 7. Valves shall have a close-off pressure of 200 psig (1379 kPa).
 8. Valves shall have a fluid temperature limit of 14°F to 248 °F (-10°C to 120 °C), not rated for Steam Service.

9. The maximum actuator fluid temperature limit shall be 14°F to 212°F (-10°C to 100°C) which is not the rate for steam service.
 10. Valves shall have an accuracy of +/-5% up to 15psid.
 11. Valves flow characteristics shall be of equal percentage with a characterized profile laser cut which is directly into the ball.
 12. Valves shall have a maximum leakage in accordance with the ANSI Class IV IEC 60534-4, Class IV Leakage.
 13. Valves shall have an integral pressure regulator to regulate pressure, to maintain a constant pressure differential while operating within a pressure differential range of 5 psig to 58 psig (34 kPa to 400 kPa).
 14. Valves shall have a pressure regulator which is removable and replaceable from the valve body NPS ½ .in to 1 .in to 1/4 .in (DN 15 to DN 32).
 15. Valves shall have a threaded NPT connections.
 16. Two pressure testing (P/T) ports shall be incorporated into the valve body for differential pressure verification.
 17. Valves and actuators shall be supplied as an assembly.
 18. Valves and actuators shall be provided with a 5 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 19. Pressure-Independent Ball Valves shall be Johnson Controls VP140 Series pressure independent valves or an approved equal.
- B. Pressure-Independent Globe Valves NPS ½ in. to ¾ .in (DN 15-20)
1. Pressure-Independent Globe Valves bodies shall be manufactured from DZR forged brass.
 2. Valves shall have a pressure rating of 360 psig (2482 kPa).
 3. Valves shall have a close-off pressure of 100 psig (700 kPa).
 4. Valves fluid temperature limit shall be 14°F to 248°F (-10°C to 120°C) which is not rated for steam service.
 5. Valves accuracy shall be +/-5% up to 15 psid.
 6. Valves flow characteristic shall be inherently linear and capable of equi- percentage with actuator.
 7. Valves shall have a maximum leakage in accordance with ANSI Class IV IEC 60534-4, Class IV Leakage.
 8. Valves shall have an integral pressure regulator to regulate pressure to maintain a constant pressure differential while operating within a pressure differential range of 5 psig to 87 psig (34 kPa to 600 kPa). Pressure regulator shall be serviceable/ replaceable without special tools.
 9. Valves dirt free design shall allow the valve to pass strife contaminated water tests of 100,000 cycles at 900ppm iron oxide.
 10. Valves shall have a threaded NPT connections.
 11. Two P/T ports shall be incorporated into the valve body for differential pressure verification.

12. Valves pre-set function shall be adjustable for max flow without special tools.
 13. Valves and actuators shall be supplied as an assembly, the single actuator shall be capable of:
 14. Auto calibration
 15. Linear and equi-percentage control curve
 16. VDC or mA control signal, with selection of control signal to be either 0 VDC to 10 VDC, 2 VDC to 10 VDC, 0 VDC to 5 VDC, 5 VDC to 10 VDC, 0 mA to 20 mA, 4 mA to 20 mA
 17. LED feedback indication to indicate moving to position, end of stroke confirmation position reached, cycling and loss of signal.
 18. Pressure-independent globe valves and actuators shall be provided with a 5 year warranty.
 19. All valves shall be Johnson Controls VP140 Series pressure independent valves or an approved equal.
- C. Pressure-Independent Ball Valves NPS ½ in. through 1 in. to 1/4 in. with integrated controller
1. Pressure-Independent Ball Valves shall have bodies manufactured from DZR forged brass, or cast iron.
 2. Valve Balls shall be chrome-plated brass.
 3. Valve stems and stem extensions shall be brass, blowout-proof design.
 4. Valve ball seats shall be PTFE.
 5. Valves stem seal shall be PTFE packing ring stem seals with EPDM.
 6. Valves shall have a threaded NPT connections.
 7. Valves shall have a pressure rating of 360 psig (2482 kPa) for NPS ½ in. through 1 in. to ¼ in. (DN 15 to 32).
 8. Valves close off pressure shall be 200 psig (1370 kPa).
 9. Valves fluid temperature limits shall be 14°F to 248°F (-10°C to 120°C) which is not rated for steam service.
 10. Valves maximum actuator fluid temperature limits shall be 14°F to 212°F (-10°C to 100°C) which is not rated for steam service.
 11. Valves accuracy shall be +/- 5% up to 15 psid.
 12. Valves flow characteristic shall be of equal percentage with characterized profile laser cut directly into the ball.
 13. Valves maximum leakage shall be in accordance with the ANSI Class IV IEC 60534-4, American National Standards Institute (ANSI) Class IV Leakage.
 14. Valves Integral pressure regulator shall be designed to regulate pressure and to maintain a constant pressure differential while operating within a pressure differential range of 5 psig to 58 psig (34 kPa to 400 kPa).
 15. Valves pressure regulators shall be removable or replaceable from the valve body from NPS ½ in. through 1 in. to ¼ in. (DN 15 to DN 32).
 16. Two P/T ports shall be incorporated into the valve bodies for differential pressure verification.

17. Valves and actuators shall be provided with a 5 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
 18. All valves shall be Johnson Controls VP140 Series pressure independent valves or an approved equal.
- D. Pressure-Independent Ball Valves NPS ½ in. through 1 in. to 1/4 in. with integrated controller
1. The specifications apply to Pressure-Independent Ball valves ½ in. through 1 in. to ¼ in. with integrated controller or actuators.
 2. The actuator or controller shall provide both standalone and networked direct digital control of terminal units.
 3. The actuator or controller shall be BACnet Testing Labs (BTL) listed/certified and carry the BTL Label.
 4. The actuator or controller shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 5. A BACnet Protocol Implementation Conformance Statement shall be provided for the actuator or controller.
 6. The actuator or controller shall communicate over the Field Controller Bus (FC Bus) using BACnet Standard protocol SSPC-135, Clause 9.
 7. The actuator or controllers shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications. An externally mounted isolation transformer shall not be acceptable.
 8. The actuator or controller shall be a configurable digital controller. Connecting and mounting all the components as a single assembly, enabling the component to be removed as one piece. With ball valve linkage for use on the Johnson Control VP140 ½ in. through 1.in to ¼ in. valves.
 9. The actuator or controller shall be assembled in a plenum-rated plastic housing with flammability rated to UL95-5VB or the controller is designed and suitable for use in other environmental air spaced (plenums) in accordance with Section 300.252© of the National Electrical Code.
 10. All controllers shall continuously and adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. This shall reduce commissioning costs and eliminated the maintenance costs of manually re-tuning loops to compensate for load changes.
 11. The controller shall provide the ability to download and upload configuration files, both locally and through the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
 12. Control set point changes initiated over the network shall be written to the actuator or the controller's non-volatile memory to prevent the loss of set point changes and to prove consistent operation in the event of a communication failure.
 13. The controller firmware shall be flash-upgradeable remotely through the communications bus to minimize the cost of feature enhancements.

14. Inputs:

- a. Analog inputs with user defined ranges shall monitor the following analog signals, with only the equipment in the terminal controller cabinet:
 - i. 0 VDC to 10 VDC Sensors
 - ii. 1000 ohm RTDs
 - iii. NTC Thermistors
- b. Binary inputs shall monitor dry contact closures. Filtering eliminates false signals resulting from input 'bouncing'.
- c. The inputs shall be isolated from power, communications, and output circuits for noise immunity.
- d. Humidity control shall be provided by side loop applications.

15. Outputs:

- a. Analog output shall provide a 0 VDC to 10 VDC control output.
- b. Binary outputs shall provide a SPST Triac output rated for 500 mA at 24 VAC.
- c. The inputs shall be isolated from power, communications, and output circuits for noise immunity.

16. The actuator or controller shall be configured with a software tool which provides a question and answers format for developing and downloading applications

17. Sensor support:

- a. The actuator or controller shall communicate over the Sensor-Actuator Bus (SA Bus) with a Network Sensor.
- b. The actuator or controllers shall support an LCD display room sensor.
- c. The actuator or controllers shall support standard room sensors as defined by analog input requirements.
- d. The actuator or controllers shall support humidity sensors defined by the AI side loop.

E. Piping packages

1. Piping packages shall be supplied with control valve and actuator assembly packs.
2. Piping packages assemblies shall be factory leak tested at 100 psi for 24 hours.
3. Piping packages shall include pressure gages.
4. Piping packages shall be pressurized at 40 psi with pressure gages reflecting internal pressure of assembly.

Control Dampers

- A. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the drawings.
- B. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide

open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.

- C. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
- D. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" WC static pressure when tested in accordance with AMCA Std. 500.
- E. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" WC, but no more than 4000 FPM or 6" WC.
 - 1. Acceptable manufacturers are Johnson Controls VD-1250, VD1630, or VD-1330, Ruskin CD50 or CD60, and Vent Products 5650.
- F. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below.
 - 1. Acceptable manufacturers: Johnson Controls VD-1620, VD-1320, Ruskin CD36, and Vent Products 5800.
- G. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

Direct-Digital Control System for HVAC/Building Management System

Table of Contents

Part 1 – General

- 1.A Related Documents
- 1.B Definitions
- 1.C BMS System Description
- 1.D Quality Assurance
- 1.E References
- 1.F Work By Others
- 1.G Submittals
- 1.H Record Documentation
- 1.I Warranty

Part 2 – Products

- 2.A General Description
- 2.B BMS System Architecture
- 2.C User Interface
- 2.D Network Automation Engines
- 2.E Network Integration Engines
- 2.F Network Control Engines
- 2.G Application and Data Servers
- 2.H DDC System Controllers
- 2.I Field Devices
- 2.J System Tools
- 2.K Computing Hardware and Software
- 2.L Miscellaneous Devices

Part 3 – Execution

- 3.A BMS Specifics
- 3.B Installation Practices
- 3.C Training
- 3.D Commissioning Requirements
- 3.E Performance Verification

Part 1 – General

1.A Related Documents

1. All work of the work shall be coordinated and provided by the single BMS Contractor.
2. The work shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the applicable sections for details.
3. The work shall be as required by the Specifications, Point Schedules and Drawings.
4. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.B Definitions

1. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
2. Binary: A two-state system where an “on” condition is represented by one discrete signal level and an “Off” condition is represented by a second discrete signal level.

3. BMS: The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
4. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.
5. Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
6. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
7. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.
8. Node: A digitally programmable entity existing on the BMS network.
9. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances to provide a single coherent BMS as required by this Division.
10. Provide: The term "Provide" and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
11. PC: Personal Computer from a recognized major manufacturer or a virtual equivalent provided by, or with the consent of The City.
12. Furnish: The term "Furnish" and its derivatives when used in this Division shall mean supply at the BMS Contractor's expense to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.
13. Wiring: The term "Wiring" and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
14. Install: The term "Install" and its derivatives when used in this Division shall mean receive at the jobsite and mount.
15. Protocol: The term "protocol" and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.
16. Software: The term "software" and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

17. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.
18. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.
19. The following abbreviations and acronyms may be used in describing the work of this Division:

AHJ	Authority Having Jurisdiction
AI	Analog Input
AO	Analog Output
AWG	American Wire Gauge
BTL	BACnet® Testing Laboratories
CPU	Central Processing Unit
DDC	Direct Digital Control
DI	Digital Input
DO	Digital Output
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
HD	High Definition
HOA	Hand-Off-Auto
I/O	Input/Output
IT	Information Technology
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCC	Motor Control Center
NC	Normally Closed
NO	Normally Open
OAT	Outdoor Air Temperature
OEM	Original Equipment Manufacturer (Private label)
OWS	Operator Workstation
PC	Personal Computer
ppm	parts per million
RAM	Random Access Memory

RF	Radio Frequency
RFI	Radio Frequency Interference
RH	Relative Humidity
ROM	Read Only Memory
RTD	Resistance Temperature Device
TCP/IP	Transmission Control Protocol/Internet Protocol
UPS	Uninterruptible Power Supply
VAC	Volts, Alternating Current
VAV	Variable Air Volume
VDC	Volts, Direct Current
VPN	Virtual Private Network
VSD	Variable Speed Drive
WAN	Wide Area Network

1.C BMS System Description

1. The Contractor shall provide and install all essential hardware and software to interface to the existing City of Winnipeg Extended Application and Data Server (ADX).
2. The Contractor shall design the Metasys User Interface (MUI), to match the existing system. MUI graphics shall use the City of Winnipeg templates.
3. The Contractor will not have access to the City of Winnipeg SCT server. All MUI files shall be provided by the BMS contractor in the correct format for merging into the existing system with support from the City of Winnipeg.
4. The Contractor shall create or add MUI user views to match existing structure.
5. There is an existing central monitoring system in place. All Direct Digital Controller (DDC) points are identified as centrally monitored points.
6. All new controls shall be the Series Network Engine (SNE-XX000) supervisory controller which will utilize BACnet/IP and \ or MS/TP field controllers. The Contractor is required to meet with the City of Winnipeg for additional requests if the SNE-XX000 is not in the projects design or additional requirements are required. See note #2 and 3.
7. Field Controllers shall communicate through BACnet/IP or MSTP bus to a SNE-XX000 supervisory controller. See note #1, and 2.
8. No LON protocols are to be accepted.
9. The Contractor to provide commissioning sheets for all points on field devices.
10. The Contractor to communicate with equipment provider to ensure proper field point integration as well as controllability of the equipment, if not package controls.
11. If Other vendor (non-JCI) controls are to be used then a seamless integration must be proven before approval will be given. See note #1 and 4.

Notes:

1. The term BACnet refers to an industry standard protocol which complies with ASHRAE, and must be listed with the BACnet International / BACnet Testing Laboratories (BI/BTL). Basically, states that all devices using the BACnet technology will be able to communicate to each other. The controls contractor performing the controller installation should confirm that all devices specified are able to communicate to the proposed devices. Then

supply documentation such that all devices supplied will communicate to each other as required for proper operation of the system (PICS Statement, BI/BTL Listing, and ASHRAE listings).

2. If the Metasys Series Network Engine (SNE) are to be installed on the project then the version of these devices and their software must be such that the City of Winnipeg does not be required to update/upgrade the existing ADX server in order for all user views, alarms, and point monitoring to occur. The contractor must co-ordinate with City staff to determine the correct version to be installed.
3. If the Metasys Series Network Engine (SNE) is existing, the contractor is required to meet with the City of Winnipeg for additional directions.
4. All points must be integrated back to the City of Winnipeg ADX server. Important: The only way to bring points into the ADX server is to route them through a Johnson Controls supervisory device.

General

1. The BMS Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated BMS.
2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
3. The BMS installer shall be a BMS manufacturer-owned branch office, or an independent controls contractor who is factory trained and authorized by the BMS manufacturer to sell, service and support the BMS specified herein.
4. As evidence and assurance of the contractor's ability to support the The City's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The BMS architecture shall consist of the products of a manufacturer regularly engaged in the production of BMS, and shall be the manufacturer's latest standard of design at the time of bid.

1.D References

1. All work shall conform to the following Codes and Standards, as applicable:
 - a. National Fire Protection Association (NFPA) Standards
 - b. National Electric Code (NEC) and applicable local Electric Code
 - c. UL listing and labels
 - d. UL 864 10th Edition UUKL Smoke Control (for USA and Canada)
 - e. UL 268 Smoke Detector
 - f. UL 916 Energy Management.
 - g. NFPA 70 – National Electrical Code
 - h. NFPA 90A – Standard For The Installation Of Air Conditioning And Ventilating Systems
 - i. NFPA 92A and 92B Smoke Purge/Control Equipment
 - j. Factory Mutual (FM)
 - k. American National Standards Institute (ANSI)

- l. National Electric Manufacturer's Association (NEMA)
 - m. American Society of Mechanical Engineers (ASME)
 - n. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
 - o. Air Movement and Control Association (AMCA)
 - p. Institute of Electrical and Electronic Engineers (IEEE)
 - q. American Standard Code for Information Interchange (ASCII)
 - r. Electronics Industries Association (EIA)
 - s. Occupational Safety and Health Administration (OSHA)
 - t. American Society for Testing and Materials (ASTM)
 - u. Federal Communications Commission (FCC) including Part 15, RF Devices
 - v. Americans Disability Act (ADA)
 - w. ANSI/EIA 909.1-A-1999 (LonWorks®)
 - x. ANSI/ASHRAE Standard 195 (BACnet)
2. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
3. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.E Submittals

1. Shop Drawings, Product Data, and Samples

- a. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
- b. Submittals shall be in defined packages. Each package shall be complete, shall only reference itself, and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
- c. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
- d. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to The City.
- e. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
- f. The BMS Contractor shall correct any errors or omissions noted in the first review.
- g. At a minimum, submit the following:
 - BMS network architecture diagrams including all nodes and interconnections
 - Systems schematics, sequences, and flow diagrams
 - Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address
 - Samples of Graphic Display screen types and associated menus
 - Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features
 - Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type
 - Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
 - Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type
 - Details of all BMS interfaces and connections to the work of other trades.
 - Product data sheets or marked catalog pages including part number, photo and description for all products including software

2. Existing Systems Inventory

- a. Where applicable, provide a complete and current BMS site inventory for all existing field and supervisory controllers to be integrated into the new BMS including manufacturer, model number, firmware version, available updates, battery condition, integrations, controlled equipment, and point counts.
- b. Site inventory shall be provided on a separate, new USB compatible flash drive.

1.F Record Documentation

1. Operation and Maintenance Manuals.

- a. Three (3) copies of the Operation and Maintenance Manuals shall be provided to The City's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media or USB Flash Drive, and include the following for the BMS provided:
 - Table of contents
 - As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal
 - Manufacturer's product data sheets or catalog pages for all products including software
 - System Operator's manuals
 - Archive copy of all site-specific databases and sequences
 - BMS network diagrams
 - Interfaces to all third party products and work by other trades
- b. The Operation and Maintenance Manual shall be self-contained, and include all necessary software required to access the product data sheets. Include a logically organized table of contents. Viewer software shall provide the ability to display, zoom, print, and search all documents.

1.G Warranty

1. Standard Material and Labor Warranty:

- a. Provide a one-year labor and material warranty on the BMS.
- b. If within twelve (12) months from the date of acceptance of product, upon written notice from The City, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
- c. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

Part 2 – Products

1. Control Network

- a. Network Engines shall provide supervisory control over the control network and shall selectively support the following communication protocols:

-
- i. BACnet Standard Master-Slave/Token-Passing (MS/TP) Bus Protocol ASHRAE SSPC-135:
 - a) The Network Engines shall be BTL listed/certified.
 - b) The Network Engines shall be tested and certified as a BACnet Building Controller (B-BC) profile.
 - b. Control networks shall provide either “Peer-to-Peer”, Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 38400 baud.
 - c. Control network shall support digital controllers as indicated in plans and specifications.
 - d. Default control network communication protocol for this project shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
 - e. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
 - f. The PICS shall be submitted 10 days prior to bidding.
2. Integration
- a. Hardwired
 - i. Analog and digital signal values shall be passed from one system to another via hardwired connections.
 - ii. There will be one separate physical point on each system for each point to be integrated between the systems.
 - b. Direct Protocol (Integrator Panel)
 - i. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and third party manufacturers’ control panels. The BMS shall have the ability to receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.
 - ii. All data required by the application shall be mapped into the Automation Engine’s database, and shall be transparent to the operator.
 - iii. Point inputs and outputs from the third party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and LAN Communications.
 - c. BACnet Protocol Integration – BACnet
 - i. The neutral protocol used between systems will be BACnet IP and comply with the ASHRAE BACnet standard 135.
 - ii. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
 - iii. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.A Network Engines

1. General

- a. The Network Engine shall be a fully user-programmable, supervisory controller. The Network Engine(s) shall monitor the network of distributed equipment controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Engine(s).
- b. Automation network – The Network Engine(s) shall reside on the automation network and shall support a subnet of system controllers.
- c. User Interface – Each Network Engine shall have the ability to deliver a web-based User Interface using the Site Management Portal functionality previously described. All computers connected physically or virtually to the automation network shall have access to the web-based user interface.
 - i. The web-based user interface software shall be embedded in the Network Engine(s). Systems that require a local copy of the system database on the user's device are not acceptable.
 - ii. The Network Engine(s) shall support a minimum of two (2) concurrent users.
 - iii. The web-based user interface shall have the capability to access all system data through a single Network Engine.
 - iv. Remote users connected to the network using a Virtual Private Network (VPN) shall also have total system access through one Network Engine.
 - v. Systems that require the user to address more than one Network Engine to access all system information are not acceptable.
 - vi. The Network Engine shall have the capability of serving web-based user interface graphics. The graphics capability shall be embedded in the Network Engine.
 - vii. Systems that only support user interface graphics from a central database or require the graphics to reside on the user's device are not acceptable.
 - viii. The web-based user interface shall support the following functions using a supported web browser:
 - Configuration
 - Commissioning
 - Data Archiving
 - Monitoring
 - Commanding
 - System Diagnostics
 - ix. Systems that require workstation software or modified web browsers for system queries are not acceptable.
- d. Processor – The Network Engine(s) shall be microprocessor-based with a minimum word size of 32 bits. The Network Engine(s) shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. Network

- Engine(s) size and capability shall be sufficient to fully meet the requirements of this Specification.
- e. Memory – Each Network Engine shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
 - f. Secure Boot – The Network Engine(s) shall prevent malicious or unauthorized software applications from loading during the system startup process.
 - g. User Authentication – The Network Engine(s) shall support local and Remote Authentication Dial-in User Service (RADIUS) authentication.
 - h. Password Security – Access to the Network Engines’ embedded user interface shall require a password of 8 to 50 characters including a minimum of one lower case letter, one upper case letter, one number, and one special character. An alarm shall be generated after three unsuccessful attempts within 15 minutes, and the user shall be denied access until permission is renewed by a system administrator.
 - i. Network Security – Communication between the Network Engine and other system networked devices including additional Network Engines, Application and Data Servers, Open Data Servers (BACnet listed OWS), and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.
 - j. Hardware Real Time Clock – The Network Engine(s) shall include an integrated, hardware-based, real-time clock, with a supercapacitor to maintain time for a minimum of 72 hours during a power loss. Controllers using a battery to maintain time during a power loss shall not be acceptable.
 - k. Diagnostics – The Network Engine(s) shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Engine(s) shall provide both local and remote annunciation of any detected component failures or repeated failures to establish communication.
 - l. Power Failure – In the event of the loss of normal power, the Network Engine(s) shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
 - i. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 - ii. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
 - m. Certification – The Network Engine(s) shall meet and be listed to the UL 916 Standard for Energy Management Equipment and be FCC Compliant to CFR47, Part 15, Subpart B, Class A.
 - n. Device Integration – The Network Engine(s) shall support integrating networked devices using the following communication protocols on the device/controller network:
 - i. The Network Engine(s) shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.

- The Network Engine(s) shall support Remote Field Bus integration via a BACnet IP to MS/TP router.
 - The Network Engine(s) shall be tested and BTL listed/certified as a BACnet Building Controller (B-BC).
 - A BACnet Protocol Implementation Conformance Statement shall be provided for the Network Engine(s).
 - The Protocol Implementation Conformance Statement shall be submitted 10 days prior to bidding.
- ii. The Network Engine(s) shall support Johnson Controls N2 or third party N2 Open devices
- iii. The Network Engine(s) shall optionally support integration of networked devices using the following networking protocols:
- MODBUS RTU
 - MODBUS TCP
 - KNX - KNX is an open communication standard (EN 50090, ISO/IEC 14543) that many European manufacturers have applied to lighting controls, blinds and shutters, HVAC controls, security systems, energy management, audio, video, displays, and remote controls.
 - M-Bus - M-Bus (Meter Bus) is a European standard (EN 1434-3) that applies primarily to energy and heat meters.
 - C-CURE 9000 Access Control System
 - victor Video Management System
- o. The Network Engine(s) shall include the following multi-color, flashing LEDs to indicate important operating conditions and status:
- i. Heartbeat – to indicate each of the following states: operational (normal), powered but not operational, starting up, shutting down, or no power applied
 - ii. Fault – to indicate if fault conditions have been detected
 - iii. Ethernet Activity – to indicate if Ethernet Traffic is occurring or not occurring.
 - iv. Ethernet Link Speed – to indicate the speed of Ethernet Link (10, 100, or 1000 Mbps)
 - v. Site Director – to indicate if the Network Engine has been designated as the Site Director
 - vi. BACnet/IP – to indicate if the Network Engine is transmitting BACnet messages over BACnet/IP to other devices, including other Network Engines
 - vii. USB -1 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 1
 - viii. USB-1 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 2
 - ix. FC BUS-# – to indicate if communication is occurring on FC Bus port # (1 or 2)
 - x. FC EOL-# – to indicate if the end-of-line termination switch # (1 or 2) is on or off

2. Network Engine – Standard

- a. The Network Engine shall support up to 50 supervised devices across all supported integrations.
- b. Communications Ports – The Network Engine(s) shall provide the following ports for connecting networkable devices:
 - i. Two (2) USB ports
 - ii. One (1) RS-485 ports
 - iii. One (1) Ethernet port
- c. Provide Johnson Controls Series Network Engine (SNE-XX000) or approved equal as indicated on plans.

2.B DDC Equipment Controllers

1. General Purpose Equipment Controller

- a. The General Purpose Equipment Controller (CGM) shall be a fully programmable, digital controller that communicates via BACnet MS/TP protocol.
 - i. The CGM shall support BACnet Standard ANSI/ASHRAE 135.
 - The CGM shall be BTL listed/certified.
 - The CGM shall be tested and certified as a BACnet Advanced Application Controller (B-AAC).
 - A BACnet Protocol Implementation Conformance Statement shall be provided for the CGM.
 - The Conformance Statement shall be submitted 10 days prior to bidding.
 - b. The CGM shall employ finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
 - c. CGM controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
 - d. The CGM shall be assembled in a plastic housing with protection class IP20 (IEC529) and flammability rated to UL94-5VB.
 - e. The CGM shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control:
 - i. Schedules
 - ii. Calendars
 - iii. Alarms
 - iv. Trends

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- f. The CGM can continue time-based monitoring when offline for extended periods of time from a network.
 - g. The CGM can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the equipment controllers.
 - h. The CGM shall include troubleshooting LEDs to indicate the following conditions:
 - i. Power—to indicate if the controller is powered or not powered.
 - ii. Fault – to indicate if the controller is in its default state, has no faults, has a device fault, is in startup or download mode, or has an SA Bus communication issue
 - iii. SA Bus – to indicate if SA Bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin
 - iv. FC Bus – to indicate if FC Bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin.
 - v. EOL – to indicate if the end-of-line termination switch is on or off
 - i. The CGM shall have the ability to transfer and apply firmware files to all SA Bus IOM devices connected to it.
 - j. The CGM shall include pluggable and labeled screw terminal blocks for all I/O, FC and SA Bus communication, and power wiring connections.
 - k. The CGM shall accommodate the direct wiring of analog and binary I/O field points with the following resolution.
 - i. Inputs – 24-bit analog-to-digital converter
 - ii. Outputs – +/- 200 mV accuracy in 0-10 VDC applications
 - l. The CGM shall support the following types of inputs and outputs supplied in the amounts required for the specified applications:
 - i. Universal Inputs – shall be configurable to monitor any of the following:
 - 0-10 VDC analog input
 - 4-20 mA analog input
 - 0-600k ohms analog input
 - Dry contact binary input
 - ii. Binary Inputs – shall be configurable to monitor either of the following:
 - Dry Contact Maintained Mode
 - Pulse Counter Mode
 - iii. Analog Outputs – shall be configurable to output either of the following:
 - 0-10 VDC analog output
 - 4-20 mA analog output
 - iv. Binary Outputs – shall output the following:

- 24 VAC Triac
- v. Configurable Outputs – shall be capable of the following:
 - 0-10 VDC analog output
 - 24 VAC Triac binary output
- m. The CGM shall have the ability to reside on a Field Controller Bus (FC Bus).
 - i. The FC Bus shall be a MS/TP Bus supporting BACnet Standard protocol SSPC-135.
 - ii. The FC Bus shall support communications between the CGMs and the Network Engine.
 - iii. The FC Bus shall also support Input/Output Module (IOM) communications with the CGM and with the Network Engine.
 - iv. The FC Bus shall support a minimum of 100 IOMs and CGMs in any combination.
 - v. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the CGM and the furthest connected device.
- n. The CGM shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.
- o. The CGM shall have the ability to monitor and control a network of sensors and actuators over a SA Bus.
 - i. The SA Bus shall be a MS/TP Bus supporting BACnet Standard Protocol SSPC-135.
 - ii. The SA Bus shall support a minimum of 10 devices per trunk.
 - iii. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the CGM and the furthest connected device.
- p. The CGM shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over a MS/TP Bus.
- q. The CGM shall support, but not be limited to, the following applications.
 - iv. Heating central plant applications.
 - v. Built-up air handling units for special applications.
 - vi. Terminal & package units.
 - vii. Special programs as required for systems control.
- r. The CGM shall support a Local Controller Display as a remote device communicating over the SA Bus.
 - i. The Display shall use a BACnet Standard SSPC-135 MS/TP protocol.
 - ii. The Display shall allow the user to view monitored points without logging into the system.
 - iii. The Display shall allow the user to view and change setpoints, modes of operation, and parameters.
 - iv. The Display shall provide password protection with user adjustable password timeout.

- v. The Display shall be menu driven with separate paths for:
 - Input/Output
 - Parameter/Setpoint
 - Overrides
 - vi. The Display shall use easy-to-read English text messages.
 - vii. The Display shall allow the user to select the points to be shown and in what order.
 - viii. The Display shall support a back lit LCD with adjustable contrast and brightness and automatic backlight brightening during user interaction.
 - ix. The display shall be a minimum of 4 lines and a minimum of 20 characters per line.
 - x. The Display shall have a keypad with no more than 6 keys.
 - xi. The Display shall be panel mountable.
- s. Provide Johnson Controls CGM or approved equal as shown on plans.
2. Input/Output Module
- a. The Input/Output Module (IOM) provides additional inputs and outputs for use in digital controllers.
 - b. The IOM shall communicate with controllers over the FC Bus or the SA Bus.
 - c. The IOM shall support BACnet Standard ANSI/ASHRAE 135.
 - i. The IOM shall be BTL listed/certified and carry the BTL Label.
 - ii. The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - iii. A BACnet Protocol Implementation Conformance Statement shall be provided for the IOM.
 - iv. The Conformance Statement shall be submitted 10 days prior to bidding.
 - d. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
 - e. The IOM shall have a minimum of 4 points to a maximum of 17 points.
 - f. The IOM shall support the following types of inputs and outputs:
 - i. Universal Inputs – shall be configured to monitor any of the following:
 - Analog Input, Voltage Mode
 - Analog Input, Current Mode
 - Analog Input, Resistive Mode
 - The IOM shall provide minimum 15 bit A/D resolution of analog inputs
 - Binary Input, Dry Contact Maintained Mode
 - Binary Input, Pulse Counter Mode
 - ii. Binary Inputs – shall be configured to monitor either of the following:
 - Dry Contact Maintained Mode

- Pulse Counter Mode
 - iii. Analog Outputs – shall be configured to output either of the following:
 - Analog Output, Voltage Mode
 - Analog Output, current Mode
 - The IOM shall provide minimum 15 bit D/A resolution of analog outputs
 - iv. Binary Outputs – shall output the following:
 - 24 VAC Triac
 - v. Configurable Outputs – shall be capable of the following:
 - Analog Output, Voltage Mode
 - Binary Output Mode
 - g. The IOM shall include troubleshooting LEDs to indicate the following conditions:
 - i. Power On
 - ii. Power Off
 - iii. Download or Startup in progress, not ready for normal operation
 - iv. No Faults
 - v. Device Fault
 - vi. Normal Data Transmission
 - vii. No Data Transmission
 - viii. No Communication
 - h. Provide Johnson Controls IOM or approved equal as shown on plans.
3. Network Thermostat – Fan Coil and Zoning
- a. The network thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters, a pressure dependent VAV System, zoning type systems employing reheat including local hydronic reheat valves, or other similar equipment.
 - b. The Networked Thermostat shall communicate over the FC Bus using BACnet Standard protocol SSPC-135 or Johnson Controls N2 protocol.
 - i. Communications shall be selectable locally at thermostat through the display.
 - c. The TEC shall be BTL listed/certified and carry the BTL Label.
 - i. The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - ii. A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.
 - iii. The Conformance Statement shall be submitted 10 days prior to bidding.
 - d. The network thermostat shall include a 4.2 inch LED backlit touch screen with the following configurable icons.
 - i. Home screen configurable icons include:

- On/Off icon
 - Fan override icon
 - Zone temperature icon
 - Hold temperature icon
 - Zone humidity (on applicable models) icon
 - Occupancy status (on applicable models) icon
 - Temperature setpoint icon
 - Alarm icon
 - Unit status icon
 - Date/Time icon
 - Fan override icon
- ii. Home screen non-configurable icon includes:
- Menu icon
- e. The network thermostat shall provide the flexibility to support any one of the following inputs:
- i. Integral indoor air temperature sensor
- ii. Analog input for remote air temperature sensing that supports the following sensor types.
- Nickel
 - Platinum
 - A99B PENN
 - 2.25k ohm NTC
 - 10k ohm NTC
 - 10k ohm NTC Type 3
- iii. Universal input that supports the following configurations:
- Analog sensor
 - Cooling when switch is closed
 - Heating when switch is closed
- iv. Remote indoor air temperature sensor
- v. Two configurable binary inputs with the following configurations:
- Disabled
 - Occupancy
 - Override
 - Remote PIR
 - Dirty filter
 - Service
 - Fan Lock

- Open door
 - Open window
- f. The network thermostat shall provide 4 digit passcode security.
- g. The network thermostat shall employ nonvolatile EEPROM for all adjustable parameters.
- h. The network thermostat shall have a temperature accuracy of $\pm 0.9^{\circ}\text{F}/\pm 0.5^{\circ}\text{C}$ at $70.0^{\circ}\text{F}/21.0^{\circ}\text{C}$ typical calibrated.
- i. The network thermostat shall have a humidity accuracy of $\pm 5\%$ RH from 20 to 80% RH at 50 to 90°F (10 to 32°C.)
- j. The network thermostat shall provide user equipment visibility from a mobile device through the MAP.
- k. On/off or floating fan coil and zoning applications:
- i. The network thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters, a pressure dependent VAV System, zoning type systems employing reheat including local hydronic reheat valves, or other similar equipment.
 - ii. The network thermostat shall provide the flexibility to support any one of the following fan outputs:
 - Three speed fan control
 - Proportional speed fan control configurable from 0 to 10V
 - iii. The network thermostat shall provide the flexibility to support any one of the following valve outputs:
 - Two on/off
 - Two floating
 - iv. The network thermostat shall provide the flexibility to adjust the following control parameters:
 - Adjustable maximum setpoint offset from 0 to 20°F
 - Adjustable fan on delay from 0 to 120 seconds
 - Adjustable fan off delay from 0 to 120 seconds
 - Adjustable minimum cooling on time from 0 to 360 seconds
 - Adjustable minimum cooling off time from 0 to 360 seconds
 - Adjustable minimum heating on time from 0 to 360 seconds
 - Adjustable minimum heating off time from 0 to 360 seconds
 - Adjustable minimum reheat on time from 0 to 360 seconds
 - Adjustable minimum reheat off time from 0 to 360 seconds
 - Adjustable stroke time from 5 to 300 seconds
 - Adjustable supply fan minimum command from 0 to 100%
 - Adjustable supply fan Medium command from 0 to 100%
 - Adjustable supply fan high command from 0 to 100%
 - Adjustable reheat minimum damper position from 0 to 100%

- v. Provide Johnson Controls TEC361x or approved equal as indicated on plans.
4. Standalone Thermostat – Fan Coil and Zoning
 - a. The standalone thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters, a pressure dependent VAV system, zoning type systems employing reheat including local hydronic reheat valves, or other similar equipment.
 - b. The standalone thermostat shall include a 4.2 inch LED backlit touch screen with the following configurable icons.
 - i. Home screen configurable icons include:
 - On/Off icon
 - Fan override icon
 - Zone temperature icon
 - Hold temperature icon
 - Zone humidity (on applicable models) icon
 - Occupancy status (on applicable models) icon
 - Temperature setpoint icon
 - Alarm icon
 - Unit status icon
 - Date/Time icon
 - Fan override icon
 - ii. Home screen non-configurable icon includes:
 - Menu icon
 - c. The standalone thermostat shall provide the flexibility to support any one of the following inputs:
 - i. Integral indoor air temperature sensor
 - ii. Analog input for remote air temperature sensing that supports the following sensor types:
 - Nickel
 - Platinum
 - A99B PENN
 - 2.25k ohm NTC
 - 10k ohm NTC
 - 10k ohm NTC Type 3
 - iii. Universal input that supports the following configurations.
 - Analog sensor
 - Cooling when switch is closed
 - Heating when switch is closed
 - iv. Remote indoor air temperature sensor

- v. Two configurable binary inputs with the following configurations.
 - Disabled
 - Occupancy
 - Override
 - Remote PIR
 - Dirty filter
 - Service
 - Fan Lock
 - Open door
 - Open window
- d. The standalone thermostat shall provide 4 digit passcode security.
- e. The standalone thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.
- f. The standalone thermostat shall have a temperature accuracy of $\pm 0.9^{\circ}\text{F}/\pm 0.5^{\circ}\text{C}$ at $70.0^{\circ}\text{F}/21.0^{\circ}\text{C}$ typical calibrated.
- g. The standalone thermostat shall have a humidity accuracy of $\pm 5\%$ RH from 20 to 80% RH at 50 to 90°F (10 to 32°C.)
- h. On/Off or Floating fan coil and zoning applications.
 - i. The standalone thermostat shall provide the flexibility to support any one of the following fan outputs:
 - Three speed fan control
 - Proportional speed fan control configurable from 0 to 10V
 - ii. The standalone thermostat shall provide the flexibility to support any one of the following valve outputs:
 - Two on/off
 - Two floating
 - iii. The standalone thermostat shall provide the flexibility to adjust the following control parameters:
 - Adjustable maximum setpoint offset from 0 to 20°F
 - Adjustable fan on delay from 0 to 120 seconds
 - Adjustable fan off delay from 0 to 120 seconds
 - Adjustable minimum cooling on time from 0 to 360 seconds
 - Adjustable minimum cooling off time from 0 to 360 seconds
 - Adjustable minimum heating on time from 0 to 360 seconds
 - Adjustable minimum heating off time from 0 to 360 seconds
 - Adjustable minimum reheat on time from 0 to 360 seconds
 - Adjustable minimum reheat off time from 0 to 360 seconds
 - Adjustable stroke time from 5 to 300 seconds

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- Adjustable supply fan minimum command from 0 to 100%
 - Adjustable supply fan Medium command from 0 to 100%
 - Adjustable supply fan high command from 0 to 100%
 - Adjustable reheat minimum damper position from 0 to 100%
- iv. Provide Johnson Controls TEC331x or approved equal as indicated on plans.
- i. Proportional fan coil and zoning applications
- i. The standalone thermostat shall provide the flexibility to support any one of the following fan outputs:
- Three speed fan control
 - Proportional speed fan control configurable from 0 to 10V
- ii. The standalone thermostat shall provide the flexibility to support the following valve outputs:
- Two proportional configurable from 0 to 10V
- iii. The standalone thermostat shall provide the flexibility to adjust the following control parameters:
- Adjustable maximum setpoint offset from 0 to 20°F
 - Adjustable fan on delay from 0 to 120 seconds
 - Adjustable fan off delay from 0 to 120 seconds
 - Adjustable minimum reheat on time from 0 to 360 seconds
 - Adjustable minimum reheat off time from 0 to 360 seconds
 - Adjustable supply fan minimum command from 0 to 100%
 - Adjustable supply fan Medium command from 0 to 100%
 - Adjustable supply fan high command from 0 to 100%
 - Adjustable reheat minimum damper position from 0 to 100%
 - Adjustable proportional valve opened voltage from 0 to 10 VDC
 - Adjustable proportional valve closed voltage from 0 to 10 VDC
- iv. Provide Johnson Controls TEC322x or approved equal as indicated on plans.
- v. Where required by application and indicated on plans or room schedules provide the standalone thermostat with an integral Passive Infra-Red (PIR) occupancy sensor with a field of 94 angular degrees up to a distance of 15 ft., clear line of sight.
- vi. Where required by application and indicated on plans or room schedules provide the standalone thermostat with an integral relative humidity sensor.
5. Network Sensors
- a. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
- i. Zone Temperature
 - ii. Zone Humidity

- iii. Zone Setpoint
 - iv. Discharge Air Temperature
 - v. Zone CO₂
 - b. The NS shall transmit the information back to the controller on the SA Bus using BACnet Standard protocol SSPC-135.
 - c. The NS shall be BTL listed/certified and carry the BTL Label.
 - i. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
 - ii. A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
 - iii. The Conformance Statement shall be submitted 10 days prior to bidding.
 - d. The Network Zone Temperature Sensors shall include the following items:
 - i. A backlit LCD to indicate the temperature, humidity and setpoint
 - ii. An LED to indicate the status of the Override feature
 - iii. A button to toggle the temperature display between Fahrenheit and Celsius
 - iv. A button to program the display for temperature or humidity
 - v. A button to initiate a timed override command
 - vi. Available in either surface mount, wall mount, or flush mount
 - vii. Available with either screw terminals or phone jack
 - e. The Network Discharge Air Sensors shall include the following:
 - i. 4 inch or 8 inch duct insertion probe
 - ii. Ten foot pigtail lead
 - iii. Dip Switches for programmable address selection
 - iv. Ability to provide an averaging temperature from multiple locations
 - v. Ability to provide a selectable temperature from multiple locations
 - f. The Network CO₂ Zone Sensors shall include the following:
 - i. Available in either surface mount or wall mount
 - ii. Available with screw terminals or phone jack
 - iii. Measurement range of 0-2000 ppm
 - iv. Sensing resolution of 1 ppm.
 - v. Sensing accuracy of +/- 2% of the reading plus 40 ppm
 - g. Provide Johnson Controls NS series or approved equal where indicated on plans.
6. Wireless Field Bus System
- a. The Wireless Field Bus System shall employ standard IEEE802.15.4 technology to create a wireless mesh network to provide wireless connectivity for select BACnet devices at multiple system levels. This includes communications from field controllers to sensors

- and from engines to these field controllers. Wireless devices shall co-exist on the same network with hardwired devices. Hardwired controllers shall be capable of retrofit to wireless devices with no special software.
- b. The Wireless Field Bus Coordinator shall provide a wireless interface between supported field controllers and supervisory controllers (engines) via the BACnet MS/TP field bus. Each wireless mesh network shall be provided with a zone coordinator for initiation and formation of the network.
- i. The Coordinator shall function as a standard BACnet IP/MSTP Router.
 - ii. The Coordinator shall use direct sequence spread spectrum RF technology.
 - iii. The Coordinator shall operate on the 2.4 GHZ ISM Band.
 - iv. The Coordinator shall meet the IEEE 802.15.4 standard for low power, low duty-cycle RF transmitting systems.
 - v. The Coordinator shall be FCC compliant to CFR Part 15 subpart B Class A.
 - vi. The Coordinator shall operate as a bidirectional transceiver with the sensors and routers to confirm and synchronize data transmission.
 - vii. The Coordinator shall be capable of communication with sensors and routers up to a maximum distance of 250 Feet (line of sight).
 - viii. The Coordinator shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
 - ix. The Coordinator shall have LEDs to provide diagnostic information required for efficient operation and commissioning.
 - x. The Coordinator shall provide a secure user interface via a Wi-Fi or Ethernet connection using a mobile or desktop web browser to:
 - Configure the wireless network settings
 - View the connection status of the wireless enabled controllers
 - View and edit the controller configurations
 - View, edit and override controller values
- c. The Wireless Field Bus Router shall be used with any model Field Equipment Controller or VAV Modular Assembly to provide a wireless interface to network engines, via the Coordinator, and associated Wireless Mesh Room Temperature Sensors.
- i. The Router shall use direct sequence spread spectrum RF technology.
 - ii. The Router shall operate on the 2.4 GHZ ISM Band.
 - iii. The Router shall meet the IEEE 802.15.4 standard for low power, low duty-cycle RF transmitting systems.
 - iv. The Router shall be FCC compliant to CFR Part 15 subpart B Class A.
 - v. The Router shall operate as a bidirectional transceiver with other mesh network devices to ensure network integrity.
 - vi. The Router shall be capable of communication with other mesh network devices at a maximum distance of 250 feet (line of sight).

-
- vii. The Router shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
 - viii. The Router shall provide LED indication for use in commissioning and troubleshooting that can be disabled.
 - ix. The Router shall be available in a variety of mounting options; plenum, wall, or ceiling mount.
 - x. The Router shall support the ability to be used alternatively as a wireless repeater.
- d. The wireless room temperature sensors shall sense and transmit room temperatures, room set point, room occupancy notification, and low battery condition to an associated Router as dictated by specified sensor type.
 - i. The sensors shall use direct sequence spread spectrum RF technology.
 - ii. The sensors shall operate on the 2.4 GHZ ISM Band.
 - iii. The sensors shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - iv. The sensors shall be FCC compliant to CFR Part 15 subpart B Class A.
 - v. The sensors shall be available with:
 - Warmer/cooler setpoint adjustment
 - No setpoint adjustment
 - Setpoint adjustment scale – 55 to 85°F
 - Temperature and humidity sensing
 - Support for 10K and 3K ohm refrigerator/freezer temperature probe
 - Support for NIST rated 3K ohm refrigerator/freezer temperature probe
 - vi. Wireless sensors shall be provided with display of room temperature, signal strength, fan mode, occupancy and network status as required by application and indicated on plans or in schedules.
 - vii. The sensors shall be assembled in NEMA 1 plastic housings.
 - e. Provide Johnson Controls ZFR coordinators and routers, with WRZ sensors, or approved equals, as shown on plans.
7. One-to-One Wireless Room Temperature Sensor System
- a. The One-To-One Wireless Receiver shall receive wireless RF signals containing temperature data from multiple Wireless Room Temperature Sensors and communicate this information to the appropriate controller via the SA Bus.
 - i. The Receiver shall use direct sequence spread spectrum RF technology.
 - ii. The Receiver shall operate on the 2.4 GHZ ISM Band.
 - iii. The Receiver shall meet the IEEE 802.15.4 standard for low power, low duty-cycle RF transmitting systems.
 - iv. The Receiver shall be FCC compliant to CFR Part 15 subpart B Class A.

- v. The Receiver shall operate as a bidirectional transceiver with the sensors to confirm and synchronize data transmission.
- vi. The Receiver shall be capable of communication with from one to five WRZ sensors up to a distance of 200 Feet.
- vii. The Receiver shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
- viii. The Receiver shall have LED indicators to provide information regarding the following conditions:
 - Power
 - SA Bus – Receiver Activity/No Activity
 - Wireless RF – Transmission from sensors/No Transmission
 - Wireless Rapid Transmit Mode – No transmission/ weak signal/Adequate signal/Excellent signal
- b. The Sensors shall sense and report room temperatures to the WRZ Receiver.
 - i. The sensors shall use direct sequence spread spectrum RF technology.
 - ii. The sensors shall operate on the 2.4 GHZ ISM Band.
 - iii. The sensors shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - iv. The sensors shall be FCC compliant to CFR Part 15 subpart B Class A.
 - v. The sensors shall be available with:
 - Warmer/cooler setpoint adjustment
 - No setpoint adjustment
 - Setpoint adjustment scale – 55 to 85°F
 - vi. The sensors shall be assembled in NEMA 1 plastic housings
- c. Provide Johnson Controls WRZ series Receivers and Sensors, or approved equals, as shown on plans.

2.C Miscellaneous Devices

- 1. Variable Frequency Motor Speed Control Drives
 - a. The VSD and all components shall be designed, manufactured and tested in accordance with the latest applicable standards.
 - i. Institute of Electrical and Electronic Engineers (IEEE)
 - IEEE 519-1992: Guide for harmonic content and control.
 - ii. Underwriters Laboratories (UL508C: Power Conversion Equipment)
 - UL
 - cUL
 - iii. National Electrical Manufacturer's Association (NEMA)
 - ICS 7.0: Industrial Controls & Systems for VSDs.

iv. EN 61000-3-12, EN 61800-3 (1996) +A11 (2000) Category C2

- Fulfill all EMC immunity requirements.

b. VSD through 250 HP shall have the following features:

- i. The VSD may be designed in a NEMA Type 1, NEMA 12, or NEMA 3R enclosure
- ii. Incoming Power: Three-phase, 208 / 240 / 480 (+10% to -10%) and 50/60 Hz (+10 to -5%). The VSD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on a low overload application at 40°C ambient and 1.5 - 10 kHz switching frequency with automatic switching frequency de-rating in case of overload.
- iii. Humidity: 0 to 95% (non-condensing and non-corrosive)
- iv. Altitude: 0 to 3,300 feet (1000 meters) above sea level
- v. Ambient Temperature: -10 to 40°C (VT)
- vi. Storage Temperature: -40 to 70°C
- vii. The VSDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation.
- viii. The VSDs shall have an efficiency at full load and speed that exceeds 97%. The efficiency shall exceed 90% at 50% speed.
- ix. The VSDs shall maintain a minimum line side displacement power factor of 0.96, regardless of speed and load for VFDs less than 75 HP. The VSDs shall maintain a minimum line side displacement power factor of .99, regardless of speed and load for motors greater than 75 HP.
- x. The VSDs shall have a one (1) minute overload current rating of 110% for low overload applications.
- xi. The current withstand rating of the drive shall be 100,000 AIC.
- xii. The VSDs shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VSD.
- xiii. The VSDs shall have an integral EMI/RFI filter as standard.
- xiv. VFD must contain a circuit breaker or fused disconnect as an option.
- xv. Total harmonic distortion shall be calculated based on total demand distortion conditions as defined in IEEE 519-1992. Any harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings, and the total system load.
- xvi. Provide built in Communication capability for interface with RS-485 (ModBus RTU) (Johnson Controls Metasys N2) (MS/TP BACnet) or Ethernet (BACnet/IP) (Modbus/TCP).
 - Communication capability via expansion card to support RS-485 shall include Johnson Controls Metasys – SA Bus or LonWorks.

- c. Provide Johnson Controls VSD Series II or equal as indicated on plans.

2. Local Control Panels

- a. All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508A label listing compliance. Control panels shall be fully enclosed, with sub-panel, hinged door, and flush latch.
- b. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
- c. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
- d. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
- e. All wiring shall be neatly installed in plastic trays or tie-wrapped.
- f. Control panels for use in seismic areas shall be built in an approved facility and carry the appropriate label.
- g. Except where otherwise noted, all standard and custom control panels shall be built in an ISO9002 certified facility.

3. Power Supplies

- a. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
- b. Input: 120 VAC +10%, 60Hz
- c. Output: 24 VDC
- d. Line Regulation: +0.05% for 10% line change
- e. Load Regulation: +0.05% for 50% load change
- f. Ripple and Noise: 1 mV rms, 5 mV peak to peak
- g. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
- h. A power disconnect switch shall be provided next to the power supply.
- i.

Part 3 – Performance/Execution

3.A BMS Specific Requirements

1. Graphic Displays

- a. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

-
- f. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.
 2. BMS Line Voltage Power Source
 - a. 120-volt AC circuits used for the BMS shall be taken from panel boards and circuit breakers provided by Division 26.
 - b. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
 - c. DDC terminal unit controllers may use AC power from motor power circuits.
 3. BMS Raceway
 - a. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
 - b. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 - c. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
 - d. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
 4. Penetrations
 - a. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
 - b. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 - c. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
 - d. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
 5. BMS Identification Standards
 - a. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
 - b. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.
 6. BMS Panel Installation
 - a. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
 - b. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.
 7. Input Devices

- a. All Input devices shall be installed per the manufacturer recommendation.
 - b. Locate components of the BMS in accessible local control panels wherever possible.
8. HVAC Input Devices – General
- a. All Input devices shall be installed per the manufacturer recommendation.
 - b. Locate components of the BMS in accessible local control panels wherever possible.
 - c. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
 - d. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
 - e. Outside Air Sensors
 - i. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outdoor air conditions accurately.
 - ii. Sensors shall be installed with a rain proof, perforated cover.
 - f. Water Differential Pressure Sensors
 - i. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
 - ii. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
 - iii. The transmitters shall be installed in an accessible location wherever possible.
 - g. Medium to High Differential Water Pressure Applications (Over 21" WC)
 - i. Air bleed units, bypass valves and compression fittings shall be provided.
 - h. Building Differential Air Pressure Applications (-0.5" to +0.5" WC)
 - i. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
 - ii. The interior tip shall be inconspicuous and located as shown on the drawings.
 - i.
 - i. Duct Temperature Sensors
 - i. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - ii. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
 - iii. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
 - iv. The sensor shall be mounted to suitable supports using factory approved element holders.
 - j. Space Sensors

- i. Shall be mounted per ADA requirements.
- ii. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
- k. Low Temperature Limit Switches
 - i. Install on the discharge side of the first water or steam coil in the air stream.
 - ii. Mount element horizontally across duct in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.
 - iii. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
- l. Air Differential Pressure Status Switches
 - i. Install with static pressure tips, tubing, fittings, and air filter.
- m. Water Differential Pressure Status Switches
 - i. Install with shut off valves for isolation.
- n. HVAC Output Devices
 - i. All output devices shall be installed per the manufacturers' recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
 - ii. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
 - iii. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
 - iv. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
 - v. Electronic Signal Isolation Transducers: Whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

3.C Commissioning Requirements

1. Fully commission all aspects of the BMS work.
2. Acceptance Check Sheet
 - a. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.
 - b. Submit the check sheet to the Engineer for approval.

- c. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.
3. VAV box performance verification and documentation:
 - a. The BMS Contractor shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.
 - b. The BMS Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.
 - c. Promptly rectify all listed deficiencies and submit a document summarizing completion to the Engineer.

3.D Performance Verification

1. The installing contractor shall perform a complete Performance Verification (PV) of the Building management system three times throughout the project:
 - a. At project turnover to customer.
 - b. At six (6) months of project operation.
 - c. At twelve (12) months of project operation or end of warranty.
2. Performance Verification shall include a complete and current Building Automation System site inventory including the following information at a minimum: a listing of all field and supervisory controllers with the following key attribute data; corresponding model numbers, firmware versions, available security updates, CPU and memory performance data, battery conditions, integrations, controlled equipment, and device and point counts.
3. Performance Verification shall include a complete written evaluation of system configuration and performance in the following categories:
 - a. Security – The Security evaluation shall include information about controllers that require security updates and conformance of user accounts to latest security rules and best practices.
 - b. Energy Performance – The Energy Performance and Savings evaluation shall identify opportunities through schedule and nightly setbacks, economizers, eliminating simultaneous heating and cooling and adding VSD to equipment.
 - c. Comfort and Health – The Comfort and Health evaluation shall identify temperature, pressure, and carbon dioxide values that deviate from desired set points that could lead to occupant discomfort.
 - d. Reliability – The Reliability evaluation shall identify overridden control points, control points creating excessive alarms, and opportunities to adding control points and trends to further enable system functionality.
 - e. Standards – The Standards evaluation shall identify conformance to published standards for point count, network performance and protocol standards.

- 4. Provide all reports as specified on a new, USB compatible flash drive.

Part 1 General

1.1 Systems:

- .1 Sequence of operation:
 - .1 Outside Air Conditions
 - .2 Existing Loop Pumps
 - .3 Make Up Air Units
 - .4 Sump Pit Monitor
 - .5 Crawlspace Ventilation System
 - .6 Smudging Exhaust Fan
 - .7 Pool Storage Exhaust Fan
 - .8 Hydronic Fan Coil Units
 - .9 Hydronic Unit Heater

1.2 Related Sections

- .1 Section 25 30 00 - Instruments And Control Elements.
- .2 Section 25 50 02 - Digital Control Equipment.
- .3 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 System Description

- .1 This section defines the manner in which controls function.
- .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.

1.4 Submittals For Review

- .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.

1.5 Submittals At Project 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

- .1 Not Used

Part 3 Execution

3.1 Outside Air Conditions

- .1 The controller shall connect to existing building network to monitor the outside air temperature and humidity from existing sensors on the network and calculate the outside air enthalpy on a continual basis. These values shall be made available to the system at all times.

3.2 Existing Loop Pumps

- .1 Chilled Glycol Primary Loop Pumps
 - .2 Existing Chiller Pumps P-3/4 and bypass valve shall be adjusted to accommodate added flow for vocational HVAC equipment.
 - .3 Existing glycol loop circulation pumps, P-5/6 shall be adjusted to accommodate added flow for vocational HVAC equipment.
 - .4 Existing terminal unit heating loop pumps P-7/8 shall be adjusted to accommodate added flow for vocational HVAC equipment.
- .2

3.3 Make Up Air Systems (MUA-1)

- .1 Interlock schedule:

Make-up Air System	Exhaust Fan
MUA-1	EF-1,2,3,4, range hoods

- .2 Run Conditions - Interlocked:

- .1 Each make-up air unit (MUA) and exhaust fan (EF) group shall run together as shown in the schedule above.
 - .1 Each system will have a clearly labeled system switch located near the user device that will turn the system on. Coordinate final location of system switches with The City’s requirements.
 - .2 When the system switch is turned on, all MUAs and EFs for that system shall turn on.
 - .3 Make-up airflow shall be proven before exhaust fan(s) start.
- .2 Alarms shall be provided as follows:
 - .1 High Discharge Air Temp: If the discharge temperature is greater than the cooling setpoint by 2.5°C (5°F) (adj.).
 - .2 Low Discharge Air Temp: If the discharge air temperature is less than the setpoint by 2.5°C (5°F) (adj.).
 - .3 MUA Supply Fan Failure: Commanded on, but the status is off.
 - .4 MUA Supply Fan in Hand: Commanded off, but the status is on.
 - .5 MUA Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .6 Exhaust Fan Failure: Commanded on, but the status is off.
 - .7 Exhaust Fan in Hand: Commanded off, but the status is on.
 - .8 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .9 All alarms generated by the MUA onboard controller.
 - .10
- .3 Discharge Air setpoint:

- .1 When the thermostat nearest the MUA supply zone is in heating mode, the discharge air set-point will be 22°C (72°F) (adj.).
 - .2 When the thermostat nearest the MUA supply zone is in cooling mode, the discharge air set-point will be 16°C (60°F) (adj.).
 - .3 If neither cooling nor heating mode is applicable, the discharge air temperature shall be 21°C (70°F) (adj.)
- .3 Emergency Shutdown:
 - .1 The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
 - .4 Freeze Protection:
 - .1 The unit shall shut down and generate an alarm upon receiving a freezestat status.

3.4 Sump Pit Monitor (P22 To P-25)

- .1 Packaged Sump Pumps complete with:
 - .1 Control panel with alternator, alarm outputs.
- .2 DDC to monitor:
 - .1 Sump pump controller for faults.
 - .2 High water level as sensed by independent level switch, connect to DDC.
 - .3 Oil detection (where applicable).

3.5 Crawlspace Ventilation System (EF-5)

- .1 Run condition – Humidistat
 - .1 The system shall be enabled whenever the outdoor air is above 5°C (41°F) (adj.)
 - .2 The exhaust fan shall run and the intake damper shall open when the humidistat reads a relative humidity above 55% (adj.) and the calculated outdoor dew-point is below the calculated crawlspace dew-point.
- .2 Alarms shall be provided as follows:
 - .1 Exhaust Fan Failure: Commanded on, but the status is off.
 - .2 Exhaust Fan in Hand: Commanded off, but the status is on.
 - .3 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .4 Damper Failure: Commanded open but damper is closed, or commanded closed and damper is open.

3.6 Smudging Exhaust Fan (EF-6)

- .1 Run Conditions – Manual Timer:
 - .1 Exhaust fan shall be enabled by a space mounted timer and run continuously while timer is active.
 - .2 Supply and return duct dampers associated with each smudging fan shall close whenever fan is running and associated fan coil shall be disabled.
 - .3 ERV-1 shall be commanded to operate upon activation of smudging fan.
 - .4 Smudging fan exhaust damper shall open and associated bypass damper shall close while fan is operating. Fan shall not start until damper positions are proven.

3.7 Pool Storage Ventilation Fan (F-1)

- .1 Run Conditions – schedule (user adj.):
 - .1 Fan shall be enabled by occupied/ unoccupied schedule.

3.8 Hydronic Fan Coils (FC-1 to FC-12),

- .1 Run Conditions - Scheduled:
 - 1. The unit shall be enabled to operate according to a user definable time schedule . Occupancy sensors within each room of each zone shall sense occupancy to command the unit to run:
 - .2 Occupied Mode: The unit shall maintain
 - .1 A 75°F (adj.) cooling setpoint
 - .2 A 70°F (adj.) heating setpoint.
 - .3 Unit shall continue to operate for 5 minutes (user adj.) following sensing of unoccupied status.
 - .3 Unoccupied Mode (night setback): The unit shall maintain
 - .1 A 85°F (adj.) cooling setpoint.
 - .2 A 55°F (adj.) heating setpoint.
- .2 Alarms shall be provided as follows:
 - .1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
 - .2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
- .3 Zone Setpoint Adjust:
 - .1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor within definable range.
- .4 Zone Unoccupied Override:
 - .1 A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- .5 Fan:
 - .1 The fan shall run anytime the unit is commanded to run unless shutdown on safeties.
- .6 Pressure Independent Control Valves for heating and cooling coils:
 - .1 The fan coil controller shall enable heating mode or cooling based on the zone temperature.
 - .2 The controller shall measure the zone temperature and modulate the control valve flow to maintain temperature setpoint.
 - .3 The cooling shall be enabled whenever:
 - .1 the zone temperature is above cooling setpoint.
 - .2 AND the fan is on.
- .7 Fan Status:
 - .1 The controller shall monitor the fan status.
 - .2 Alarms shall be provided as follows:
 - .1 Fan Failure: Commanded on, but the status is off.

.2 Fan in Hand: Commanded off, but the status is on.

3.9 Hydronic Unit Heater

- .1 Run Conditions – Temperature:
 - .1 The unit shall run according to a user definable temperature:
 - .2 The unit shall maintain
 - .1 The unit shall maintain a heating setpoint of 16°C (adj.).
- .2 Zone Setpoint Adjust:
 - .1 The occupant shall be able to adjust the zone temperature heating setpoint at the zone sensor.
- .3 Fan:
 - .1 The fan shall run anytime the zone temperature drops below heating setpoint, unless shutdown on safeties.

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-C22.1-21 - 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
- .7 Canada Green Building Council (CaGBC)
 - .1 LEED v4 for Building Design and Construction (BD+C).
 - .2 LEED v4 for Interior Design and Construction (ID+C).
 - .3 California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - .4 South Coast Air Quality Management District (SCAQMD).
 - .5 California Air Resources Board (CARB).

1.3 Regulatory Requirements

- .1 Conform to CSA-C22.1-21.
- .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.
- .6 Provide 3rd party certification where specified to verify compliance with LEED v4 requirements.

1.4 Definitions

- .1 The following are definitions of terms and expressions used in the specification:
 - .1 Contract Administrator: Electrical Engineering Contract Administrator: Epp Siepman Engineering Inc.

- .2 Inspection Authority: agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.
- .3 Supply Authority: electrical power utility company responsible for delivery of electrical power to project.
- .4 Electrical Code: Canadian Electrical Code or Local Code in effect at project location.
- .5 Indicated: as shown on Contract drawings or noted in Contract Documents.
- .6 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.
- .7 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.
- .8 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.
- .9 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.
- .10 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.
- .11 New: Produced from new materials.
- .12 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .13 Defective: A condition determined exclusively by the Contract Administrator.

1.5 Permits & 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 Subcontractor 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 & 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 For 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 Lighting
- .4 Lighting Controls
- .5 Branch Wiring, Conduit, Raceway, Boxes
- .6 Exit & Emergency Lighting
- .7 Electric Heat
- .8 Voice/Data
- .9 Paging
- .10 Audio/Visual Systems
- .11 Intercom
- .12 Fire Alarm
- .13 CCTV
- .14 Intrusion
- .15 Access Control
- .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@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.
 - .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 to bear the Electrical Subcontractor's and where applicable the Utility's reviewed stamp.

- .3 Shop drawings shall be reviewed by the Electrical Subcontractor, 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 co-ordinated 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 Electrical Subcontractor 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 (4) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, one (1) 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 (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) 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 Subcontractor 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 00 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
 - .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 00 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
 - .2 Table of Contents: Provide:
 - .1 Title of project.
 - .2 Date of submission.
 - .3 Names, addresses, and telephone numbers of Contract Administrator and Electrical Subcontractor 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 related 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 Division'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 Division 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: Transfer the marked-up information to AutoCAD and produce an electronic record set in Adobe Acrobat (PDF) format, as well as the AutoCAD file.
 - .2 Specifications: Adobe Acrobat (PDF).
 - .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.
 - .3 Submit completed record documents to Contract Administrator 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 Electrical Subcontractor for correction and completion.
 - .5 Record drawings shall contain a stamp bearing the words "Record Drawing" or "As-Built Drawing", the Electrical Subcontractor's company name, date, and the Electrical Subcontractor's signature.
 - .6 The Contract Administrators 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 Contract Administrator before backfilling commences.
 - .8 Record actual size and location of all cables including depth of cables where buried.
 - .9 Electrical Subcontractor shall 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 Subcontractor shall perform the work as directed at no additional cost to The City.

1.11 Efficiency Manitoba

- .1 Electrical Subcontractor 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 Subcontractor shall gather all information as required to complete the application.
- .4 Electrical Subcontractor 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 (10) 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 (10) 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.
- .5 Wet applied material including but not limited to interior adhesives, coatings, sealants, paint shall be classified as Low-emitting materials under LEED v4 BD+C, to meet the threshold of at least 90%, by volume, for emission and 100% for Volatile Organic Compound (VOC). Certification to be provided to confirm compliance with General Emissions Evaluation and VOC content requirements for wet applied products.
 - .1 General emissions evaluation. Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario. The default scenario is the private office scenario. The manufacturer's or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in mass per surface area. Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.1:
 - .1 0.5 mg/m³ or less;
 - .2 between 0.5 and 5.0 mg/m³; or
 - .3 5.0 mg/m³ or more.
 - .2 Additional VOC content requirements for wet-applied products. In addition to meeting the general requirements for VOC emissions (above), on-site wet-applied products must not contain excessive levels of VOCs, for the health of the installers and other trades workers who are exposed to these products. To demonstrate compliance, a product or layer must meet the following requirements, as applicable. Disclosure of VOC content must be made by the manufacturer. Any testing must follow the test method specified in the applicable regulation.
 - .3 All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

- .4 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

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-C22.1-21.
- .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 Electrical Subcontractor'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 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 Device 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 (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		
- General	1150	45"
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.	1150mm	45"
Occupancy Sensors – General	Per manufacturers recommendations	
Fire Alarm Visual, Audible, & Combination Devices	2350mm* or 150mm**	92"* or 6"***
Fire Alarm Manual Pullstations	1200mm	47"
Thermostats		
- General	1150mm	45"
Intercom Stations	1150mm	45"
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"***

*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 to bottom of finished wall plate.

*****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 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.
- .5 Panelboards mounted on exterior concrete/block walls shall have minimum 3/4" air gap behind enclosure (to minimize condensation).
- .6 All transformers, motor control centers and floor-mounted distribution panels shall be mounted on 100mm (4") concrete housekeeping pads. The Electrical Subcontractors shall be responsible for provision of these pads.

3.9 Fireproofing

- .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 00.
- .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 Testing

- .1 Conduct and pay for tests including, but not limited to, the following systems:
 - .1 Power generation and distribution system.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Heating cables and mats.
 - .6 Systems:
 - .1 Fire Alarm
 - .2 Public Address
 - .3 Communication cabling systems.
 - .4 Intrusion Detection
 - .5 Access Control
 - .6 CCTV
 - .7 Grounding systems.
- .2 Insulation Resistance Testing
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
 - .3 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 Cleaning

- .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 electrical devices and equipment serving utilization equipment that has been removed.
- .10 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- .11 Repair adjacent construction and finishes damaged during demolition and extension work.

-
- .12 Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
 - .13 Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

- .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 FINISHES

- .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.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Building wire and cable.
- .2 Armoured cable.
- .3 Metal clad cable.
- .4 Fire rated cable.
- .5 Wiring connectors and connections.

1.2

Related Sections

- .1 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 C22.2 No. 0.3-09 (R2014) - Test Methods for Electrical Wires and Cables.
- .3 CSA C22.2 No. 51-14 - Armoured Cables.
- .4 CSA C22.2 No. 52-15 - Underground Secondary and Service Entrance Cables.
- .5 CAN/CSA-C22.2 No. 65-18 - Wire Connectors.
- .6 CSA C22.2 No. 75-17 - Thermoplastic-Insulated Wires and Cables.
- .7 CSA C22.2 No. 123-16 - Metal Sheathed Cables.
- .8 CAN C22.2 No.131-17 - Type TECK 90 Cable.
- .9 CSA C22.2 No. 208-14 - Fire Alarm and Signal Cable.
- .10 NECA (National Electrical Contractor's Association) - National Electrical Installation Standards (NEIS).
- .11 NETA (InterNational Electrical Testing Association) - ANSI/NETA ATS-2017 - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- .12 CSA (Canadian Standards Association).
- .13 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 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide for Fire Rated Cable.

1.6 Submittals For Information

- .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 Closeout Submittals

- .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.

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 Regulatory Requirements

- .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.

1.10 Project 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 Building Wire And Cable

- .1 Description: Single conductor insulated wire.
- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation: Thermoplastic material rated 90 degrees C.

2.2 Armoured Cable

- .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: Thermoplastic.

2.3 Metal Clad Cable

- .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 (XPPE), type RW90.
- .6 Armour Material: Aluminum.
- .7 Armour Design: Interlocked metal tape.
- .8 Outer jacket: PVC.
- .9 Rating: Hazardous Location, CSA FT4

2.4 Fire Rated Cable

- .1 Manufacturers:
 - .1 Pyrotex; Product: 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

2.5 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 building wire in raceway.
- .2 Exposed Dry Interior Locations: Use only building wire in raceway.
- .3 Above Accessible Ceilings: Use only building wire in raceway.
- .4 Wet or Damp Interior Locations: Use only armoured cable with jacket, metal clad cable, and building wire in raceway.
- .5 Exterior Locations: Use only metal clad cable.
- .6 Underground Installations: Use only 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.
- .6 Use conductor not smaller than 16 AWG for control circuits.

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

- .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 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
- .12 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.
- .13 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).
- .14 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.
- .15 Fire Rated Cable shall be installed in complete unbroken lengths parallel with building lines and terminated as per manufacturer's instructions. Care shall be taken at all times to prevent the entry of moisture into the ends of the cable.
- .16 Fire Rated Cable shall be surface-mounted to building surfaces with stainless steel banding or straps.
- .17 Use suitable cable fittings and connectors.
- .18 Neatly train and lace wiring inside boxes, equipment, and panelboards.
- .19 Clean conductor surfaces before installing lugs and connectors.
- .20 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- .21 Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
- .22 Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

-
- .23 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.
 - .24 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - .25 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - .26 Identify wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Grounding electrodes and conductors.
- .2 Equipment grounding conductors.
- .3 Bonding.

1.2

References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 IEEE 81-2012 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

1.3

System Description

- .1 Metal and underground water pipe.
- .2 Metal frame of the building.
- .3 Metal and underground gas piping system.
- .4 Rod electrode.

1.4

Performance Requirements

- .1 Maximum Grounding System Resistance: 5 ohms.

1.5

Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide for grounding electrodes and connections.

1.6

Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate overall resistance to ground.

1.7

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.

1.8

Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.

1.9 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: 15.8 mm(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 Bonding connections shall be made using a star configuration. Loop connections shall be avoided.

- .10 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.
- .11 Provide separate bonding conductor in all non-metallic raceways.
- .12 Bond together metal siding not attached to grounded structure; bond to ground.
- .13 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- .14 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 System Grounding

- .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 Equipment Bonding

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to:
 - .1 Service equipment
 - .2 Distribution Panels
 - .3 Transformers
 - .4 Motor Frames
 - .5 Starters
 - .6 Control Panels
 - .7 Building Steel Work
 - .8 Outdoor lighting

3.5 Communication And Security Systems

- .1 Install communications grounding system for bonding of all telephone, data, fire alarm, paging, security 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 and security systems as indicated.

3.6 Field Quality 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 Contractor's Association.
- .3 CSA (Canadian Standards Association).
- .4 ULC (Underwriters' Laboratories of Canada).

1.3 Submittals For 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 Regulatory 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, size 1.6" x 1.6" (40 x 40 mm), 0.1" (2.5 mm) thick, surface-mounted, suspended or set in poured concrete walls and ceilings as required.

2.3 Installation

- .1 Install products to manufacturer's written instructions.
- .2 Provide anchors, fasteners, and supports to CSA-C22.1.
- .3 Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- .4 Do not use powder-actuated anchors.
- .5 Obtain permission from Contract Administrator before using powder-actuated anchors.
- .6 Do not drill or cut structural members.
- .7 Obtain permission from Contract Administrator before drilling or cutting structural members.
- .8 Do not use plastic cable ties.
- .9 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- .10 Install surface-mounted cabinets and panelboards with minimum of four anchors.
- .11 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 inch) off wall.
- .12 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 26 - Grounding And Bonding.
- .4 Section 26 05 29 - Electrical Supporting Devices.
- .5 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 CAN/CSA-C22.2 No. 227.1-06 (R2016) - Electrical Nonmetallic Tubing.
- .10 CSA C22.2 No. 227.2.1-14 - Liquid-Tight Flexible Nonmetallic Conduit.
- .11 CSA (Canadian Standards Association).
- .12 UL (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.

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 Regulatory 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) and 16mm (1/2 inch) for conduits crossing each other.
- .5 Wet and Damp Locations: Use non-metallic conduit.

- .6 Dry Locations:
 - .1 Concealed: Use electrical metallic tubing.
 - .2 Exposed: Use electrical metallic tubing.

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.
- .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 Electrical Non-metallic Tubing

- .1 Description: CSA 227.1.
- .2 Fittings and Conduit Bodies: CSA 227.1.
- .3 Provide a separate ground wire in all electrical non-metallic tubing.

2.8 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 sprinklerproof 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 Examination

- .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, Electrical Subcontractor 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 Maintain adequate clearance between conduit and piping.

- .17 Maintain 300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding 40 degrees C (104 degrees F).
- .18 Cut conduit square using saw or pipe cutter; de-burr cut ends.
- .19 Bring conduit to shoulder of fittings; fasten securely.
- .20 Where threaded connections are used, threads shall be of sufficient length to ensure a tight connection.
- .21 Where conduit becomes blocked, remove and replaced blocked sections.
- .22 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.
- .23 Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- .24 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.
- .25 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- .26 Ensure conduit systems are dry prior to installation of wiring.
- .27 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.
- .28 Provide polypropylene pull string in each empty conduit except sleeves and nipples.
- .29 Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- .30 Ground and bond conduit to Section 26 05 26.
- .31 Identify conduit to Section 26 05 53.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Wall and ceiling outlet boxes.
- .2 Floor boxes.
- .3 Pull and junction boxes.

1.2

Related Sections

- .1 Section 07 84 00 - Firestopping.
- .2 Section 08 31 00 - 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

Regulatory 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 indicated or 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 Floor Boxes

- .1 Floor Boxes: CSA-C22.2 No. 18, fully adjustable, four compartments with feed through tunnel compartment, [shallow 62 mm (2-7/16 inches)] [standard 87 mm (3-7/16 inches)] deep, suitable for concrete or wood floor applications.
- .2 Manufacturers:
 - .1 Legrand Wiremold: Evolution Series.
- .3 Substitutions: Refer to 26 05 00 Common Work Results for Electrical.
- .4 Material: Steel.
- .5 Shape: Circular.
- .6 Service Fittings: As specified in Section 26 27 26.
- .7 Shape: Round and.
- .8 Service Fittings: As specified in Section 26 27 26.

2.3 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 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.
- .22 Use stamped steel bridges to fasten in-wall outlet box between studs.
- .23 Install in-wall mounting box without damaging wall insulation or reducing its effectiveness.
- .24 Use adjustable steel channel fasteners for hung ceiling outlet box.
- .25 Do not fasten boxes to ceiling support wires.
- .26 Support boxes independently of conduit.
- .27 Use gang box where more than one device is mounted together.
- .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.

3.3 Adjusting

- .1 Adjust floor box flush with finish flooring material.
- .2 Adjust flush-mounting outlets to make front flush with finished wall material.
- .3 Install knockout closures in unused box openings.

3.4 Cleaning

- .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 Related Sections

- .1 Section 09 90 00 - Painting.

1.3 References

- .1 CSA (Canadian Standards Association).
- .2 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For 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.

1.5 Regulatory Requirements

- .1 Provide products listed and classified by CSA or ULC and as suitable for purpose specified and shown.

1.6 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:
 - .1 Nameplates at individual breakers shall include:
 - .1 Load Name
 - .2 Room Location of Load
 - .3 Breaker Size/Poles
 - .3 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"
 - .4 Mechanical equipment disconnect switches:
 - .1 Nameplate shall include:
 - .1 Mechanical Equipment Mark
 - .2 Panel Name & Circuit number
 - .5 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)
 - .6 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
 - .7 Fire Alarm Equipment Branch Circuit Breakers

- .1 Nameplate shall indicate "FIRE ALARM PANEL" or approved wording.
- .8 Pole mounted luminaires.
 - .1 Nameplate shall include:
 - .1 Manufacturer & Model # of Pole
 - .2 Manufacturer & Model # of Luminaire
 - .3 Voltage
 - .4 Driver Model #
 - .5 Lamp Wattage & Model #
 - .6 Fed From Panel & Circuit Number
- .9 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
- .4 Letter Size:
 - .1 Use 6 mm(1/4 inch) letters for identifying equipment mark designations and system types.
 - .2 Use 3 mm(1/8 inch) letters for identifying supporting information.
 - .3 Use 6 mm(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 5 mm(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 Markers

- .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 Markers

- .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 4.7 m(10 ft).
- .4 Spacing: 6 m(20 ft) on centre.
- .5 Colour:
 - .1 Normal Power System: Blue
 - .2 Life-Safety Power System: Red
 - .3 Fire Alarm System: Red.
 - .4 Communication System: Yellow

- .5 Security Systems: Black
- .6 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 Controls System: CONTROLS

2.4 Underground 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 conduit using field painting to Section [09 90 00].
- .6 Paint coloured band on each conduit longer than 2 m(6 ft).
- .7 Paint bands 6 m(20 ft) on centre.
- .8 Colour:
 - .1 600 Volt System: Orange
 - .2 208 Volt System: Blue

- .3 Fire Alarm System: Red.
- .4 Communication System: Yellow
- .5 Security Systems: Black
- .6 Controls System: White

- .9 Identify underground conduits using underground warning tape. Install one tape per trench at 75 mm(3 inches) below finished grade.

- .10 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 26 05 33 - Conduit.
- .5 Section 26 05 19 - Building Wire And Cable.
- .6 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 For 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 Submittals For 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, installation, and starting of Product.

1.7 Regulatory Requirements

- .1 Products: Listed and classified by CSA or ULC, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Mechanical 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 Subcontractor 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 Automatic Door Operators

- .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 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 the Division's requirements.
- .4 Execution: Coordinate complete installation with automatic door shop drawings and Contractor.

2.3 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 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 the Division's requirements.
- .4 Execution: Coordinate complete installation with overhead door shop drawings and Contractor.

2.4 Rolling Fire Shutter Door

- .1 Power: Provide a disconnect switch at rolling fire shutter door motor electrical connection.
- .2 Controls: Wire and connect shutter door up/down controls complete with all safety controls including but not limited to remote control panel, remote key switches, remote emergency shut-off, and infrared safety beams. Confirm controls requirements with rolling fire shutter door shop drawings and rolling fire shutter door installation contractor.
- .3 Fire Alarm: Provide signals from fire alarm system to door controller to facilitate emergency operation of rolling fire shutter door. Signals shall include General Alarm, and activation of adjacent Fire (Smoke or Heat) Detectors on either side of door within 1.5m (5ft) of door. Provide signals from shutter door controller to fire alarm system to indicate door status OPEN or CLOSED. Provide additional signals to fire alarm system for shutter door release alarm and trouble conditions.
- .4 Execution: Coordinate complete installation with rolling fire shutter door shop drawings and rolling fire shutter door contractor.

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 Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.
 - .10 Illuminated Signage: Provide a disconnect switch for illuminated signage.
 - .11 Mechanical Equipment:
 - .1 Power Wiring
 - .1 Install power feeders, starters, disconnects, and associated equipment and make connections to all mechanical equipment.
 - .2 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.
 - .3 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.
 - .4 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's serving.

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 For 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 For 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 – 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 Regulatory Requirements

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

1.9 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 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 Two-winding Transformers

- .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, 600 mm (24 inches) 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 100 mm (4") housekeeping pad.
- .7 Provide grounding and bonding to Section 26 05 26.
- .8 Provide minimum 150 mm (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 Adjusting

- .1 Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Distribution panelboards.
- .2 Branch circuit panelboards.

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).
- .10 ANSI/UL 1449, Standard for Safety for Surge Protective Devices
- .11 ANSI/IEEE C62.41.1, Guide on the Surge Environment in Low Voltage AC Power Circuits
- .12 ANSI/IEEE C62.41.2, Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits
- .13 ANSI/IEEE C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits
- .14 IEEE C62.62, Test Specifications for Surge Protective Devices for Low Voltage AC Power Circuits
- .15 IEEE C62.72, Guide for the Application of Surge-Protective Devices for Low-Voltage AC Power Circuits

1.4 Submittals For 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 For 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 and certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 Regulatory 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
 - .3 Siemens
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: CSA-C22.2 No.29, circuit breaker type.

- .3 Panelboard Bus: Aluminum and ratings as indicated. Provide copper ground bus in each panelboard.
- .4 Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 250 volt panelboards; 50,000 amperes rms symmetrical for 600 volt panelboards or as indicated.
- .5 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.
- .6 Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- .7 Enclosure: CSA C22.2 No. 94.1:
 - .1 Surface mounted: Type 1 with sprinkler-hood.
 - .2 Recessed mounted: Type 1.
 - .3 Exterior use: Type 4 or as indicated.
- .8 Cabinet Front: Surface type, continuous hinged trim complete with hinged door (door-in-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: Aluminum 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, bolt-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 Enclosure: CSA C22.2 No. 94.1:
 - .1 Surface mounted: Type 1 with sprinkler-hood.
 - .2 Recessed mounted: Type 1.
 - .3 Exterior use: Type 4 or as indicated.
- .7 Cabinet Box: 153 mm(6 inches) deep, 508 mm(20 inches) wide.
- .8 Cabinet Front: Surface type, continuous hinged trim complete with hinged door (door-in-door) with flush lock, metal directory frame and finished in manufacturer's standard gray enamel.

2.3 Surge Protective 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 Nominal Discharge Current Rating (In)
 - .1 Type 1 & 2 devices - 20 kA
 - .2 Type 3 devices - 3 kA
 - .2 Short Circuit-Current Rating (SCCR) shall be no less than 200 kA.
 - .3 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.
 - .4 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
 - .5 Noise Filtering
 - .6 Surge Rating (Imax) shall be no less than:
 - .1 MD:1: 200kA
 - .2 Branch Circuit Panels (CP2A and CP3): 100kA
- .4 Provide SPDs as indicated on the electrical single line diagram.

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 Adjusting

- .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 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 For 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 For 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 Regulatory 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 Cover 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 2 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.
- .2 Box Size: 600 mm(24 inches) wide x 600 mm(24 inches) high x 150 mm(6 inches) deep.
- .3 Backboard: Provide [19 mm(3/4 inch)] thick plywood backboard for mounting terminal blocks. Paint matte white.
- .4 Fronts: Steel, surface type with screw cover front and door with concealed hinge, and flush lock. 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 Manufacturers:
- .2 Terminal Blocks: CSA-C22.2 No. 158.
- .3 Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- .4 Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- .5 Provide ground bus terminal block, with each connector bonded to enclosure.

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 Cleaning

- .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 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 For 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 For 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 (2) of each style, size, and finish wall plate.
- .2 Provide [two (2)], [split nozzles] [protective rings] and.
- .3 Provide [two (2)] carpet rings.

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 Regulatory 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 with 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 & Occupancy Sensors

- .1 Refer to Lighting Control Schedule.

2.3 Ceiling Occupancy Sensors & Photocell

- .1 Refer to Lighting Control Schedule.

2.4 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 LED Drivers: 10 amps
 - .3 Motor Load: 1/2HP
- .9 Operating Temperature: 0 degrees C. to 40 degrees C.

2.5 Receptacles

- .1 Manufacturers:
 - .1 Leviton
 - .2 Hubbell
 - .3 Cooper
 - .4 Legrand
- .2 General-duty duplex convenience receptacle:
 - .1 Grade: Industrial 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 Configuration: Type as specified and indicated.
 - .1 General Use Receptacles Tamperproof: Classrooms and other general areas.
 - .1 15A - CAT#5262.
 - .2 20A - CAT#5362.
 - .2 High Abuse Receptacles: Labs, shop areas and gymnasiums, corridors.
 - .1 15A - CAT#5262
 - .2 20A – CAT#5362
 - .3 GFCI Receptacles
 - .1 15A - CAT#7599
 - .2 20A – CAT#7899
 - .4 Exterior GFCI
 - .1 20A - CAT#X7891-PL
- .4 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.
- .5 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.

- .6 USB Charger Receptacle: General-duty tamper resistant decorator style duplex receptacle with USB type A and type C chargers with smart chips optimized for USB power delivery. Type A port to be rated 2.4A @5V and type C to be rated 3A @5V. Standard of acceptance Leviton T5633 for 5-15R and T5833 for 5-20R.
- .7 Range Receptacle: CSA configuration 14-50R commercial specification grade complete with stainless steel faceplate.
 - .1 Flush Mounted: Leviton CAT#1279-W-50
 - .2 Surface Mounted: Leviton CAT#55050
- .8 Suitable for No. 10 AWG for back and side wiring.
- .9 Break-off links for use as split receptacles.
- .10 Double wipe contacts and riveted grounding contacts.
- .11 Receptacles shall be of one manufacturer throughout the project.

2.6 Wall Plates

- .1 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.
- .2 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.
- .3 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.

Part 3 Execution

3.1 Examination

- .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.

3.2 Preparation

- .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 Install tamper resistant receptacles in all classrooms, child care areas, hotel/motel guest rooms and suites, corridors, and offices.
- .9 Install tamper resistant receptacles in all rooms for child care facilities, preschools, schools and dwelling units.
- .10 Use exterior use receptacles for exterior applications unless noted otherwise.
- .11 Connect wiring device grounding terminal to branch circuit equipment grounding conductor and outlet box.
- .12 Install locator pilot light for lighting controls located in crawlspace.
- .13 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .14 Connect wiring devices by wrapping conductor around screw terminal.
- .15 Use jumbo size plates for outlets installed in masonry walls.
- .16 Stainless steel protective coverings shall be maintained until project completion and turn-over to the Division.
- .17 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- .18 Install metallic While-In-Use covers on exterior receptacles.
- .19 Use weatherproof covers for parking receptacles, and dust-tight applications only, or as indicated.
- .20 Install protective rings on active flush cover service fittings.

3.4 Interface With Other Products

- .1 Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights specified and as indicated on drawings.

3.5 Field Quality 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.

3.6 Adjusting

- .1 Adjust devices and wall plates to be flush and level.

3.7 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 Luminaires.
- .2 Emergency lighting inverter.
- .3 Exit signs.
- .4 LED luminaires and drivers.
- .5 Luminaire accessories.

1.2 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 CAN/CSA-E920-98 (R2007) - Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements.
- .7 CAN/CSA-E928-98 (R2007) - Auxiliaries for Lamps - A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements.
- .8 CAN/CSA-E61347-2-3-03 (R2008) - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps.
- .9 NEMA WD 6-2002 (R2008) - Wiring Devices - Dimensional Requirements.
- .10 CSA (Canadian Standards Association).
- .11 ULC (Underwriters' Laboratories of Canada).

1.3 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- .3 Product Data: Provide dimensions, ratings, and performance data.

1.4 Submittals For 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.

1.5 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.

1.6 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.

1.7 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 Efficiency Manitoba..
- .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 operated designated incandescent, fluorescent and 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: Steel
- .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 Luminaires And Drivers

- .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 Electrical Subcontractor 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 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 4'-0" 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.

2.6 Source Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.

Part 3 Execution

3.1 Installation

- .1 Support luminaires larger than 600 x 1200 mm(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 Bond products and metal accessories to branch circuit equipment grounding conductor.
- .15 Install specified lamps in each luminaire, emergency lighting unit and exit sign.

3.2 Field Quality Control

- .1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 Adjusting

- .1 Aim and adjust luminaires as directed.
- .2 Position exit sign directional arrows as indicated.

3.4 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.

3.5 Closeout Activities

- .1 Demonstration: Demonstrate luminaire operation for minimum of one (1) hours.

3.6 Protection Of Finished Work

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Re-lamp luminaires with failed lamps at Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 General use battery unit
- .2 General use remote fixture
- .3 Decorative remote fixture

1.2 RELATED SECTIONS

- .1 Section 26 05 00 Common Work Results for Electrical
- .2 Section 26 05 19 Building Wire and Cable
- .3 Section 26 05 53 Electrical Identification
- .4 Section 26 27 26 Wiring Devices

1.3 REFERENCES

- .1 CSA-C22.2 No. 141-15 - Emergency lighting equipment.

1.4 REGULATORY REQUIREMENTS

- .1 Conform to CSA-C22.2 No. 141-15
- .2 Refer to 26 05 00 Common Work Results for Electrical

1.5 DEFINITIONS

- .1 The following are definitions of terms and expressions used in the specification:
 - .1 **Zone sensing:** A method to monitor AC circuits for loss of voltage, using voltage sensing relays. Refer to sequence of operations for further requirements.
 - .2 **Voltage sensing:** Refer to Zone sensing.

1.6 SUBMITTALS FOR 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.
 - .2 Product Data: Provide dimensions, ratings, and performance data.
 - .3 Custom colors: Submit hard copy of available colors and finishes where custom color selection required.

1.7 SUBMITTALS FOR 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.

1.8 CLOSEOUT SUBMITTALS

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Operation and Maintenance Data:
 - .1 Submit manufacturer's operation and maintenance instructions for each product.
- .3 Record documentation:
 - .1 Record actual locations of emergency lighting equipment.
 - .2 Record routing of all AC and DC emergency lighting circuits.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials:
 - .1 Provide one (1) replacement head for every two (2) battery units supplied.
 - .2 Provide one (1) replacement head for every six (6) remote fixtures supplied

1.10 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.

1.11 WARRANTY

- .1 Batteries used for emergency lighting:
 - .1 Provide extended warranty period of 10 years.
 - .2 Provide no-charge replacement for the first 5-years.
 - .3 Provide pro-rated charge for replacement on the remaining 5-years.

PART 2 PRODUCTS

2.1 BATTERY UNIT – GENERAL USE (BU-X)

- .1 Description: Self-contained AC/DC emergency lighting unit.
- .2 Manufacturers:
 - .1 Lumacell: RGS series
 - .2 Emergi-Lite: ESL series
 - .3 Ready-Lite: LDX series
 - .4 Beluce: Nova NV series
 - .5 Aimlite: EBST series
 - .6 Substitutions: Refer to Section 26 05 00
- .3 Battery: 12-volt DC, lead acid type. capacity as indicated
- .4 Battery charger: Solid state pulse charger, current limited, temperature compensated, short circuit proof, and reverse polarity protected.
- .5 Heads: Quantity of two (2), MR16 LED
 - .1 Lumacell, Emergi-Lite, Ready-Lite: 6-watts
 - .2 Beluce, Aimlite: 7-watts
- .6 Housing: Factory white, corrosion resistant steel cabinet.

- .7 Status LED's for:
 - .1 Battery failure
 - .2 Battery disconnected
 - .3 Charger failure
 - .4 Lamp failure
 - .5 Service alarm
 - .6 AC-ON
 - .7 Charger high-rate
- .8 Test switch: Transfers unit from external power supply to integral battery supply.
- .9 Electrical connection: [Line cord with non-locking 5-15R CSA configuration][Line cord with locking L5-15R CSA configuration][Direct connection].
- .10 Input Voltage: Universal 120/347-volt AC.
- .11 Accessories:
 - .1 AC/DC terminal blocks for incoming and outgoing AC and DC circuits
 - .2 Auto test function
 - .3 Mounting shelf

2.2 ZONE SENSING

- .1 Zone sensing (voltage sensing) relays either internal, or external to the battery unit.
- .2 Quantity of relays shall be as required or as indicated. Allow for a minimum of two (2) zone sensing relays per battery unit to pick up external AC monitored circuits.
- .3 Provide a push to test button for each zone either on the side of the battery unit, or on the cover of the external zone sensing panel.

2.3 GENERAL USE REMOTE FIXTURE (RH-X)

- .1 Description: General-use emergency lighting remote fixture
- .2 Manufacturers:
 - .1 Lumacell: MQM series
 - .2 Emergi-Lite: EF9M series
 - .3 Ready-Lite: RM series
 - .4 Beluce: SR series
 - .5 Aimlite: RMSM series
 - .6 Substitutions: Refer to Section 26 05 00
- .3 Voltage: To match supplying battery unit output DC voltage
- .4 Heads:
 - .1 MR16 LED, 12-volt DC
 - .2 Lumacell, Emergi-Lite, Ready-Lite: 6-watts
 - .3 Beluce, Aimlite: 7-watts
 - .4 Quantity of heads and arrangement as indicated on the plans.
- .5 Housing: White, injection molded, impact resistant, fire-retardent thermoplastic

2.4 DECORATIVE REMOTE FIXTURE (RH-X)

- .1 Description: General use decorative emergency lighting remote fixture.

- .2 Manufacturers:
 - .1 Lumacell: Signature DR series
 - .2 Emergi-Lite: Distinction EF150 series
 - .3 Ready-Lite: Legend RL150 series
 - .4 Beluce: BTMR series
 - .5 Aimlite: RMMB series
 - .6 Substitutions: Refer to Section 26 05 00
- .3 Voltage: To match supplying battery unit output DC voltage
- .4 Heads:
 - .1 MR16 LED, 12-volt DC
 - .2 Lumacell, Emergi-Lite, Ready-Lite: 6-watts
 - .3 Beluce, Aimlite: 7-watts
 - .4 Quantity of heads and arrangement as indicated on the plans
- .5 Housing: White, powder coated die-cast aluminum.

2.5 AC SUPPLY CIRCUITS

- .1 Building wire and cable to section 26 05 19 building wire and cable, installed with conduit raceway system for main runs.
- .2 Armored cable (AC90) to section 26 05 19 building wire and cable for drops to emergency lighting equipment.

2.6 DC EMERGENCY OUTPUT CIRCUITS

- .1 Building wire and cable to section 26 05 19 building wire and cable, installed with conduit raceway system for main runs.
- .2 Armored cable (AC90) to section 26 05 19 building wire and cable for drops to emergency lighting equipment.

2.7 SEQUENCE OF OPERATIONS

- .1 Minimum run-time:
 - .1 Thirty (30) minutes
- .2 Loss of power to the AC supply circuit to the battery unit will trigger the DC emergency output circuit(s) of the battery unit.
- .3 Loss of power to the AC circuit(s) monitored by the zone sensing relays will trigger the DC emergency output circuit(s) of the associated battery unit.
- .4 Emergency lighting circuit(s) shall operate for the minimum run-time identified.

2.8 SOURCE QUALITY CONTROL

- .1 Refer to 26 05 00 Common Work Results for Electrical.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install emergency lighting to CSA-C22.1.
- .2 Install emergency lighting to manufacturers recommendations.

- .3 Install accessories as supplied by the manufacturer.
- .4 Install emergency lighting square and plumb and adjust to align with building lines and with each other.
- .5 Secure emergency lighting to prevent movement.
- .6 Install specified lamps in emergency lighting equipment.
- .7 Orient emergency lighting to maximize light distribution.
- .8 Adjust emergency lighting heads for wide optics and to suit egress path.
- .9 Install wall mounted emergency lighting at heights indicated.
- .10 Suspended ceilings: Install clips or bar hangars to secure grid-supported emergency lighting in place.
- .11 Exposed grid ceilings: Fasten surface mounted emergency lighting to ceiling grid members using bolts, screws, or suitable clips.
- .12 Battery units:
 - .1 Install battery unit on shelf.
 - .2 Provide 5-15R duplex receptacle for battery unit cord connection.
 - .3 Provide 5-15R surge protection duplex receptacle for battery unit cord connection.
 - .4 Bundle cord connection neatly to reduce surplus.
 - .5 Wire and connect AC and DC circuits to battery unit using AC and DC terminal blocks.
 - .6 Where applicable, DC emergency output circuits shall be load balanced. Adjust field wiring to emergency lighting DC remote fixtures as required.
 - .7 Perform voltage drop calculations on DC output circuits, and adjust conductor sizes as required wi
 - .8
 - .9 Provide nameplate to section 26 05 53 electrical identification. Nameplate shall include:
 - .1 Battery unit # as it relates to the record documents
 - .2 Manufacturer and model number of the unit. Model number shall be complete with all associated components and options.
 - .3 AC supply circuit
 - .4 AC lighting circuits monitored (zone sensing)
 - .5 Date installed or commissioned.
- .13 Zone sensing:
 - .1 Wire and connect monitored AC exit sign circuit to zone sensing relays.
 - .2 Wire and connect monitored AC lighting circuits to zone sensing relays as indicated.
 - .3 Where zone sensing is external, interface zone sensing relay panel with associated battery units.
 - .4 Provide nameplate to section 26 05 53 electrical identification. Nameplate shall include:
 - .1 Associated battery unit # as it relates to the record documents
 - .2 Manufacturer and model number of the unit. Model number shall be complete with all associated components and options.
 - .3 AC supply circuit

- .4 AC lighting circuits monitored (zone sensing)
- .5 Date installed or commissioned.
- .14 Remote heads:
 - .1 Wire and connect remote heads to associated battery unit DC output circuits.
 - .2 Provide nameplate to section 26 05 53 electrical identification. Nameplate shall include:
 - .1 Associated battery unit # as it relates to the record documents
 - .2 Associated remote head # as it relates to the record documents
 - .3 Manufacturer and model number of the unit. Model number shall be complete with all associated components and options.
 - .4 Date installed or commissioned.
- .15 DC emergency output circuits:
 - .1 Perform voltage drop calculations on DC output circuits, and adjust conductor sizes as required wi

3.2 INTERFACE WITH OTHER PRODUCTS

- .1 Interface zone sensing relay panels where required with associated battery unit.
- .2 Interface exit signage AC supply circuits with zone sensing relays.
- .3 Interface exit signage DC supply circuit with battery unit DC emergency output circuits.

3.3 FIELD QUALITY CONTROL

- .1 Prior to the life-safety system review by the Contract Administer or by the inspection authority for the intended purpose of occupancy, perform the following:
 - .1 Ensure battery unit(s) are fully charged.
 - .2 Ensure all AC supply circuits associated with the emergency lighting system are clearly identified at the associated branch circuit panel, either by temporary or permanent means.
 - .3 Ensure all AC supply circuits monitored by the emergency lighting system are clearly identified at the associated branch circuit panel, and at the associated zone sensing equipment, either by temporary or permanent means.
 - .4 Ensure all DC emergency output circuits are load balanced.
 - .5 Ensure all lamps are seated correctly within their respective lamp holders and lamps operate as intended.
 - .6 Ensure emergency lighting coverage is optimized to maximize light distribution.
 - .7 Pre-test the emergency lighting system under the following conditions:
 - .1 Disconnect the AC supply circuit to the battery unit by turning off the associated branch circuit breaker.
 - .2 Disconnect the AC supply circuits that are monitored by the zone sensing relays, by turning off the associated branch circuit breaker for each of the monitored circuits. Test each circuit individually.
 - .3 Verify emergency lighting sequence of operations for each battery unit.
 - .8 Submit the pre-test results indicating successful operation of each of the battery units specified.

3.4 ADJUSTING

- .1 Adjust emergency lighting as directed by the Contract Administer.
- .2 Adjust emergency lighting as directed by the inspection authority.

3.5

CLEANING

- .1 Clean to 26 05 00 Common Work Results for Electrical.
- .2 Clean photometric control surfaces as recommended by manufacturer.

3.6

CLOSEOUT ACTIVITIES

- .1 Demonstration: Demonstrate emergency lighting operation.

3.7

PROTECTION OF FINISHED WORK

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Re-lamp emergency lighting equipment that have failed lamps at Substantial Completion.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Luminaires and accessories.
- .2 Lamps.
- .3 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 CAN/CSA-E61347-2-3-03 (R2013) - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps.
- .8 CAN/CSA-E922-98 (R2007) - Ballasts for Discharge Lamps (Excluding Tubular Fluorescent Lamps) - General Safety Requirements.
- .9 IES RP-33-14 - Lighting for Exterior Environments
- .10 IES RP8-14 - Roadway Lighting.
- .11 IES RP20-14 - Lighting for Parking Facilities.
- .12 CSA (Canadian Standards Association).
- .13 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 For 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 Submittals For 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, installation, and starting of Product.

1.7 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Maintenance Data: Submit maintenance data for each luminaire.

1.8 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.

1.9 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.10 Regulatory Requirements

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

1.11 Delivery, Storage, 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 Luminaires And Accessories

- .1 Manufacturers:
 - .1 Refer to Luminaire Schedule on drawings.
 - .2 Substitutions: None.

2.2 Poles

- .1 Manufacturers:
 - .1 Hapco.
 - .2 Valmont.
 - .3 Prairie Pole.
 - .4 Lithonia
- .2 Material and Finish: Black finish.

- .3 Section Shape and Dimensions: 5-inch square.
- .4 Height: As indicated.
- .5 Base: Fatigue resistant.
- .6 Accessories: Anchor bolts and cast reinforced handhole.
- .7 Loading Capacity Ratings:
 - .1 As required.
- .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 Adjusting

- .1 Aim and adjust luminaires to provide illumination levels and distribution as directed and indicated on Drawings.

3.4 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 enclosure.
- .4 Clean photocell control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

3.5 Protection Of Finished Work

- .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 Electric cabinet heaters.
- .2 Thermostats and accessories.

1.2

References

- .1 NEMA DC 3-2008 - Residential Controls - Electric Wall-Mounted Room Thermostats.

1.3

Submittals For Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide unit size, finish, and performance data.

1.4

Submittals For Information

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.5

Closeout Submittals

- .1 Section 01 78 00: 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

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 (1).
- .16 Provide terminal blocks for power and control wiring connections.
- .17 Louvre: Provide discharge louvre with individually adjustable blades.

2.3 Accessories

- .1 Room Thermostat: Heating only low voltage thermostat with control point reset.
- .2 Mounting Accessories: Impact resistant clear enclosure with lockable cover.

Part 3 Execution

3.1 Examination

- .1 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 from structure using construction details shown on Drawings.

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 J-STD-607-A-2002, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .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 Busbar (TMGB)

- .1 Existing.

2.2 Telecommunications Grounding Busbar (TGB)

- .1 Existing.

2.3 Telecommunications Bonding Backbone (TBB)

- .1 Existing.

2.4 Telecommunications Bonding Conductor (TBC)

- .1 #6 AWG copper conductor, green marked to: ANSI J-STD-607-A.

2.5 Warning Labels

- .1 Non-metallic warning labels in English to: ANSI J-STD-607-A.
- .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 BUSBAR (TMGB)

- .1 Modify and expand the existing TMGB as required to accommodate the addition and renovation.

3.2 Telecommunications Grounding Busbar (TGB)

- .1 Modify and expand the existing TGB as required to accommodate the addition and renovation.

3.3 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.

3.4 Telecommunications Bonding Conductor (TBC)

- .1 Use approved 2 hole compression lugs for connection to TMGB or TGB.

3.5 Bonding To TGB

- .1 Bond metallic raceways in telecommunications room to TGB using #6 AWG copper conductor.
- .2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB using #6 AWG copper conductor.
- .3 Bond equipment racks and cabinets located in telecommunications room to TGB using #6 AWG copper conductor.

3.6 Labelling

- .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 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors 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, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.
- .2 Overhead cable tray distribution system.

2.2 Material

- .1 Conduits: EMT type, in accordance with Section 26 05 33 - Conduits.
- .2 Junction boxes: in accordance with Section 26 05 34 - Boxes.
- .3 Cabinets and enclosures: in accordance with Section 26 27 16 – Cabinets and Enclosures.
- .4 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 The City.
 - .2 Inform The City 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 The City.

3.2 Installation

- .1 Install empty raceway system, including underfloor or 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 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 Cleaning

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse or recycling.
 - .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 Related Requirements

- .1 Section 26 05 00 Common Work Results for Electrical.

1.2 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.

1.3 Definitions

- .1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.4 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.

1.5 Action And Informational Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 As-built Records and Drawings:
 - .1 Provide Microsoft Access database reflecting cable installation and cross-connections.
 - .2 Provide electronic drawings in AutoCAD 2012 format depicting all construction.
 - .3 Provide two (2) bound complete hard-copy sets of as-built records to The City
 - .1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

1.6 Quality Assurance

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 CATEGORY 6A CABLE

- .1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or CMP to: CSA-C22.2 No. 214, Category 6A (Cat 6A) to: TIA/EIA-568-B.2.
- .2 Meets or exceeds requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 2nd Edition Class E channel standards
- .3 Meets or exceeds requirements of ANSI/TIA-568-C.2 and IEC 61156-5 Category 6A component standards
- .4 Meets or exceeds requirements of IEEE 802.af and IEEE 802.3at for PoE applications
- .5 Cable diameter: 0.236" (5.9mm) nominal
- .6 Configuration:
 - .1 Unshielded
 - .2 Twisted pairs – 4
 - .3 Conductors – 23 AWG
- .7 Descending length cable markings enable easy identification of remaining cable.
- .8 Minimum bend radius shall be no less than four times the outer diameter of the cable.
- .9 Cables are to be labelled within 4-inches of each termination.
- .10 Cable and connectivity to be of one manufacturer.
- .11 Acceptable Manufactures:
 - .1 Belden RevConnect (10GXW)
 - .2 Leviton (Atlas-X1 Millenium)

2.2 CATEGORY 6 CABLE

- .1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or CMP to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-B.2.
- .2 Meets or exceeds requirements of ANSI/TIA-568-C.2 Category 6 and ISO 11801 2nd Edition Class E channel standards
- .3 Meets or exceeds requirements of ANSI/TIA-568-C.2 and IEC 61156-5 Category 6 component standards
- .4 Meets or exceeds requirements of IEEE 802.af and IEEE 802.3at for PoE applications
- .5 Cable diameter: 0.236" (5.9mm) nominal
- .6 Configuration:
 - .1 Unshielded
 - .2 Twisted pairs – 4

.3 Conductors – 23 AWG

- .7 Descending length cable markings enable easy identification of remaining cable.
- .8 Minimum bend radius shall be no less than four times the outer diameter of the cable.
- .9 Cables are to be labelled within 4-inches of each termination.
- .10 Cable and connectivity to be of one manufacturer.
- .11 Acceptable Manufactures:
 - .1 Belden RevConnect (2400)
 - .2 Leviton (Atlas-X1)

2.3 Work Area Utp 4-pair Modular Jack

- .1 Eight-position modular jack ("RJ-45"), type T568A Category 6 to: TIA/EIA-568- C.2:
 - .1 In self-contained surface-mount box, 4 jacks per box.
 - .2 Mounted in compatible single gang faceplate, flush entry, 4 jack positions per faceplate.

2.4 Termination And Cross-connection Hardware For Utp

- .1 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.
 - .2 Horizontal cable-management unit for every 48 ports.

2.5 Utp Equipment Patch Cords

- .1 For every terminated workstation cable installed, provide (1) snag-less cable with factory-installed male plug at one end to mate with "RJ-45" jack with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs to: TIA/EIA-568-C.2.
- .2 Must be of the same or exceed the performance as the Category 6 horizontal cabling.
- .3 Lengths to be 1 meter to reduce cable management burden.
- .4 Colour-coded as follows:
 - .1 Data – Blue
 - .2 Wireless – Green
 - .3 Video – Red
 - .4 Door Entry – Purple
 - .5 Paging - Black

2.6 Utp Work Area Cords

- .1 For every terminated cable, provide (1) 3 metre long blue snag-less cable with factory-installed male plug at one end to mate with "RJ-45" jack with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs, to: TIA/EIA-568-C.2. Unless specified otherwise.
- .2 Must be of the same or exceed the performance as the Category 6 horizontal cabling.

2.7 Wireless Access Points

- .1 Wireless Access Points shall be POE and shall be Division supplied and Electrical Subcontractor Installed. Electrical Subcontractor to allow for 20' of cable slack in the ceiling so Wireless Access Point can be easily relocated as needed for optimum location, coordinate final location with the Division.
- .2 Provide (2) Category 6A cables for each Wireless Access Point.

2.8 Data Cabinets

- .1 Wall mountable equipment cabinet to be 18/19U high and the frame to be constructed of rugged 12 GA steel welded and rigid, 30" deep and 22" wide.
- .2 Front and side lockable perforated doors.
- .3 Standard with 19" EIA 10-32 tapped mounting holes with permanently marked U spacing identification.
- .4 Cabinet is standard with one copper 10-32 x 0.5 L ground stud.
- .5 All racks to be black in colour and tapped front and back with 10-32 holes.
- .6 Built-in vertical wire management 6" x 6" in dimensions.
- .7 Acceptable Manufacturer: Tripp Lite SRW18USG

2.9 Horizontal Wire Managers

- .1 One (1) 2 rack unit horizontal cable management shall be provided for every 48 port patch panel.
- .2 Shall feature a front access design with a hinged cover.
- .3 Shall be minimum of 2 Rack Unit, steel construction and with black powder coat finish.
- .4 Shall have a hinged door with a positive (nonmagnetic) locking system.

2.10 Optical-fiber Cable

- .1 Distribution with conductive members, multi-mode 50/125, laser-optimized OM3, 4700 MHz km capacity, 12 strands to: CSA-C22.2 No. 232 TIA/EIA-568- B.3, flame test classification FT4 or OFNR, each end terminated with duplex LC connectors.

2.11 Optical-fiber Patch Panel

- .1 Mounted in rack or cabinet, 1 rack units, with lockable cover, capable of terminating 48 pairs of fiber, equipped with duplex LC compatible adapters.

2.12 Optical-fiber Patch Cords

- .1 Interconnect cable, 2 strands, 1 metre long, each end equipped with duplex LC connectors. Multi-Mode 50/125, laser-optimized OM3, 4700 MHz km capacity to: TIA/EIA-568-B.3.

Part 3 Execution

3.1 Installation Of Termination And Cross-connect Hardware

- .1 Install termination and cross-connect hardware on wall 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 conduits, cable trays, and "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 1 metres.
 - .1 Where raceways are used to distribute cables to each zone, provide supplementary "J" hooks to support cables at intervals not exceeding 1 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 the new data rack to the data rack as indicated and according to manufacturers' 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 jumper wires, and 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 via email.
 - .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.
 - .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.

- .2 Perform the following tests: wire map, length, insertion loss, NEXT loss, ELFEXT, PSELFEXT, ACR, PSACR, propagation delay, delay skew, return loss.
- .1 Test Optical-fiber strands for attenuation to: TIA/EIA-568-B.1 and correct deficiencies: provide record of results as hard copy, and electronic record via email.
 - .1 Test backbone links in both directions. Backbone links:
 - .1 Test multi-mode fiber at both applicable wavelengths (850 nm and 1300 nm).
 - .2 Maximum attenuation: Cable attenuation + Connector loss + Splice loss.
 - .1 Multi-mode-fiber attenuation coefficients:
 - .1 3.0 db/km @ 850 nm; and
 - .2 1.5 db km @ 1300 nm
 - .2 Maximum connector insertion loss: 0.75 db per pair and maximum splice insertion loss: 0.3 db.
 - .2 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.
 - .3 Provide record of results as electronic record on CD to: TIA/TSB-140.
 - .4 Provide record of results as electronic record via email to: TIA/TSB-140.
 - .5 All test equipment must have been calibrated/re-calibrated once a year or within the period recommended by the manufacturer.

3.7 Electrical Subcontractor Certification

- .1 The cabling system shall be installed by the Electrical Subcontractor contractor or Communications Subcontractor certified by the cable manufacturer.

3.8 Warranty

- .1 The Electrical Subcontractor shall support the installed system for a period of two years from the date of acceptance by The City.
- .2 The Electrical Subcontractor 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 Electrical Subcontractor.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Paging equipment and accessories.

1.2 RELATED SECTIONS

- .1 Section 26 05 19 - Building Wire and Cable.
- .2 Section 26 05 34 - Boxes.
- .3 Section 26 05 26 - Grounding and Bonding.

1.3 SYSTEM DESCRIPTION - CLASSROOM INTERCOM SYSTEM

- .1 Description: Existing PA system being expanded.
- .2 Communications:
 - .1 Public Address System

1.4 SUMMARY

- .1 Work Included. The scope of work of this Section consists of the designing, installation, and programming of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances and services necessary and/or incidental to properly complete all work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Architect and The City, as being required and in general, is as follows:

- .1 Public Address System, including but not limited to:
 - .1 Public address system amplifiers, zone controls, back boxes, and all equipment, cabling and support required to interface the Public Address System to the The City's Telephone System (Not included in this Contract).
 - .2 Public Address System Speakers, ceiling mounted, and wall mounted.
 - .3 Cabling to support the Public Address System (NOTE: any category 5/6 cable must conform with The City guidelines. Coordinate with The City prior to submission for approval)
 - .4 PA override signal to local sound systems. Coordinate with 27 40 00 Contractor.

- .2 Actual control room and rack layouts will be based upon the specific designs submitted by the Contractors. Needs for equipment, specific speakers, etc. will be dependent on actual product manufacturers. Contractors shall coordinate room layout, actual speaker and equipment placement and programming options with The City prior to installation.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.

- .2 Product Data: Submit product data for each item of equipment.
- .3 Shop Drawings: Indicate cable routing and connections. Include layout of equipment within racks and cabinets complete with component interconnections with wiring diagrams.

1.6 SUBMITTALS FOR 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 Maintenance Contracts: Provide service and maintenance of classroom intercom system for one (1) year from Date of Substantial Completion.
- .3 Operation Data: Include instructions for routine operation of system components.
- .4 Maintenance Data: Include instructions for minor troubleshooting, preventive maintenance, and cleaning.
- .5 Record Documentation: Accurately record actual locations of devices and wiring.

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 Supplier Qualifications: Authorized distributor of specified manufacturer with minimum five (5) years documented experience.

Part 2 Products

2.1 MANUFACTURERS

- .1 TOA Electronics
- .2 Or Approved Equal in Accordance with B7.
- .3 All Public Address main equipment including card cages and all cards, power amplifiers, program sources, etc., shall be rack mounted in the Electrical Room 4-post cabinet in the basement, provide all required racking hardware. The system shall be a 70-Volt paging system providing paging zones as indicated and determined by the The City. The system shall be of modular design utilizing plug-in circuit cards to enable quick on-site replacement or addition of components for system expansion and modification. Provide shelves, doors, blank panels, AC power distribution, etc. as required to support all equipment and fill empty rack space.
- .4 Public address loudspeaker system to incorporate:
 - .1 Voice paging.
 - .2 Recorded music from digital audio - MP3.
 - .3 Broadcast programs from AM/FM tuner.
 - .4 Additional features as specified.
- .5 Operations:
 - .1 Paging:

- .1 Voice paging from microphone overrides broadcast or recorded music reproductions.
- .2 Selective area page to areas as indicated.
- .3 Emergency page to all areas.
- .2 Music:
 - .1 Music from external source.

2.2 PRE-AMPLIFIER MIXER

- .1 TOA Electronics M-9000M2 CU complete with A-9000 & 900 Series Modules
- .2 Or Approved Equal in Accordance with B7.
- .3 Quantity: 1
- .4 Dual channel modular mixer/matrix, max 8x8:
 - .1 Power Source: 120 V AC, 60 Hz
 - .2 Power Consumption: 40 W
 - .3 Audio Input: Max. 8 channels, modular construction
 - .4 Audio Output: Preamplifier output 1, 2: 0 dB(*1), 600 Ω , balanced, removable terminal block (3 pins)
 - .5 Digital Audio Signal Reference Level: -20 dBFS
 - .6 Frequency Response: 20 Hz - 20 kHz, +1, -3 dB
 - .7 S/N Ratio:
 - .1 At Input short, 20 Hz - 20 kHz, set to ALL FLAT or OFF setting
 - .2 Output volume min.: 90 dB
 - .3 Output volume max.: 61 dB (Input 1 volume: 0 dB, Other Inputs: OFF)

2.3 DUAL MIC/LINE INPUT MODULE WITH DSP

- .1 TOA Electronics D-001T
- .2 Or Approved Equal in Accordance with B7.
- .3 Quantity: 4

2.4 DUAL MIC/LINE OUTPUT MODULE WITH DSP

- .1 TOA Electronics T-001T
- .2 Or Approved Equal in Accordance with B7.

2.5 DIGITAL MULTI-CHANNEL AMPLIFIER

- .1 TOA Electronics DA-250FH CU
- .2 Or Approved Equal in Accordance with B7.
- .3 Quantity: 1
- .4 Digital multi-channel amplifier 250W x 4 channel, 70V:
 - .1 Power Source: 120 V AC, 50/60 Hz
 - .2 Amplification System: Class D
 - .3 Power Consumption:
 - .1 200 W (based on UL/CSA standards)
 - .2 1200 W (rated output 70 V line, 19.6 Ω x 4)

- .4 Input:
 - .1 4 circuits, +4 dB* (1.23 V) (input level control in maximum position), 10 k Ω , electronically-balanced, removable terminal block (3 pins)
CH 1 mode ON/OFF switch (ON: CH 1 to All ch, OFF: Each ch)
- .5 Rated Output:
 - .1 4 channels: 250 W \times 4 (70 V line, 19.6 Ω)
2 channels (BRIDGE): 500 W \times 2 (140 V line, 39.2 Ω)
M4 screw terminal, distance between barriers: 8.8 mm
- .6 Frequency Response: 20 - 20,000 Hz (\pm 1 dB): HPF OFF/50 - 20,000 Hz (-3 dB, +1 dB): HPF ON (selectable with the inner jumper)
- .7 Total Harmonic Distortion:
 - .1 0.1% (1 kHz), 0.3% (20 - 20,000Hz): HPF OFF
 - .2 0.1% (1 kHz), 0.3% (100 - 20,000 Hz): HPF ON

2.6 DIGITAL POWER AMPLIFIER

- .1 TOA Electronics DA-250F
- .2 Or Approved Equal in Accordance with B7.
- .3 Quantity: 1
- .4 4-Channel Digital Power Amplifier 250W x 4 channels (4 Ohm output):
 - .1 Power Source: 120 V AC, 50/60 Hz
 - .2 Amplification System: Class D
 - .3 Power Consumption:
 - .1 200 W (based on UL/CSA standards)
 - .2 1200 W (rated output 70 V line, 19.6 Ω \times 4)
 - .4 Input:
 - .1 4 circuits, +4 dB* (1.23 V) (input level control in maximum position), 10 k Ω , electronically-balanced, removable terminal block (3 pins)
CH 1 mode ON/OFF switch (ON: CH 1 to All ch, OFF: Each ch)
 - .5 Rated Output:
 - .1 4 channels: 250 W \times 4 (70 V line, 19.6 Ω)
2 channels (BRIDGE): 500 W \times 2 (140 V line, 39.2 Ω)
M4 screw terminal, distance between barriers: 8.8 mm
 - .6 Frequency Response: 20 - 20,000 Hz (\pm 1 dB): HPF OFF/50 - 20,000 Hz (-3 dB, +1 dB): HPF ON (selectable with the inner jumper)
 - .7 Total Harmonic Distortion:
 - .1 0.1% (1 kHz), 0.3% (20 - 20,000Hz): HPF OFF
 - .2 0.1% (1 kHz), 0.3% (100 - 20,000 Hz): HPF ON

2.7 MICROPHONE

- .1 TOA Electronics Q-RM9012 complete with power supply AD-246.
- .2 Or Approved Equal in Accordance with B7.
- .3 Quantity: 2
- .4 Microphone: uni-directional, dynamic type, complete with cradle :
 - .1 Frequency response: 100-20,000 Hz.
 - .2 S/N Ratio: 60dB or more

- .3 Audio Output: 0dB = 1V, 600 Ohm, transformer balanced
- .4 Housing, metal, flexible goose neck, desk mounting
- .5 Push-to-talk switch.
- .6 Number of Paging Zones: 12

2.8 WALL MOUNT SPEAKER BASEMENT (TYPE A)

- .1 Product: TOA Electronics PC-580RU Or Approved Equal in Accordance with B7.
- .2 Tap Settings: 1W (70V Line)

2.9 WALL MOUNT SPEAKER FITNESS ROOM (TYPE B)

- .1 Product: TOA Electronics HS-1200BT Or Approved Equal in Accordance with B7.

2.10 WALL MOUNT SPEAKER POOL AND AUDITORIUM (TYPE C)

- .1 Product: TOA Electronics F-1000BT Or Approved Equal in Accordance with B7.
- .2 Tap Settings: 2.5W (70V Line)

2.11 AM/FM TUNER

- .1 Product: TOA Electronics DT930UL Or Approved Equal in Accordance with B7.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that surfaces are ready to receive work.
- .3 Verify field measurements are as instructed by manufacturer.
- .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 components to manufacturer's written instructions.
- .2 Wiring Methods:
 - .1 Install wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces, and in gypsum board partitions, where cable wiring method may be used. Use ULC listed plenum cable in environmental air spaces including plenum ceilings.
- .3 Wiring Within Enclosures:
 - .1 Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
 - .2 Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other Integrated Electronic Communications Network system conductors.

-
- .4 Splices, Taps, and Terminations:
 - .1 Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets and equipment enclosures.
 - .5 Identification of Conductors and Cables:
 - .1 Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
 - .6 Weatherproofing:
 - .1 Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.
 - .7 Repairs:
 - .1 Wherever walls, ceilings, floors, or other building finishes are cut for installation , repair, restore, and refinish to original appearance.
 - .8 Ground and bond equipment and circuits to Section 26 05 26.

3.3 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field inspection and testing.
- .2 Manufacturer's Field Services:
 - .1 Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- .3 Inspection:
 - .1 Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- .4 Testing:
 - .1 Perform operational test on completed installation to verify proper operation.
- .5 Replace equipment, components, and wiring to eliminate audible noise, clicks, pops, or hum when system is in standby or operation.

3.4 CLOSEOUT ACTIVITIES

- .1 Demonstration:
 - .1 Allow minimum of two (2) hour training session to facilitate the training of staff.
 - .2 Provide detailed operation and maintenance instruction and training.
 - .3 Use submitted operation and maintenance manual as reference during demonstration.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 General performance and requirements
- .2 Compact loop driver.
- .3 Induction loop driver.

1.2 RELATED SECTIONS

- .1 Section 26 05 19 - Building Wire and Cable.

1.3 SYSTEM DESCRIPTION

- .1 Assistive listening system to provide hearing accessibility within public spaces. Induction loops in reception counters and in public use spaces to provide sufficient level of hearing accessibility.

1.4 SUBMITTALS FOR 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.

1.5 SUBMITTALS FOR 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.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 10: Submission procedures.
- .2 Operation Data:
 - .1 Operating instructions
 - .2 Programming instructions
 - .3 Testing instructions
- .3 Maintenance Data:
 - .1 Maintenance and repair procedures.
- .4 Record Documentation:
 - .1 Record actual locations of all devices and equipment.
 - .2 Record actual routing of all device and equipment wiring
 - .3 Identify all wiring types and interconnections.
 - .1 Provide wiring legend where appropriate.

1.7 QUALITY ASSURANCE

- .1 Manufacturer:
 - .1 Company specializing in manufacturing the products specified in this section.
 - .2 Minimum ten (10) years of experience
 - .3 Service facilities within 160 km(100 miles) of Project.

1.8 WARRANTY

- .1 Maintenance contracts:
 - .1 Provide service and maintenance of system for one (1) year from Date of Substantial Completion.

1.9 REGULATORY REQUIREMENT

- .1 Listed and classified by ULC as suitable for the purpose specified and indicated.

1.10 DEFINITIONS

- .1 The following are definitions of terms and expressions used in the specification:
 - .1 **DSP:** Digital signal processing.
 - .2 **RF:** Radio frequency.
 - .3 **SNR:** Signal-to-noise ratio.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Listen technologies.
- .2 All connected devices and components to be fully compatible.
- .3 Substitutions:
 - .1 Refer to Section 01 62 00.

2.2 COMPACT LOOP DRIVER

- .1 Manufacturer: Ampertonic CLD1.
- .2 Loop resistance of 0.3 ohms to 1.0 ohms resistive.Audio frequency response of 80 Hz to 6.3k Hz, ± 1.5 dB.
- .3 Two (2) mixing audio inputs and a mixed signal output.

2.3 INDUCTION LOOP DRIVER

- .1 Manufacturer: Ampertonic CLS1.
- .2 Loop resistance of 0.2 ohms to 1.8 ohms resistive.Audio frequency response of 80 Hz to 6.3k Hz, ± 3 dB.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install to manufacturer's written instructions.

- .2 Install devices and components to heights indicated in 26 05 00 Common Work Results for Electrical.
- .3 Wire and cable:
 - .1 General wiring methods:
 - .1 Install all system wiring within conduit raceway only. J-hook or cable tray not permitted.
 - .2 CAT6 (IP) copper cabling to section 27 15 13 Communications Copper Horizontal Cabling.

3.2 INTERFACE WITH OTHER SYSTEMS

- .1 Interface with PA audio system.
 - .1 Accept audio input from PA audio system.

3.3 SYSTEM PROGRAMMING

- .1 Initially configure the system in accordance with the contract documents.
- .2 Delete default access codes after demonstration.
- .3 The City shall perform any additional programming with the assistance of the contractor.

3.4 DEMONSTRATION

- .1 Section 01 79 00: Systems demonstrations.
- .2 Demonstrate normal and abnormal modes of operation.
- .3 Training:
 - .1 Provide two (2) sessions with the City personnel.
 - .2 Each session shall be minimum two (2) hours.
 - .3 Provide sign-off sheet from the City's personnel confirming acceptance of training.
 - .4 Include sign-off sheet in final copy of O&M

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 Wiring
- .7 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 26 05 19 - Building Wire and Cable.

1.4 SYSTEM 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 by Bosch. Refer to Division 08 specifications.
- .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 FOR 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 FOR 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 (10) years experience and with service facilities within (100 miles) of Project.

1.9 REGULATORY 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 Bosch
- .2 Johnson Controls
- .3 Mercury
- .4 Altronix
- .5 HID

2.2 ALARM & ACCESS CONTROL PANEL

- .1 Control Panel:
 - .1 Merucry LP1502
 - .2 Mercury MR52
- .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 THE CITYthe 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 "cards" must 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 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.
- .24 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.
- .25 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.
- .26 All commands and updates to the panels shall be verified and shall automatically retry if communications have failed.
- .27 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.

2.3 PROXIMITY READER

- .1 Manufacturer:
 - .1 HID Signo Reader 40
 - .2 HID Signo Reader 20
- .2 Supplied by Division 28.
- .3 Installed and wired by Division 28

2.4 PROXIMITY CARD

- .1 Provide three hundred (200) compatible proximity cards.

2.5 POWER SUPPLY

- .1 Shall be centralized power supply, sized as required for system requirements.

2.6 REQUEST TO EXIT DETECTOR

- .1 Manufacturer:
 - .1 Bosch DS150i
 - .2 Bosch DS160
- .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 22 AWG, 4 conductors stranded or 18 AWG, 4 conductors for devices. Wire size determined by manufacturer specifications. Install wiring in conduit.
- .3 Use 18 AWG, 4 conductors or 18 AWG, 2 conductors for power supply wiring.
- .4 Make conduit and wiring connections to door hardware devices provided under Section 08 71 00.
- .5 Delete default access codes after commissioning, training to the City's personnel, and set up of the City's codes.

3.2 SYSTEM PROGRAMMING

- .1 Database: The contractor shall assist the 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 TRAINING

- .1 The contractor shall supply personnel to create a cadre of key the 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 the 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 the 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 the 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 SYSTEM TESTING

- .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 MANUFACTURER'S FIELD SERVICES

- .1 Section 01 78 10: Prepare and start components.
- .2 Include services of technician to supervise installation, adjustments, final connections, system testing, and the City training.

3.6 DEMONSTRATION

- .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 the City personnel. Provide sign-off sheet from the City personnel to confirm acceptance of training.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Alarm control panel.
- .2 Zone expansion panels.
- .3 Initiating Devices.
- .4 Signaling devices.

1.2 RELATED SECTIONS

- .1 Section 08 71 00 - Door Hardware - General.
- .2 Section 26 05 19 - Building Wire and Cable.

1.3 REFERENCES

- .1 CAN/ULC-S303-M91(R1999) - Local Burglar Alarm Units and Systems.
- .2 CAN/ULC-S304-06 - Signal Receiving Centre and Premise Burglar Alarm Control Units.
- .3 ULC-306-03 - Intrusion Detection Units.
- .4 ULC-S318-96 - Power Supplies for Burglar Alarm Systems.
- .5 NFPA 730 - Guide for Premises Security, 2011 Edition.
- .6 NFPA 731 - Installation of Electronic Premises Security Systems, 2011 Edition.

1.4 SYSTEM DESCRIPTION

- .1 Intrusion Detection System: Protect building and selected areas from intrusion during SECURE hours and provide redundant monitoring of specific building mechanical systems as follows:
 - .1 Exterior Doors:
 - .1 Detect status of doors using magnetic contacts.
 - .2 Interior Secured Spaces
 - .1 Detect motion using passive infrared (PIR) technology.

1.5 SUBMITTALS FOR 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 FOR 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 (1) years of experience and with service facilities within(100 miles) of Project.

1.9 REGULATORY 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 BoschSubstitutions: Not permitted.

2.2 ALARM CONTROL PANEL

- .1 Product: Bosch B9512G
- .2 Control Panel: Modular construction with surface wall-mounted enclosure with adequate power supply to serve control panel modules, alarm signaling devices remote annunciator keypads, remote devices, and relays.
- .3 Include battery-operated emergency power supply with capacity for operating system in standby mode for twenty-four (24) hours.
- .4 System Supervision: Provide electrically-supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.
- .5 Initiating Circuits: Supervised zone module with alarm and trouble indication.
- .6 Signal Circuits: Supervised zone coded signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm.
- .7 Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
- .8 Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
- .9 Alarm Sequence of Operation: Actuation of intrusion detecting device places system in alarm mode, which causes the following operations:

- .1 Sound and display local alarm signaling devices with non-coded signal.
- .2 Transmit zone-coded signal to central station.
- .3 Indicate location of actuated device on [control panel] remote annunciator keypad.
- .4 Alarm Reset: Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.
- .5 Lamp Test: Manual lamp test function causes alarm indication at each zone at remote annunciator keypad.

2.3 INITIATING DEVICES

- .1 Standard Range Motion Detector: Dual passive infrared (PIR) motion sensor complete with temperature compensation complete with RFI protection suitable for wall and ceiling mounting and up to (50'-0" x 40'-0") area of coverage.
 - .1 Product: Bosch ISC-CDL1-W15
- .2 Steel Door Contact: 2-wire magnetic door contact.
 - .1 Product:
 - .1 Metal Door Frame Door:
 - .1 GRI 184-12W SPST
 - .2 GRI 199-12W DPDT – Access Control
 - .2 Wood Frame Door:
 - .1 GRI 4040-12WG SPST
 - .2 GRI 4545-12WG DPDT

2.4 SIGNAL DEVICES

- .1 Master Keypad:
 - .1 Bosch B930 Alpha-numeric Keypad
- .2 Arming Stations:
 - .1 Bosch B915 Alpha-Numeric Keypad

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install to manufacturer's written instructions.
- .2 Use minimum 4/C 22 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in conduit.
- .3 Use minimum 10/C 18 AWG minimum size conductors for interconnection between main control panel and expansion panels. Install wiring in conduit.
- .4 Confirm wiring with manufacturer.
- .5 Make conduit and wiring connections to door hardware devices provided under Section 08 71 00.
- .6 Delete default access codes after commissioning, training to the City's personnel, and set up of the City's codes.

3.2 MANUFACTURER'S FIELD SERVICES

- .1 Section 01 78 10: Prepare and start components.

-
- .2 Include services of technician to supervise installation, adjustments, final connections, system testing, and the City training.

3.3 DEMONSTRATION

- .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 the City personnel. Provide sign-off sheet from the City personnel to confirm acceptance of training.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Fire alarm initiating and signaling devices.
- .2 Auxiliary fire alarm equipment and wiring.

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 23 33 00 - Duct Work Accessories: Smoke dampers.
- .6 Section 26 05 00 - Common Work Results for Electrical
- .7 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: Existing, fully supervised, manual and automatic, single stage addressable fire alarm system with networked fire alarm control panels.
- .2 The existing fire alarm system shall be expanded and modified as required to 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 The existing fire alarm system shall be expanded, and will include, but not be limited to the following:
 - .1 Power supplies and booster facilities

- .2 Manual alarm stations
- .3 Automatic alarm initiating devices
- .4 Audible and visual signal devices
- .5 End-of-line devices
- .6 Ancillary devices
- .7 Input and output modules
- .8 Isolator modules

1.5 Submittals For Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide electrical characteristics and connection requirements.
- .3 Shop Drawings:
 - .1 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 Submittals For 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 products.

1.7 Closeout Submittals

- .1 Section 01 78 00: 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.

1.8 Maintenance Material Submittals

- .1
- .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 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 Expand and modify fire alarm system to CAN/ULC S524.

1.10 Regulatory 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 All new product shall be fully compatible with the existing Simplex fire alarm system.
- .2 Substitutions: None.

2.2 Fire Alarm And Smoke Detection Control Panel

- .1 Control Panel: Existing Simplex 4100 Fire Alarm Panel located in the entrance lobby.

2.3 Manual Initiating Devices

- .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).
 - .2 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 Automatic Initiating Devices

- .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).
 - .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.
- .3 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.
- .4 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. Provide dual sounder bases as indicated with separate audible signals for fire or CO alarm.

2.5 Input Modules

- .1 Fully addressable modules to facilitate the monitoring of the following:
 - .1 Sprinkler flow and tamper inputs
 - .2 Dry contact devices

2.6 Output Modules

- .1 Fully addressable output modules with provision to accept a 24 VDC input from the control panel or local power supply (transponder) to facilitate the following:
 - .1 Audible signals
 - .2 Visual signals
- .2 Output modules shall provide dry normally open contact with output up to 2A at 24V.

2.7 Signal Line Isolators

- .1 Provide signal isolators on addressable loops to suit CAN/ULC S524 and CAN/ULC S537.

2.8 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.

2.9 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.

2.10 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.

2.11 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.

2.12 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 Where Manual Stations are located in public areas, install Manual Station Vandal Guard.
- .5 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.
- .6 Locate ceiling mounted detectors minimum 100mm (4") from edge of ceiling where it meets the wall as measured from the edge of the detector.
- .7 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.
- .8 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.
- .9 Mount end-of-line devices in separate box adjacent to last device in circuit.
- .10 Mount outlet box for electric door holder to withstand 36 kg (80 lbs) pulling force.
- .11 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.
- .12 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 Circuits shall have a minimum 15% spare capacity for future system expansion.
 - .4 All SLC, signal and power riser wiring shall be supervised, including internal wiring between modules.
 - .5 No t-tapping permitted for all fire alarm device wiring.
- .13 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.
- .14 Where devices are surface mounted in finished areas, provide a surface mounted metal raceway device box. Color of box shall match the device.
- .15 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.
- .16 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.
- .17 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.

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- .18 Programming of room names and numbers shall match the Division's name and numbering scheme.

3.2 Wiring Methods

- .1 Concealed Dry Interior Locations: Use only FAS wire in raceway.
- .2 Exposed Dry Interior Locations: Use only FAS wire in raceway.
- .3 Above Accessible Ceilings: Use only FAS wire in raceway.
- .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.

3.4 Field Quality 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 78 00: Prepare and start components.
- .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 inside and outside the Limit of Construction, as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 01 74 21 - Demolition & Removals
- .2 31 22 13 - Rough Grading
- .3 32 11 23 - Granular Base Courses
- .4 32 12 16 - Asphalt Paving

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 Submit product data for: plastic web snow fence and snow fence supports to the Contract Administrator.

1.5 SCHEDULING

- .1 Obtain approval from the Contract Administrator of schedule indicating beginning of work.

Part 2 Products

2.1 MATERIALS

- .1 Wood strapping material, minimum thickness of 25mm and minimum length of 2440mm.
- .2 Snow Fence: plastic UV stabilized, high density polyethylene web snow fence, international orange colour, 1.22 meter height, or approved equal.

- .3 Snow Fence Supports: rolled steel T-bar fence posts, or approved equal.

Part 3 Execution

3.1 TREE PROTECTION

- .1 All trees identified for protection on Drawings are to remain and be protected from damage throughout the duration of construction.
- .2 Obtain approval from the Contract Administrator of proposed barrier locations and materials prior to installation.
- .3 All tree protection wood strapping and snow fencing is to be in place prior to start of site works and shall stay in place until construction completion. Repair, replace and maintain tree protection wood strapping and snow fence during construction of the Work.
- .4 For trees greater than 100mm caliper, 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 into 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.
- .5 For trees less than 100mm caliper, install snow fencing around the tree to a 2.0 meter radius complete with installation hardware. The 2.0 meter radius of the snow fencing may be reduced to suit the tree being protected as approved by the Contract Administrator.
- .6 The 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 considered to 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.
- .7 Ensure no tree pruning is done inside drip line. If pruning inside drip line is required, work is to be done by a Certified Arborist or Canadian Certified Horticultural Technician (CCHT), to be approved by the Contract Administrator.
- .8 Remove wood strapping and snow fencing material without harming trees as soon as construction is completed.

3.2 EXCAVATION, TRENCHING AND TUNNELLING

- .1 No excavation, tunnelling or trenching is permitted within the drip line of the trees or within the monument protection zone, without approval from the Contract Administrator.

- .2 If roots are encountered during excavation under drip lines and root pruning is required, work is to be done by a Certified Arborist or Canadian Certified Horticultural Technician (CCHT), to be approved by the Contract Administrator.
- .3 If utility or geothermal pipes have to traverse protected areas with large trees the Contractor must obtain written approval to remove the necessary specimens from the Contract Administrator or arrange to push pipes a minimum 2.4m below existing grades as possible for the entire span of the tree canopy above.

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 The Contract Administrator will inspect the placement of tree protection barriers when initially installed and determine acceptance.
- .2 Tree protection measures will be reviewed regularly to ensure they remain in place during heavy construction activities on site.
- .3 Tree protection will be taken down for finish grading and feathering and soft landscape installation adjacent to or under their canopies.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM) – Latest Edition
 - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).

1.2 EXISTING CONDITIONS

- .1 Locate underground and surface utility lines and buried objects. Report discrepancies to Contract Administrator if they impact proposed work.
- .2 Any damage to utilities during construction are the responsibility of the Contractor and will be repaired at no additional cost to the Contract Administrator.

1.3 PROTECTION

- .1 Protect existing fencing, trees, landscaping, natural features, benchmarks, buildings, pavement, surface, or underground utility lines which are to remain as noted on the drawings or directed by Contract Administrator. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Fill material in accordance with Section 31 23 33.01 - 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 Contract Administrator.

Part 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:
 - .1 150 mm for grassed areas.
 - .2 Sub-grade elevation as indicated for pavement areas.
- .3 Slope rough grade away from building as indicated.

- .4 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.
- .5 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:
 - .1 90% under landscaped areas.
 - .2 95% under roadways, parking and walk areas.
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.2 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping to a local site location as directed by Contract Administrator.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM), Latest Editions.
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard 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, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB), Latest Editions.
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 City of Winnipeg Standard Construction Standard Specifications (CW), Latest Editions.
 - .1 CW 2030 – Excavation Bedding and Backfill.

1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: any solid material in excess of 0.50 m³ and which cannot be removed by means of heavy-duty excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

- .5 Borrow material: material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of Work.
- .6 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.
 - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 - 80
0.005 mm	0 - 45
 - .3 Coarse-grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.3 SUBMITTALS

- .1 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Submit to Contract Administrator written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
 - .2 Submit to Contract Administrator written notice when bottom of excavation is reached.
 - .3 Submit to Contract Administrator testing results as described in PART 3 of this Section.
- .2 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating location plan of existing utilities as found in field, clearance records from utility authorities, and location plan of and relocated and abandoned services, as required.

1.4 QUALITY ASSURANCE

- .1 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional Contract Administrator registered or licensed in Provinces of Manitoba, Canada.
- .3 Keep design and supporting data on site.
- .4 Engage services of qualified professional Contract Administrator who is registered or licensed in Province of Manitoba, Canada in which Work is to be

conducted to design and inspect cofferdams, shoring, bracing, and underpinning required for Work.

- .5 Do not use soil material until written report of soil test results are reviewed and approved by Contract Administrator.
- .6 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused granular materials from landfill to local facility for reuse as directed by Contract Administrator.
- .3 Haul away unused excavated material to a local site location as directed by Contract Administrator.

1.6 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of 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 Prior to beginning excavation Work, notify Contract Administrator and establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful soil hydrovac methods.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator before re-routing. Costs for such Work to be paid by Contract Administrator.
 - .9 Record location of maintained, re-routed, and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 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 Contract Administrator.
- .3 Where required for excavation, cut roots or branches as directed by Contract Administrator.

Part 2 Products

2.1 MATERIALS

- .1 Bedding and backfill materials: properties to CW 2030 – Excavation Bedding and Backfill and following requirements:

- .1 Type 1 material to consist of well graded pit-run material.
- .2 Type 2 and Type 3 material to consist of sound, hard, crushed rock, or crushed gravel free from organic or soft material that would disintegrate through decay or weathering, well graded throughout.
- .3 Sand to be clean and free running.
- .4 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

- .5 Table:

Sieve Designation	% Passing			
	Type 1	Type 2	Type 3	Sand
75 mm	90-100			
28 mm	80-100		100	
20 mm		100		
10 mm				100
5 mm	40-80	40-70	0-5	90-100
2.5 mm		25-60		
0.630 mm				25-60
0.315 mm	10-35	8-25		
0.080 mm	5-30	6-17		0-3

- .2 Excavation material: common excavation material from site excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Geotextiles: to Section 31 32 19.01 - Geotextiles.

Part 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 requirements of authorities having jurisdiction.

- .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.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and 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 Contract Administrator 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 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as directed by Contract Administrator after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as directed by Contract Administrator.
 - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Contract Administrator.
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil to a local site location as directed by Contract Administrator.

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated by 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.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as approved by Contract Administrator.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Contract Administrator details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved runoff areas and in a manner not detrimental to the property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses, or drainage areas.

3.8 EXCAVATION

- .1 Advise 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 indicated by Contract Administrator.
- .3 Remove concrete, paving, walks, demolished foundations, rubble, and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 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.
- .6 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.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material in approved location.
- .10 Do not obstruct flow of surface drainage or natural watercourses.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft, or organic matter.
- .12 Notify Contract Administrator when bottom of excavation is reached.
- .13 Obtain Contract Administrator approval of completed excavation.
- .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Contract Administrator.
- .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.
- .16 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Bedding and surround of underground services shall consist of a 200mm minimum thickness of sand or Type 2 or 3 material, above and below each pipe.
- .2 Place bedding and surround material in unfrozen condition.

3.10 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Contract Administrator has inspected and approved installations.
 - .2 Inspection, testing, approval, and recording location of underground utilities.
- .2 Areas to be backfilled to be free from debris, snow, ice, water, and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow, or debris.

- .4 Classes of backfill shall be in accordance with CW 2030 – Excavation Bedding and Backfill.
 - .1 Class 4 Backfill shall be used for proposed pipes installed in open trenches or coring shafts under proposed landscaped areas.
 - .1 Backfill the excavation with suitable common excavation material in maximum 200-millimetre-thick layers to the grade required for backfill in accordance with the Drawings. Compact each layer by mechanical means to a density equivalent to that of the surrounding unexcavated material.
 - .2 Class 2 Backfill shall be used for proposed pipes installed in open trenches or coring shafts under existing or proposed pavements and granular surfaces.
 - .1 Backfill the excavation with Type 1 material in maximum 300-millimetre-thick layers to underside of the pavement structure in accordance with the Drawings. Compact each layer with a vibratory compactor to at least 98% Standard Proctor Density.
- .5 Backfilling around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 1.0 m.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Contract Administrator.
 - .2 If approved by Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.
- .6 Consolidate and level unshrinkable fill with internal vibrators.

3.11 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Contract Administrator.
- .2 Replace topsoil, seed and sod as directed by Contract Administrator.
- .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 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

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM) - Latest Editions
 - .1 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .2 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .3 ASTM D4716, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .4 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB) – Latest Editions
 - .1 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.
- .3 City of Winnipeg Standard Construction Standard Specifications (CW) – Latest Editions
 - .1 CW 3130 – Supply and Installation of Geotextile Fabrics

1.2 SUBMITTALS

- .2 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit to Contract Administrator copies of mill test data and certificate at least 4 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, and rodents.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

- .2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIAL

- .1 Non-woven geotextile shall have physical properties requirements to ASTM 4759 and:
 - .1 Grab Tensile Strength, 900 N – minimum (ASTM D4632)
 - .2 CBR Puncture, 2200 N – minimum (ASTM D6241)
 - .3 Trapezoid Tear, 350 N – minimum (ASTM D4533)
 - .4 Apparent Opening Size, 0.18 mm – maximum (ASTM D4751)
 - .5 Permittivity, 1.4 sec⁻¹ – minimum (ASTM D4491)
 - .6 Flow Rate, 3870 l/min/sq.m. – minimum (ASTM D4491)
 - .7 U.V. Resistance, 70% per 500 hrs – minimum (ASTM D4355)
- .2 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 Factory seams: sewn in accordance with manufacturer's recommendations.
- .4 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.
- .5 Geotextile shall be supplied in rolls and stored on site in accordance with manufacturer recommendations.

Part 3 Execution

3.1 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in accordance manufacturers recommendations.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Pin successive strips of geotextile with securing pins 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 geotextile installation, backfill with granular layer within 4 h of geotextile installation.

- .8 Replace damaged or deteriorated geotextile to approval of 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 REFERENCES

- .1 American Society for Testing and Materials (ASTM) – Latest Editions
 - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB) – Latest Editions
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 City of Winnipeg Standard Construction Standard Specifications (CW)
 - .1 CW 3130 – Sub-grade, Sub-base, and Base Course Construction

1.2 SAMPLES

- .1 Submit samples of bedding, backfill and fill materials to be used, prior to beginning Work. Pack tightly in containers to prevent contamination and inform the Contract Administrator of proposed source of materials.

1.3 QUALITY ASSURANCE

- .1 The inspection and testing of base compaction will be conducted by a testing agency designated and paid for by The City. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 The The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.4 LAYOUT OF WORK

The Sub-Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Sub-Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

- .1 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Sub-base material shall consist of unfrozen, well-graded 50-millimetre crushed limestone.
 - .1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1/ CAN/CGSB-8.2.

Sieve Designation	% Passing
	50 mm Max.
200 mm	-
150 mm	-
100 mm	-
50 mm	100
25 mm	-
5 mm	25-60
0.080 mm	4-15

- .2 50 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 C131.
- .2 Base course material shall consist of unfrozen, well-graded 19-millimetre crushed limestone, free from organic or soft material that would disintegrate through decay or weathering.
 - .1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1/ CAN/CGSB-8.2.

Sieve Designation	% Passing
	19 mm Max.
25 mm	-

Sieve Designation	% Passing
	19 mm Max.
20 mm	100
5 mm	40-70
2.5 mm	25-60
0.315 mm	8-25
0.080 mm	6-17

- .1 Crushed 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.
- .2 Crushed gravel material passing the 315 sieve will have a liquid limit not greater than 25 and a plasticity index not greater than 6.
- .3 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.

Part 3 EXECUTION

3.1 SEQUENCE OF OPERATION

- .1 Place granular sub-base after sub-grade is reviewed and approved by the Contract Administrator.
- .2 Place granular base course after sub-base surface is reviewed and approved by the Contract Administrator.
- .3 Placing
 - .1 Construct granular sub-base and base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 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.

- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .4 **Compaction Equipment**
 - .1 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.
- .5 **Compacting**
 - .1 Compact to density not less than 100% maximum dry density unless noted otherwise in the Geotechnical Report.
 - .2 Shape and roll alternately to obtain smooth, even, and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Contract Administrator.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .6 **Proof rolling**
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires.
 - .2 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .3 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by the Contract Administrator.
 - .2 Backfill excavated subgrade with sub-base material and compact.
 - .4 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by the Contract Administrator and replace with new materials at no extra cost.

3.2 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

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 32 11 23 - Aggregate Base Courses.
- .2 Section 32 17 23 – Pavement Marking.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM) – Latest Editions
 - .1 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 Editions
 - .1 CAN/CGSB-1.5, Low Flash Petroleum Spirits Thinner.
 - .2 CAN/CGSB-1.74, Alkyd Traffic Paint.
- .3 City of Winnipeg Standard Construction Standard Specifications (CW)
 - .1 CW 3410 – Asphaltic Concrete Pavement Works

1.3 QUALITY ASSURANCE

- .1 Materials testing required shall include laboratory and field testing in accordance with CW 3410 – Asphaltic Concrete Pavement Works, which will be conducted by a testing agency designated and paid for by The City. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.4 LAYOUT OF WORK

- .1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.
- .2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.
- .2 Place materials defined as hazardous or toxic in designated containers.

- .3 Dispose of unused paint and paint thinner materials at official hazardous material collections site.
- .4 Do not dispose of unused paint and paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.
- .5 Divert unused asphalt from landfill to facility capable of recycling materials.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Aggregates: to CW 3410 – Asphaltic Concrete Pavement Works.
- .2 Asphalt Cement: to CW 3410 – Asphaltic Concrete Pavement Works
- .3 Mineral Filler: to CW 3410 – Asphaltic Concrete Pavement Works
- .4 Prime Coat and Tack Coat shall consist of either an emulsified or cutback asphalt. Selection shall be based upon field conditions and subject to the approval of the Contract Administrator. Method of application shall conform to manufacturer’s recommendations.
- .5 Granular sub-base and base course: to Section 32 11 23 - Aggregate Base Courses
- .6 Traffic paint: to Section 32 17 23 – Pavement Marking

2.2 MIX DESIGN STATEMENT

- .1 The Contractor shall submit a Mix Design Statement certifying the constituent materials and mix proportions that are proposed for use in the asphaltic concrete paving mix. The Contractor shall also supply reasonable evidence to the Contract Administrator that the mix proportions selected will produce asphaltic concrete confirming to the design requirements specified in CW 3410 – Asphaltic Concrete Pavement Works.

Part 3 EXECUTION

3.1 FOUNDATIONS

- .1 Asphalt pavement granular foundations for roadway and parking lot pavements to comprise of:
 - .1 100 mm compacted thickness of granular base.
 - .2 350 mm compacted thickness of granular sub-base course.

- .2 Construction of granular foundations: to Section 32 11 23 - Aggregate Base Courses

3.2 PAVEMENT THICKNESS

- .1 Pavements for roadways and parking lots shall be 100mm thickness, Type 1A (Surface Course) as specified in CW 3410 – Asphaltic Concrete Pavement Works.

3.3 BASE PREPARATION

- .1 Do base preparation in accordance with Section 32 11 23 - Aggregate Base Courses.
- .2 The placing of the asphaltic concrete paving mixture shall not commence until the construction of the granular base is complete and the Contract Administrator has approved the condition and grade of the compacted base course.

3.4 PAVEMENT CONSTRUCTION

- .1 Placing asphaltic concrete mixture: to CW 3410 – Asphaltic Concrete Pavement Works.
- .2 Main line paving, tie-ins, and approaches: to CW 3410 – Asphaltic Concrete Pavement Works.
- .3 Joints: to CW 3410 – Asphaltic Concrete Pavement Works.
- .4 Compaction of asphaltic concrete paving mixture: to CW 3410 – Asphaltic Concrete Pavement Works.

3.5 REQUIREMENTS AFTER FINAL ROLLING

- .1 After final rolling the surface shall be smooth and true to the established crown and grade. Any low or defective spots shall be immediately remedied by cutting out the course, or planning to a depth of 40 millimetres, at such spots and replacing it with a fresh hot mixture that shall be immediately compacted to conform with the surrounding area and shall be thoroughly bonded to it. The surface of the finished pavement shall be free from depressions exceeding 5 millimetres as measured with a 3-metre straight edge.
- .2 The measured in-place density of the completed course shall be an average of ninety-seven (97%) percent of the 75 Blow Marshall Density of the paving mixture, with no individual test being less than ninety-five (95%) percent.

3.6 OPENING TO TRAFFIC

- .1 In no case shall traffic or construction equipment be allowed on the asphaltic concrete pavement until completion of quality control testing by the Contract Administrator and until the completed pavement has cooled to atmospheric temperature or to such other temperature, as may be approved by the Contract Administrator, that will ensure no deformation of the pavement surface under traffic loading.

3.7

TRAFFIC MARKINGS

- .1 Paint parking space divisions and other pavement markings in accordance with Section 32 17 23 – Pavement Marking

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Provide all labour, materials, methods, equipment and accessories for the supply and installation of precast unit pavers.

1.2 RELATED SECTIONS

- .1 Standard City of Winnipeg Specification CW 3110 – R21 – Sub-grade, Sub-base and base Course Construction
- .2 Section 32 16 15 - Concrete Walks, Curbs and Gutters
- .3 Section 32 91 19 - Topsoil & Finish Grading

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM C979-99, Standard Specification for Pigments for Integrally Coloured Concrete.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA A23.1/A23.2-0, Concrete Materials and Methods of Concrete Construction/Method of Test for Concrete.
 - .2 CSA-A231.2-95, Precast Concrete Pavers.
 - .3 CSA A283-00, Qualification Code for Concrete Testing Laboratories.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate layout and relationship of paving joints to fixtures and project formed details.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Construction/Demolition Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 CONCRETE PAVERS

- .1 Precast concrete pavers: to CSA-A231.2 and as follows:
 - .1 Acceptable products: Holland unit pavers as manufactured by Barkman Concrete, Steinbach, Manitoba. No alternates accepted.

- .2 Precast Paver Sizes and Patterns:
 - .1 210 x 105 x 80mm. Colour: Charcoal (borders)
Pattern: Soldier course.

2.2 GRANULAR BASE, BEDDING AND JOINT SAND

- .1 Crushed stone for granular base: consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

- .1 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 rather than ASTM E11.

<u>Sieve Designation</u>	<u>% Passing</u>
19 mm	100
12.5 mm	70 - 100
4.75 mm	40 - 70
2.00 mm	23 - 50
0.425 mm	7 - 25
0.075 mm	3 - 8

- .2 Manufactured sand for bedding: hard, durable, crushed stone particles, conforming to the gradation of concrete sand as specified in CAN/CSA A23.1, Section 5.3.2. Sand shall be free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Do NOT use limestone screenings or stone dust as bedding material.
 - .1 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 rather than ASTM E11. 0% shall pass the 0.075 mm sieve.

<u>Sieve Designation</u>	<u>% Passing</u>
10 mm	100
5 mm	95 - 100
2.5 mm	80 - 100
1.25 mm	50 - 90
0.630 mm	25 - 60
0.315 mm	10 - 35
0.160 mm	2 - 10

- .3 Polymeric Joint sand: fine, hard, durable, angular particles, complete with binding polymer, free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Colour: Black. Approved Manufacturer: Techniseal, Sakrete, Unilock or approved equal.

Part 3 Execution

3.1 SUBGRADE PREPARATION

- .1 Ensure that sub-grade preparation conforms to levels and compaction required to allow for installation of granular base.

3.2 GRANULAR BASE

- .1 Minimum depth: as indicated on the drawings.
- .2 Spread and compact crushed stone or gravel base in uniform layers not exceeding 100mm compacted thickness.
- .3 Compact base to a density of not less than 100% Standard Density in accordance with ASTM D698.
- .4 Shape and roll alternately to obtain a smooth, even and uniformly compacted granular base and ensure conformity of grades with finish surface.
- .5 Apply water as necessary during compaction to obtain specified density. If granular base is excessively moist, remove it and install more granular material to rid it of sponginess.
- .6 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
- .7 Ensure top of granular base does not exceed plus or minus 10 mm over a 3 m straightedge.
- .8 Will require minimum two compaction tests for base, depending on the final area.

3.3 BEDDING SAND

- .1 Place and spread bedding sand to uniform thickness as indicated on drawings.
- .2 Ensure bedding material is not saturated or frozen at all times until installation is complete.
- .3 Spread and screed material on structural surface to achieve 19 mm compacted thickness after vibrating pavers in place. Do not use joint sand for bedding sand.
- .4 Do not disturb screeded material. Do not use bedding material to fill depressions in base material.
- .5 Maximum thickness after compaction: 19 mm.
- .6 Use of joint sand or limestone screenings as bedding material is NOT acceptable.

3.4 SURFACE COURSE

- .1 Ensure bedding sand and granular base are not saturated prior to placement of unit pavers.
- .2 Install unit paving true to grade on the bedding sand, in location, layout and pattern as indicated.
- .3 Where required, cut units accurately without damaging edges.
- .4 Precast concrete paving units:
 - .1 Install paving units to pattern as indicated with 3 mm wide joints.
 - .2 Use appropriate end, edge and corner stones. Saw cut pavers to fit around obstructions and at abutting structures.
 - .3 Inspect, remove, and replace chipped, broken and damaged pavers.

- .4 Compact and level units with min. 22 kN force mechanical plate vibrator use minimum 19 mm thick plywood or neoprene pad under plate compactor and over units, until they are true to grade and free of movement.
- .5 Do not compact unit paving within 1 m of unrestrained edges of pavers.
- .6 Sweep dry, polymeric joint sand material into joints in multiple directions. Paving surface must be dry prior to installation of polymeric joint sand.
- .7 Pass mechanical plate vibrator over unit paving to achieve compaction of sand in joints. Protect pavers from damage during compaction activities. Ensure joints are full at completion of compaction.
- .8 Continue application of joint sand material and vibrating of pavers until joints are full.
- .9 Prior to applying water to joint sand, blow off entire paving area with a leaf blower to remove residual sand on top of pavers. Do not displace sand in joints.
- .10 Apply water in light mist to activate polymeric sand. Do not displace sand when applying water. Do not allow water to pool on pavers. Blow off excess water if required once wetting of joint sand is complete.
- .11 At the completion of each workday, ensure all work within 1 m of laying face is left fully compacted with sand filled joints.
- .12 Surface of finished pavement should be free from depressions exceeding 5 mm as measured with 3 m straight edge.
- .13 Surface elevation of pavers: 3 to 4 mm above adjacent drainage inlets, concrete collars or channels.
- .14 Ensure conformance of final elevations to drawings.

3.5 ACCEPTANCE AND CLEANING

- .1 Remove and dispose of loose, extraneous materials from surfaces to be cleaned.
- .2 Apply cleaning compounds appropriate for removal of various contaminants encountered in accordance with manufacturer's recommendations.
- .3 Final surface to be free of contamination.

3.6 CLEAN UP OF SITE

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This Specification shall cover the supply and installation of non-woven geotextile filter fabric, riprap & boulders.

1.2 RELATED SECTIONS

- .1 Section 32 93 00 – Trees, Shrubs and Groundcovers.

1.3 REFERENCES

- .1 City of Winnipeg Standard Construction Specification CW 3130 – Supply and Installation of Geotextile Fabrics, latest revision.

1.4 SAMPLES

- .1 Submit to Contract Administrator photographs of each type of stone material at least two (2) weeks prior to commencing work.
- .2 Do not move boulders to site without prior approval from the Contract Administrator of the sample photographs.

Part 2 Products

2.1 GENERAL

- .1 Decorative landscape boulder and riprap rock mulch materials shall be free of organic matter and accepted by the Contract Administrator prior to placement.

2.2 MATERIALS

- .1 Rounded Granite Fieldstone Boulder: 600 – 1000mm diameter boulders, smooth, selected for colour and form, free of organic matter. Natural colour range from tan, grey, black to brown. Limestone boulders will not be accepted.
- .2 Field Stone Riprap: Hard, unbroken 200 – 350mm diameter round, washed, granite field stone. Limestone rip rap will not be accepted.
- .3 Infill: Clean, washed stone, 38mm diameter riverwash stone, free of excess fines, dirt, and other foreign matter.
- .4 Geotextile Filter Fabric: non-woven separation/reinforcement fabric to CW 3130.
- .5 Granular Base: 6mm down crushed limestone bedding material.

Part 3 Execution

3.1 PREPARATION

- .1 Excavate existing base to design levels.

3.2 PLACEMENT OF GEOTEXTILE FILTER FABRIC

- .1 Place geotextile fabric in accordance with CW 3130.

3.3 PLACEMENT OF DECORATIVE LANDSCAPE BOULDERS

- .1 Install stone to grades and depths indicated on the Drawings, using approved placement methods.
- .2 Set boulder onto compacted granular base, and arrange so that larger stones are uniformly distributed, smaller stones fill voids. Sufficient handwork shall be undertaken to ensure a neat and consistent appearance, to the satisfaction of the Contract Administrator.
- .3 Install decorative landscape boulders in random pattern, set stones upright with 1/3 embedded into gravel bed and top 2/3 exposed. Rotate stones so largest horizontal dimensions are aligned.
- .4 Backfill between stones with 38mm layer of riverwash stone.

3.4 PLACEMENT OF RIPRAP

- .1 Install stone to grades and depths indicated on the Drawings, using approved placement methods.
- .2 Set stone over geotextile fabric and arrange so that larger stones are uniformly distributed, smaller stones fill voids. Sufficient handwork shall be undertaken to ensure a neat and consistent appearance, to the satisfaction of the Contract Administrator.

3.5 STANDARD OF ACCEPTANCE

- .1 Place and embed a decorative landscape boulder and obtain approval by the Contract Administrator prior to backfilling. Once approved by the Contract Administrator, this sample will be the standard of acceptance for further work.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 23 10 – Excavating, Trenching and Backfilling
- .2 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM) – Latest Editions
 - .1 ASTM D698, 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) – Latest Editions
 - .1 CAN/CGSB-3.3, Kerosene, Amend. No. 1, National Standard of Canada.
 - .2 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
- .3 Canadian Standards Association (CSA International) – Latest Editions
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4 City of Winnipeg Standard Construction Standard Specifications (CW)
 - .1 CW 3310 – Portland Cement Concrete Pavement Works
 - .2 CW 3325 – Portland Cement Concrete Sidewalk

1.3 QUALITY ASSURANCE

- .1 Materials testing required shall include laboratory and field testing in accordance with CW 3310 – Portland Cement Concrete Pavement Works, which will be conducted by a testing agency approved by the Contract Administrator. The Contract or shall coordinate the timing of this testing in an efficient way.
- .2 The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contract or shall pay for costs of additional testing as required due to improper performance of work.

1.4 LAYOUT OF WORK

- .1 The Contract or shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contract or shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Disposal Plan.
- .2 Place materials defined as hazardous or toxic in designated containers.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with CW 3310 – Portland Cement Concrete Pavement Works.
- .2 Reinforcing steel: to CW 3310 – Portland Cement Concrete Pavement Works.
 - .1 All reinforcing steel shall be supplied according to the type and dimensions as shown on the Drawings.
- .3 Curing Compound: to CW 3310 – Portland Cement Concrete Pavement Works.
- .4 Granular Base: to Section 32 11 23 - Aggregate Base Courses.
- .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: to Section 31 23 10 – Excavating, Trenching and Backfilling.
- .7 Clean potable water.
- .8 All necessary ventilators, masks and heavy-duty rubber protective gear recommended by the manufacturer for the handling and application of this product.
- .9 Provide 300 x 300mm sample of etched and sealed concrete finish for Contract Administrator approval prior to proceeding with stencil fabrication and installation.

Part 3 EXECUTION

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials. Dispose of surplus and unsuitable excavated off site.
- .3 Place fill in maximum 150 mm layers and compact as specified in the Geotechnical Report.

3.2 BASE PREPARATION

- .1 Do base preparation in accordance with Section 32 11 23 - Aggregate Base Courses.
- .2 The placing of reinforcing steel and concrete shall not commence until the construction of the granular base has been completed and the Contract Administrator has approved the condition and grade of the compacted base course.

3.3 CONCRETE

- .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.
- .2 Placing concrete pavement: to CW 3310 – Portland Cement Concrete Pavement Works.
- .3 Finishing: to CW 3310 – Portland Cement Concrete Pavement Works.
- .4 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Contract Administrator can be demonstrated.

3.4 CONCRETE FINISHES

- .1 All sidewalks and paths to have a light broom finish.

3.5 TOLERANCES

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.6 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1500mm or as per drawings. Install expansion joints as indicated at intervals of 6m.

3.7 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 Install joint filler in isolation joints in accordance with CW 3310 – Portland Cement Concrete Pavement Works
- .3 Seal isolation joints with sealant approved by the Contract Administrator.

3.8 SAW CUT PATTERN

- .1 Contractor to provide a marked-up plan with proposed saw cut patterns for Contract Administrator review and approval prior to installation of saw cuts.

3.9 CURING

- .1 Immediately following concrete finishing and after any excess moisture due to bleeding has evaporated, the surface of the concrete shall be uniformly treated with a white-pigmented water based liquid membrane-forming curing compound, in accordance with the manufacturer's recommendations. The rate of application shall not be less than that recommended by the manufacturer. Where forms are used, as soon as the side forms are stripped, the edges of all concrete slabs shall be sprayed with liquid membrane-forming curing compound.
- .2 After application, the white-pigmented liquid membrane-forming curing compound shall be protected as per the manufacturer's recommendations from rain or snow.

- .3 Curing compound shall not be used when the pavement is otherwise protected from cold weather by polyethylene film for a period of not less than five days.

3.10 WEATHER CONDITIONS

- .1 The Sub-Contractor shall be responsible for taking all necessary measures to protect freshly laid concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow, and cold weather, to the satisfaction of the Contract Administrator.
- .2 Concrete shall be adequately protected from freezing for a minimum of five days after completion of paving operations. A minimum requirement for protection shall be provided as follows when the air temperature as forecast by Environment Canada is:

0°C to 3°C	The concrete shall be covered with polyethylene film.
-3°C to -5°C	Insulated tarp(s) or two sheets of polyethylene film covering, separated by 300 mm of dry straw.
- .3 Concrete damaged because of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense.
- .4 When air temperature is at or will be above 27°C during the basic curing period, curing shall be accomplished in accordance with the requirements of CSA A23.1.

3.11 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material approved by Contract Administrator. Compact and shape to required contours as indicated or as directed by Contract Administrator.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of all thickened edge sidewalks, concrete sidewalks at drive aisles and pedestrian walkway, CIP concrete curb (parking lot islands), as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 32 14 13 – Precast Unit Pavers.

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 – light broom 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 walkways 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 Administrator's 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 walkway surfaces a uniform light 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.
- .2 Provide edging as indicated on the Drawings using radius edging tool.

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 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 REFERENCES

- .1 Canadian General Standards Board (CGSB) – Latest Editions
 - .1 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner.
 - .2 CGSB1-GP-12c-68, Standard Paint Colours.
 - .3 CGSB1-GP-74M-79, Paint, Traffic, Alkyd.

Part 2 Products

2.1 MATERIALS

- .1 Paint:
 - .1 To CGSB1-GP-74M, alkyd traffic paint.
 - .2 Colour: to CGSB1-GP-12C, yellow 505-308 or white 513-301.
- .2 Thinner: to CAN/CGSB-1.5.
- .3 Glass beads:
 - .1 Overlay type: to CGSB1-GP-74M.

Part 3 Execution

3.1 EQUIPMENT REQUIREMENTS

- .1 Paint applicator to be an approved pressure type 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.
- .2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

3.2 CONDITION OF SURFACES

- .1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.
- .2 Application:
 - .1 Lay out pavement markings. Confirm pant colour with Contract Administrator prior to application.
 - .2 Unless otherwise approved by Contract Administrator, apply paint only when air temperature is above 10C, wind speed is less than 60km/h and no rain is forecast within next 4h.

- .3 Apply traffic paint evenly at rate of 3m²/L.
- .4 Do not thin paint unless approved by Contract Administrator.
- .5 Symbols and letters to conform to dimensions indicated.
- .3 Paint lines to be of uniform colour and density with sharp edges.
- .4 Thoroughly clean distributor tank before refilling with paint of different colour.
- .5 Apply glass beads at rate of 200g/m² of painted area immediately after application of paint.

3.3 TOLERANCE

- .1 Paint markings to be within plus or minus 12mm of dimensions indicated.

3.4 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification to cover all labour, equipment and materials required to mark parking stall lines, no parking areas and accessible parking symbols.

1.2 RELATED SECTIONS

- .1 N/A.

1.3 REFERENCES

- .1 CAN/CGSB – 1.5 – M91, Low Flash Petroleum Spirits Thinner.
- .2 CGSB 1-GP-12c-68, Standard Paint Colours.
- .3 CGSB 1-GP-71-83, Method, of Testing Paints and Pigments.
- .4 CGSB 1-GP-74M-79, Paint, Traffic, Alkyd.

1.4 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 Proof of Non-Toxic Composition: Product data confirming chemical composition for traffic paint conforms to the latest health and environmental standards of the local jurisdiction.

1.5 SAMPLES

- .1 Submit samples, on request, in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit to the Contract Administrator the following material sample quantities at least two (2) weeks prior to commencing work.
 - .1 One painted sample of each type of paint.
 - .2 Sampling to CSGB 1-GP-71.
- .3 Clearly 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.

Part 2 Products

2.1 MATERIALS

- .1 Paint shall conform to City of Winnipeg specifications for reflectorized traffic paint or suitable equivalent for application to asphalt and/or concrete surface.
 - .1 CGSB 1-GP-74M + Amdt-May-81, alkyd traffic paint
 - .2 High Gloss Traffic Paint (IBIS Products Limited)
- .2 Paint colours shall be to CGSB 1-GP-12C
 - .1 Blue: Pride Enterprises, Handicap Blue 15813 or approved equal.
 - .2 White CGSBI-GP-12C-68
 - .3 Thinner: To CAN/CGSB-1.5M91

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 CONDITION 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 six (6) hours after installation.

3.4 APPLICATION

- .1 Lay out parking stall lines, no parking zones, and accessible parking symbols as indicated on the Drawings. Obtain the Contract Administrator's approval prior to painting.
- .2 Unless otherwise approved by the Contract Administrator, apply paint only when air temperature is above 10°C, wind speed is less than 50 km/h and no rain is forecast within the next eight (8) hours.
- .3 Apply traffic paint evenly at rate of 3 sq.m. per litre. Do not thin paint unless approved by Contract Administrator.
- .4 Parking stall paint lines to be 100mm wide, of uniform colour and density with sharply defined edges.
- .5 Paint parking stall and no parking lines yellow. Paint accessible parking symbols white within blue rectangle.
- .6 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.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of benches, bike racks, waste receptacles, bollards, tactile warning tiles, wheelstops and the flag pole.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 19 – Construction Waste Management and Disposal
- .3 Section 01 78 00 – Closeout Submittals
- .4 Section 32 16 15 – Concrete Walks, Curbs and Gutters

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Indicate dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.
- .4 Provide maintenance data for care and cleaning of site furnishings for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Provide replacement part information for the City with maintenance data.

Part 2 Products

2.1 BENCH

- .1 970 Backed Bench 900 Series, Model MBE-0970-00088, (23" x W x 70" L x 33.1" H), surface mount, thermally modified ash wood seat and back, cast aluminum frame. Colour: Gunmetal. As supplied by Maglin, - Maglin Site Furniture, Calgary, Alberta, phone 1-888-271-8666, www.maglin.com or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*. Quantity required: two (2).

2.2 BIKE RACK

- .1 Genesis Bicycle Rack, Six bike, Model GNS-6-SF-G, (30" W x 76" L x 35" H), 2 3/8" tube, surface mount, powdercoated galvanized steel. Colour: Gunmetal, as supplied by Madrax Bicycle Security, Waunakee, Wisconsin, phone 1-800-448-7931, www.madrax.com or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*. Quantity required: three (3).

2.3 WASTE RECEPTACLE

- .1 1500 Series – Lexicon Recycle Waste Receptacle MRR-1500-00008 (42.5"H x 24.88" L x 19" D) surface mount, laser cut and formed steel side panels, metal lids, front opening, 2 streams (2 x 16 gallon polyethylene liners), vinyl graphics, rain shield. As supplied by Maglin, - Maglin Site Furniture, Calgary, Alberta, phone 1-888-271-8666, www.maglin.com or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*. Quantity required: two (2).

2.4 FLAG POLE

- .1 Model: HCA-30, HCAN, Architectural Series, Aluminum, satin brushed finish, round top finial, cone tapered pole design, surface mount complete with anchor bolts. Base type: B-7, Tilting. Manual operation with internal halyard system. Butt diameter: 125mm (5"), Top diameter: 75mm (3"), Height: 9.144m (30'). As supplied by Ewing Flagpole Co. Inc., Whitby, Ontario, phone 1 (905) 666-5600, www.ewingflagpole.com or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Performance requirements: Resistant without deformation to 141 km/hr wind velocity unflagged, 112 km/hr flagged; non-resonant, safety design factor of 2.5. Install on cast-in-place foundation as indicated on drawings and Structural Specifications.
- .3 Quantity: One (1), surface mount. Refer to Drawings for location.
- .4 Submit shop drawings for review.

2.5 BOLLARD

- .1 Model: MBO-1600-00003, extruded aluminum with aluminum trim; height 40", oval shaped (length 7", width 5.5"). Gunmetal powdercoat finish. Surface mount, removeable, Base Type 3, threaded anchor with plug. As supplied by Maglin, - Maglin Site Furniture, Calgary, Alberta, phone 1-888-271-8666, www.maglin.com or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*. Quantity required: Six (6) total, surface mount. Refer to Landscape Drawings for locations.

2.6 TACTILE WARNING TILE

- .1 Armor-Tile Tactile Cast-in-Place warning tiles.
- .2 Colour: Yellow. Size: 609 x 914mm.
- .3 As supplied by Armor-Tile Tactile Systems. Contact Brad Graham, ph. 1 (425) 766-6234 or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*.
- .4 Quantity required: Eleven (11). Refer to Landscape Drawings for locations.

2.7 WHEEL STOP

- .1 Parking Curb.
- .2 Colour: Natural. Size: 2438 x 203 x 140mm.
- .3 As manufactured by Barkman Concrete, Steinbach, Manitoba or approved equal.
- .4 Quantity required: three (3). Refer to Landscape Drawings for locations.

Part 3 Execution

3.1 INSTALLATION

- .1 Do not install site furnishings until all hard landscape components have been installed and accepted.

- .2 Assemble furnishings in accordance with manufacturer's instructions. Obtain the Contract Administrator's approval of assembled furnishings prior to mounting.
- .3 Stake or mark out (non-permanent markings) site furniture locations on site for the Contract Administrator approval prior to surface mounting or installation.
- .4 Install all furnishings true, plumb, anchored and firmly supported.
- .5 Touch up damaged finishes to the approval of the Contract Administrator.
- .6 Turn over spare parts and touch up paint to the City.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of reflective metal signs as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 Section 01 45 00 – Quality Control
- .2 Section 32 16 15 – Site Concrete

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 Standard Association (CSA)
 - .1 CAN/CSA-G40.21-M92, Structural Quality Steels.
 - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSAW47.2-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, Semigloss Alkyd Air Drying and Baking Enamel.
 - .4 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
 - .5 CGSB1-GP-12c-65, Standard Paint Colours.
 - .6 CGSB31-GP-3M-88, Corrosion Preventive Compound, Cold Application, Soft Film.
 - .7 CGSB31-GP-101Ma-89, Chemical Conversion Films for Aluminum and Aluminum Alloys.

1.4 SUBMITTALS

- .1 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Submit samples as described in Part 3 - Execution.
- .2 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Fabrication and Installer: trained and qualified fabricators, fully certified to produce high quality, custom signage with a minimum of ten (10) years experience.
- .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. Strict conformance to the 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.

Part 2 Products

2.1 REFLECTIVE METAL SIGNS

- .1 Aluminum Metal Panel: 12 gauge, 0.08" (2.06mm) thick metal plate, sign grade, aluminum panel 5052 H36 or H38, size and shape as indicated on Drawings.
- .2 Sheeting: 3M Brand Scotchlite Series 3200 Engineering Grade Reflective Sheeting, or equivalent, complete with permanent pressure sensitive adhesive backing. Sheeting colours as noted on 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: to be provided in digital (DXF or EPS) format or any other standard, cross-platform required by manufacturer. This 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 Refer to Landscape Drawings for artwork and locations.
- .6 Mounting Hardware:
 - .1 Schedule 40, 50mm diameter, square, hot dipped galvanized sign-posts.
 - .2 Hot-dipped galvanized thru bolts capable of securely fixing signage in place. Sizes as noted on Drawings.
 - .3 Mounting base/collar to suit surface mount applications, complete with concrete wedge anchors.
- .7 Site salvaged traffic and parking regulatory sign – salvaged and reinstalled from existing parking lot.
 - .1 Salvage and re-install existing parking lot signs and mounting poles as identified on drawings.

Part 3 Execution

3.1 REFLECTIVE METAL SIGNS FABRICATION AND INSTALLATION

- .1 Provide proposed colour sample to the Contract Administrator for approval prior to fabrication.

- .2 Send proofs of sign graphics and letters at 1:1 for the Contract Administrator's approval prior to fabrication.
- .3 De-bur, degrease, & etch edges of sign plates to accept reflective sheeting decals in accordance with decal manufacturer's recommendations.
- .4 Apply sheeting in accordance with manufacturers written specifications. Decals shall be centred precisely on base plate. Trim sheeting to form clean, smooth edge along perimeter of base plates.
- .5 Install sign bases:
 - .1 In soft landscape areas, friction drive posts into compacted fill or base to depths indicated.
 - .2 In paved areas, install with C.I.P. concrete bases and galvanized post sleeves as indicated on Drawings.
- .6 Fasten signage as indicated on Drawings. Confirm sign locations and orientation on site with the Contract Administrator.
- .7 Install salvaged existing signs and posts in same manner as new signage.

3.2 TOUCH UP AND CLEAN-UP

- .1 Clean any damaged surfaces with wire brush and coat with clear, exterior zinc rich sealant as required.
- .2 Dispose of surplus materials off site. Leave construction area clean and tidy.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of topsoil and finish grading.

1.2 RELATED SECTIONS

- .1 Section 32 92 20 – Mechanical Seeding
- .2 Section 32 92 23 – Sodding
- .3 Section 32 93 10 – Tree, Shrub and Groundcover Planting

1.3 PROTECTION OF EXISTING FACILITIES

- .1 Protect elements surrounding the work of this section from damage or disfiguration. Protect landscaping and other features remaining as final work. Protect existing structures, fences, roads, sidewalks, paving and curbs.

1.4 SCHEDULING OF WORK

- .1 Schedule placing of topsoil to permit immediate planting operations.

1.5 SAMPLES

- .1 Provide three (3), 1 litre samples of topsoil proposed for use on this project for testing in accordance with Section 01 33 00 - Submittal Procedures, a minimum of four (4) weeks prior to construction. Alternative is to supply soil testing results from recognized soil testing lab with testing having been completed within 75 days of submission. Do not move topsoil to site prior to confirmation of test results. Samples must be representative of topsoil to be used on site.

1.6 DELIVERY AND STORAGE

- .1 Deliver and store fertilizer in waterproof bags accompanied in writing by weight, analysis and name of manufacturer.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil for sodded/seeded areas, tree wells and planting beds: mixture of particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Dark brown to black, loam textured, imported topsoil, free of living plants and branches.
 - .2 Ph value: 6.0 to 7.5.
 - .3 Contain no toxic elements or growth inhibiting materials.
 - .4 Conductivity: maximum 2.5dS/m

- .5 Free of couchgrass or Canadian Thistle rhizomes
- .6 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .7 Consistence: friable when moist.
- .8 Contractor is responsible for supplying materials necessary to amend topsoil to specified characteristics.

2.2 SOIL AMENDMENTS

- .1 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .2 Sand: washed sand, medium to coarse textured.
- .3 Organic matter: compost Category A, unprocessed organic matter, such as mushroom compost, hay, straw, poultry litter, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .4 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .5 Fertilizer: complete commercial synthetic slow-release fertilizer with maximum 35% water soluble nitrogen. Rate and ratio as recommended by soil test results.

2.3 SOIL MIXES

- .1 All Purpose, Four Way Mix for sodded areas, tree pits and planting beds, or equivalent. Well mixed and screened combination of: 40% Black Topsoil, 40% Peat Moss, 10% Sand and 10% Compost by volume. As supplied by Riemer Soils or approved equal in accordance with *B7 Substitutes of the Bidding Procedures*.
- .2 Prepare sub-grade surface as per finish grading.

2.4 SOURCE QUALITY CONTROL

- .1 Advise Contract Administrator of sources of topsoil mix and amendments to be utilized in preparing manufactured topsoil with sufficient lead-time for testing.
- .2 Contractor is responsible for amendments to supply topsoil mix as specified.
- .3 Soil testing by recognized testing facility for pH, N, P and K, electro-conductivity and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated or approved by the Contract Administrator.

- .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.
- .5 If soils are deemed deficient from testing, ensure that testing lab provides soil amendment recommendations.

Part 3 Execution

3.1 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify the Contract Administrator and do not commence work until instructed by the Contract Administrator.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.2 PLACING AND SPREADING OF TOPSOIL / PLANTING SOIL

- .1 Place topsoil after Contract Administrator has accepted sub-grade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm over approved, dry unfrozen subgrade, where sodding / seeding and planting is indicated.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil/planting soil as indicated on the drawings for shrub beds and tree pits, allowing for the following minimum depths after settlement:
 - .1 100mm for sodded and seeded areas.
 - .2 350mm for shrub beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.3 SOIL AMENDMENTS

- .1 For planting beds, sod and seeding, apply and thoroughly mix soil amendments into full specified depth of topsoil/planting soil at the applicable rates determined from soil testing.

3.4 APPLICATION OF FERTILIZER

- .1 Spread fertilizer over entire area of topsoil/planting soil at rate and ratio determined by soil testing.
- .2 Mix fertilizer thoroughly into upper 50 mm of topsoil mix.

3.5 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil mix to required bulk density using equipment approved by the Contract Administrator. Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

- .1 The Contract Administrator will review and test topsoil/planting soil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 SURPLUS MATERIAL

- .1 Dispose of materials not required off site as directed by the Contract Administrator.

3.8 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 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 32 91 19 – Topsoil and Finish Grading

1.2 SUBMITTALS

- .1 Samples.
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

1.3 QUALITY ASSURANCE

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Conduct a pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule sod laying to coincide with preparation of soil surface.
- .2 Schedule sod installation when frost is not present in ground.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Turf Grass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass, containing not less than three (3) named, dwarf varieties grown from certified seed.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than two (2) broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm. Remove clippings.
 - .4 Soil portion of sod: 9 to 15mm in thickness.

- .5 Sod grown on mineral soil base. Peat sod will NOT be accepted.
- .2 Sod establishment support:
 - .1 Wooden pegs: 17 x 8 x 200 mm or approved alternate.
- .3 Water:
 - .1 Free of impurities that would inhibit growth.
- .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Contract Administrator of sod quality at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from the Contract Administrator.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared complete with fertilizer, in accordance with Section 32 91 19 - Topsoil Placement and Grading. If discrepancies occur, notify the Contract Administrator and do not commence sodding work until instructed by the Contract Administrator.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessive heat, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20° C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements. Lay a full row of sod not less than 300mm in width along the perimeter of sodded areas and parallel to walkways.
- .3 Lightly roll sod as directed by the Contract Administrator in two directions to provide close contact between sod and soil. The use of heavy rollers to correct irregularities in grade is not permitted. Re-roll as directed by the Contract Administrator if necessary.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to the following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 3-6 pegs per square metre.
 - .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by the Contract Administrator.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform the following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 60 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother sodded or adjacent seeded areas as directed by the Contract Administrator.
- .4 Maintain sodded areas 95% weed free.
- .5 Fertilize areas in accordance with fertilizing program during establishment period. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.5 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by the Contract Administrator provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots and without weeds.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum of two (2) times prior to acceptance.
- .2 Areas sodded in fall will be accepted in the following spring one (1) month after start of growing season provided acceptance conditions are fulfilled.

3.6 MAINTENANCE FOLLOWING SODDING ACCEPTANCE

- .1 Perform maintenance operations of sod duration of one (1) month landscape maintenance period following Sodding Acceptance to the expiration of the maintenance period, as Specified in Section 32 93 11 - Landscape Maintenance.

3.7 WARRANTY

- .1 Provide a one (1) year warranty against deterioration, bare spots or damage from faulty materials or workmanship.

3.8 CLEANING

- .1 Upon completion of installation, remove 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, accessories, relocation of the existing trees as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 32 91 19 – Topsoil and 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 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit product data for:
 - .1 Fertilizer.
 - .2 Anti-desiccant.
 - .3 Guying assembly including collar, guying strap, and posts.
- .3 Submit samples for:
 - .1 Wood Mulch.
 - .2 Stone Mulch.
 - .3 Riprap.

1.5 SOURCE QUALITY CONTROL

- .1 Obtain approval of plant material at source.

- .2 Notify the 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 Imported plant material must be accompanied with necessary permits and import licences. Conform to federal and provincial regulations. Use local nurseries and farms wherever possible.
- .5 Source of plant material: grown in Zone 3a in accordance with Agriculture Canada Plant Hardiness Zone Map.

1.6 SHIPMENT AND PRE-PLANTING CARE

- .1 Coordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting.
- .2 Tie branches of trees and shrubs securely and protect plant material against abrasion, exposure and extreme temperature change during transit. Avoid binding of planting stock with rope or wire that would damage bark, break branches or destroy natural shape of plant. Give full support to rootball of large trees during lifting.
- .3 Cover plant foliage with tarpaulin and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage.
- .4 Remove broken and damaged roots with sharp pruning shears.

1.7 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 the 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 rootballs 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 burlapped and wire basket rootballs, place to protect branches from damage. Maintain moisture level in root zones.

1.8 SCHEDULING

- .1 Obtain approval of plant substitutions/species alternatives prior to ordering plant material.
- .2 Order plant material as soon as possible after award of contract to ensure plant availability. Plants should be ordered at least one (1) full growing season prior to anticipated planting date.
- .3 Obtain approval from the 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.

1.9 WARRANTY

- .1 The Contractor hereby warrants that plant material as itemized on plant list will remain free of defects in accordance with General Conditions, for twelve (12) months, after the date of Substantial Performance, providing adequate maintenance has been provided.
- .2 An end-of-warranty site review will be conducted by the Contract Administrator.
- .3 The Contract Administrator reserves the right to extend Contractor's warranty responsibilities for an additional one (1) year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

1.10 PLANT 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 Replace any plant material in the next planting season.
- .3 Extend warranty on replacement plant material for a period equal to the original warranty period.
- .4 Continue such replacement and warranty until plant material is accepted.
- .5 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 original Drawings and Specifications, and the replaced material shall carry an additional one (1) year guarantee. Should the replaced plant material not survive, the Contractor will be responsible to replace it a third time and guarantee it for one (1) year unless it is determined that unique site conditions or inadequate maintenance causes the death of plants.

Part 2 Products

2.1 PLANT MATERIAL

- .1 Quality and source: comply with Guide Specifications for Nursery Stock, latest edition of Canadian Nursery Trades Association referring to size and development of plant and rootball. Measure plant material and rootball. Measure plants when branches are in their natural position. Height and spread dimensions refer to main body of plant and not from branch tip to branch tip. Measure caliper for trees minimum 300 mm (12") above grade for trees 100 mm (4") caliper and larger and 150 mm (6") above grade for trees up to 100 mm (4") caliper.
- .2 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
 - .1 Source of plant material: grown in Zone 3a in accordance with Plant Hardiness Zones in Canada.
- .3 Balled and burlapped: coniferous and broad leaf evergreens over 500 mm (1'-8") tall and deciduous trees in excess of 3 m (10') height must have been dug with large firm ball. Rootballs must include 75% of fibrous and feeder root system. This excludes use of native trees grown in light sandy or rocky soil. Dig and lift rootball from hole, place in wire basket lined with burlap. Secure rootball with burlap and tie basket to rootball with heavy rope. Take care not to injure trunk of tree with wire basket ties or rope. For large trees wrap rootball in double layer of burlap and drum lace with minimum 10 mm (1/2") diameter rope. Protect rootball against sudden changes in temperature and exposure to heavy rainfall.
- .4 Tree spade dug material (tree mover): dig plant material with mechanized digging equipment of hydraulic spade or clam-shell type. Diameter of spade to suit rootball size and satisfy CNTA standards. Lift rootball from hole, transport to planting location and place into spade dug prepared planting hole with scarified bottom and sides.
- .5 Plant Material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .6 Plant species, cultivars and sizes as indicated on the drawings. Substitutions to plant material as indicated on planting plan are not permitted unless written approval has been obtained as to type, variety and size. Plant substitutions must be of similar species and of equal size as those originally specified.
- .7 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.
- .8 Refer to Plant Specification List on the Drawings for species, quantities, size and quality of plant materials.

2.2 PLANTING MIX

- .1 Topsoil/Planting Mix: as specified in Section 32 91 19 - Topsoil and Finish Grading.

2.3 WATER

- .1 Potable and free of impurities or minerals that may be detrimental to plant growth.

2.4 STAKES

- .1 T-bar steel stakes 40 x 40 x 5 mm length as required, primed with one (1) coat black approved primer.

2.5 GUYING

- .1 38mm wide fabric strapping tree ties: 'Arbor Tie' or approved equal.

2.6 TRUNK COLLAR

- .1 100 mm \emptyset corrugated HDPE drainage pipe, 600 mm height.

2.7 ANTI-DESICCANT

- .1 Wax-like emulsion.

2.8 MULCH

- .1 Provide samples of all mulches for approval by the Contract Administrator 14 days prior to installation.
- .2 Wood Mulch: Enviro-mulch, colour chocolate brown, available from Reimer Soils 204-237-6668, or approved equal.
- .3 Stone Mulch: clean round, river wash stone, 38 mm \emptyset , available from Reimer Soils 204-237-6668, or approved equal.

2.9 FERTILIZER

- .1 Organic 10-6-4 applied at rate of 40 to 50 g/mm caliper of tree. To be mixed thoroughly within top 75mm layer of planting soil and watered in well.

2.10 FILTER FABRIC

- .1 Filter fabric: non-woven polypropylene or polyester synthetic fibre fabric. Acceptable products: Propex 4553, Layfield LP 8, Mirafi 180N or approved equal.

Part 3 Execution

3.1 RELATED WORK

- .1 Obtain approval of tree preservation, clearing and grubbing, earthwork and related work, site grading, and tree and shrub protection completed by others under separate contract prior to commencing work in this section.

3.2 PRE-PLANTING PREPARATION

- .1 Ensure plant material is acceptable to the Contract Administrator.
- .2 Remove damaged roots and branches from plant material.

- .3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Preparation of planting beds is specified in Section 32 91 19 - Topsoil Placement and Grading. Layout plants in pots on beds for the Contract Administrator approval prior to installation.
- .2 For individual planting holes:
 - .1 Stake out location and obtain approval from the Contract Administrator prior to excavating planting holes.
 - .2 Excavate to depth and width as indicated.
 - .3 Remove rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
 - .4 Scarify sides of planting hole.
 - .5 Remove water that enters excavations prior to planting. Notify the Contract Administrator if water source is groundwater.

3.4 PLANTING

- .1 Plant only under conditions that are conducive to good health and safe physical conditions of plants.
- .2 Provide planting schedule. Extending planting operations over a long period using a limited crew will not be accepted.
- .3 Trees: excavate holes to depth and width to accommodate rootball and shown on Drawings.
- .4 For jute burlapped rootballs, cut away top one third of wrapping and wire basket without damaging rootball. Do not pull burlap or rope from under rootball.
- .5 For container stock or rootballs in non-degradable wrapping, remove entire container or wrapping without damaging rootball.
- .6 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.
- .7 For trees and shrubs:
 - .1 Backfill soil in 150 mm (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 into soil, backfill to finish grade.
 - .2 Form watering saucer as indicated on Drawings.
- .8 For groundcovers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .9 Water plant material thoroughly. Use deep root feeders for trees.
- .10 After soil settlement has occurred, fill with soil to finish grade.
- .11 Dispose of burlap, wire and container material off site.

3.5 TRUNK PROTECTION

- .1 Install trunk protection on deciduous trees as indicated.
- .2 Install trunk protection prior to installation of tree supports when used.

3.6 TREE SUPPORTS

- .1 Install tree supports as indicated on Drawings.
- .2 Use double stake tree support for deciduous trees.
 - .1 Place stake on prevailing wind side and 150 mm from rootball.
 - .2 Drive stake minimum 300 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.
 - .3 Install fabric tree support guying, 1500 mm above grade.
- .3 Use three (3) guying straps and anchors for coniferous trees.
 - .1 Install guying fabric straps above branches to prevent slipping at approximately two thirds height for evergreens and half height or 1500 mm for deciduous trees.
 - .2 Install guying straps and anchors at three equal intervals about coniferous trees and away from trunk so that guy wire will form approximately 45° angle with ground. Install anchor at angle to achieve maximum resistance for guying strap.
 - .3 Install guying straps ensuring that guys are secure and leave room for slight movement of tree. Attach guying straps to anchors.
 - .4 Install flagging tape to guys as indicated.
- .4 After tree supports have been installed prune as directed by the Contract Administrator. Pruning to be completed by a Certified Arborist.

3.7 MULCHING

- .1 Wood & Stone Mulch:
 - .1 Obtain approval of planting before mulching material is applied.
 - .2 Ensure soil settlement has been corrected prior to mulching with wood or stone mulch.
 - .3 Spread wood or stone mulch as indicated on Drawings.
 - .4 Loosen soil in planting beds and pits and remove debris and weeds. Spread wood or stone mulch to minimum thickness of 75 mm. Mulch material susceptible to blowing must be moistened and mixed with topsoil before applying. When mulch is placed in fall, place immediately after planting. When mulch is placed in spring, wait until soil has warmed up.
 - .5 Remove mulch pieces not meeting specified acceptable size range.

3.8 MAINTENANCE

- .1 Maintain plant material for a minimum period of 30 days after installation, including:
 - .1 Watering (minimum every second day).

- .2 Fertilizing.
- .3 Weeding.
- .4 Pruning.

3.9 ACCEPTANCE

- .1 Trees, shrubs and groundcovers will be reviewed after 30 day maintenance period is complete on the most recent areas of planting.
- .2 Planting areas completed earlier must be maintained until the time noted above.
- .3 A certificate of total performance for planting will be issued at the end of maintenance inspection and the completion of associated replacements / adjustments.
- .4 The date of certificate of total performance will mark the beginning of the one (1) year warranty period.
- .5 Trees, shrubs and ground covers will be inspected at the end of the warranty period:
 - .1 Trees will be accepted by the Contract Administrator provided that:
 - .1 Trees are showing vigorous new growth and no signs of disease or pests.
 - .2 Trees are straight and securely anchored.
 - .3 Crossing branches have been cleanly pruned.
 - .2 Shrubs and groundcovers will be accepted by the Contract Administrator provided that:
 - .1 Shrubs and groundcovers are showing vigorous well-rounded new growth.
 - .2 Shrubs and groundcovers are free of disease or pests.
 - .3 Shrubs and groundcovers show no signs of malnutrition or stress.
- .6 The Contractor shall replace trees, shrubs and groundcovers that do not meet the standards in 3.9.5 with new plant material as originally specified. All replacement plants shall be subject to a 30 day maintenance period and one (1) year warranty period from the date of replacement.

END OF SECTION

Part 1 – General

1.1 DESCRIPTION

- .1 This Specification shall cover the maintenance of seeded and sodded areas and all planting, which have been installed under this Contract. In general, work shall include:
 - .1 Spring cleaning
 - .2 Fertilizing
 - .3 Watering
 - .4 Mowing
 - .5 Weed control
 - .6 Pest and disease control
 - .7 Fall clean-up/Winter preparation

1.2 RELATED SECTIONS

- .1 Section 32 91 19 - Topsoil and Finish Grading
- .2 Section 32 92 23 - Sodding
- .3 Section 32 93 10 - Tree, Shrub and Groundcover Planting

1.3 MAINTENANCE PERIOD

1. Maintenance shall occur between the date of installation and up to a period of one (1) year from date landscaped areas are accepted to start warranty. The warranty period for plant materials will be coincidental to the maintenance period.
- .2 Provide maintenance up to the date of Certificate of Substantial Performance and as follows:
 - .1 Maintain sodded areas for a minimum period of thirty (30) days after completion of installation and until areas are fully established and accepted in accordance with Section 32 92 23 - Sodding.
 - .2 Maintain Tree and shrub plantings for a minimum period of thirty (30) days after completion of installation and until areas are fully established and accepted in accordance with Section 32 93 10 – Tree, Shrub and Ground Cover Planting.
 - .3 Continue maintenance after the date of Certificate of Substantial Performance until acceptance conditions are fulfilled to the satisfaction of the Contract Administrator.

1.4 SCHEDULING AND MONITORING

- .1 Monitor the site and advise Contract Administrator of conditions which might void the Contractor's warranty responsibilities.
- .2 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 the Contract Administrator.

1.5 WATER SUPPLY

- .1 Supply of water suitable for irrigation/plant establishment.

Part 2 – Products

2.1 MATERIALS

- .1 Materials to conform to the requirements of related Specification sections.

2.2 EQUIPMENT

- .1 Provide all equipment to properly execute work and maintain such equipment in a workable, safe condition during use of this project.
- .2 Obtain approval by the Contract Administrator of equipment to be used to execute work.
- .3 Use only approved equipment.

Part 3 – Execution

3.1 EXECUTION

- .1 Program timing of operations to growth, weather conditions and use of site.
- .2 Do each operation continuously and complete within reasonable time period.
- .3 Store equipment and materials off site.
- .4 Collect and dispose of debris or excess material on daily basis.

3.2 SPRING CLEANING

- .1 Lawns:
 - .1 Rake lawn areas and remove dead vegetation, leaves and debris. Do heavy raking with flexible grass rake on areas with "snow mould".
 - .2 Roll lightly areas where grass plants have lifted due to frost action.
- .2 Planting Beds:
 - .1 Clean shrub beds and planters of debris and dead plant material.
 - .2 Trim grass edges around planting beds neatly in lines as in original layout.

3.3 FERTILIZING

- .1 Spread fertilizer evenly at frequency, ratio and rates as recommended by soil test analysis. Use approved mechanical spreading equipment. Check calibration to ensure specified rate is spread evenly. Water immediately after fertilizing. Rectify uneven spreading as soon as it becomes apparent.

3.4 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 Seeded and Sodded Areas:
 - .1 During establishment period, water as required to maintain moisture penetration of 150 mm. In general, water daily for first week and three (3) times per week for next six (6) weeks. Adjust to suit climatic conditions.
 - .2 Thereafter, water as required to replenish available moisture to a depth of 150 mm (approximately 25 mm precipitation per week).
 - .3 Ensure minimum moisture penetration of 150 mm for each application.
- .3 Trees in Lawns and Tree Wells:
 - .1 Water every other day for first month.
 - .2 Apply 9 gal. (40 litres) of water per 25 mm calliper per application using deep root feeder.
- .4 Apply water in soft spray to avoid packing of soil or damaging plant material or seeded/sodded areas. Move sprinklers or adjust irrigation system as required to avoid running of water and return to those areas until moisture penetration has been reached. Do not impede use of sidewalk and other paved areas.

3.5 MOWING OF LAWN AREAS

- .1 Mow at regular intervals to maintain grass to a height of 60 mm. Cut grass before it reaches 75 mm height. Do not remove grass clippings from lawn unless volume is such as to be harmful to lawn or unsightly. Hand trim or use edger for grass adjacent to buildings, pavement, trees and fences. Trim grass edges around planting beds neatly in lines as in original layout.
- .2 Lawn cutting operations include picking up and disposal of paper and other refuse accumulated on landscaped areas prior to mowing.

3.6 WEED CONTROL

- .1 Maintain site free of weeds. Do not allow weeds to establish for a period longer than two (2) weeks.
- .2 Apply herbicide when it will not cause damage to new grass or other plants. Avoid use of dicamba and picloram solutions near trees and shrubs.

3.7 PEST AND DISEASE CONTROL

- .1 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.

3.8 WINTER PREPARATION

- .1 Rake and assemble leaves after they have been shed by trees and shrubs. Remove from site.
- .2 Ensure adequate moisture in root zones of plant material prior to freeze-up.

3.9 FINAL ACCEPTANCE

1. The Contract Administrator, The City and Contractor will conduct a plant warranty 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 Sodded areas are established to the requirements of Section 32 92 23 - Sodding.
 - .2 Trees, shrubs and ground covers are showing growth and vigour satisfactory to the Contract Administrator and to the standards specified in Section 32 93 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 33.01 – Excavating, Trenching and Backfilling
- .2 Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM) – Latest Editions.
 - .1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.
 - .2 ASTM C117, Standard Test Method for Materials Finer than 75- μm (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).
- .7 Canadian General Standards Board (CGSB) – Latest Editions.
 - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .8 Canadian Standards Association (CSA International) – Latest Editions.
 - .1 CAN/CSA-A23.1/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).
 - .3 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .4 CSA-A3002-03, Masonry and Mortar Cement.
- .9 City of Winnipeg Standard Construction Standard Specifications (CW), latest editions.
 - .1 CW 2130 – Gravity Sewers
 - .2 CW 2140 – Sewer and Manhole Cleaning
 - .3 CW 2160 – Concrete Underground Structures and Works
 - .4 List of Approved Products for Underground Use in the City of Winnipeg.

1.3 LAYOUT OF WORK

- .1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for

the careful preservation of all stakes and marks so set whether relating to his own or to other work.

Part 2 Products

2.1 MATERIALS

- .1 Precast concrete sections: to CSA A257.4 and ASTM Standard C 76 Class II and C 478 (circular sections).
 - .1 Manholes shall be standard pre-cast concrete 1200mm diameter base and riser sections with flexible plastic gaskets between sections followed by a 1200mm x 750mm flat reducer on top.
- .2 Internal joints shall be made watertight using preformed bituminous gaskets or flexible rubber joint sealant.
- .3 Ladder rungs: in accordance with CW 2130 – Gravity Sewers and List of Approved Products for Underground Use in the City of Winnipeg
- .4 Adjusting rings: to CAN/CSA A257.4 and ASTM C478M.
- .5 Cast iron frame and covers for manholes: in accordance with CW 2130 – Gravity Sewers and List of Approved Products for Underground Use in the City of Winnipeg.
- .6 Cast-in-place concrete, grout, mortar, and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.
- .7 Granular bedding and backfill in accordance with Section 31 23 33.01 – Excavation, Trenching and Backfilling.

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 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Obtain approval of Contract Administrator before installing manholes.

3.3 INSTALLATION

- .1 Construct manholes in accordance with CW 2130 – Gravity Sewers, and details shown on the Drawings, plumb and true to alignment and grade.

- .2 Place bedding and foundation material in bottom of trench or excavation in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
 - .1 Bedding for manholes shall consist of 100 mm minimum thickness of sand or Type 2 or 3 material.
 - .2 Foundation material for trenchless installation shafts shall consist of 150 mm minimum thickness of Type 3 material placed below bedding material of manhole.
 - .3 Level bedding across full width of trench or excavation and leave ready for pipe installation.
 - .4 Level bedding to ensure manhole base is uniformly supported and the floor is level.
- .3 Install approved gasket or joint sealer between pre-cast concrete sections including 750-millimetre diameter riser adjusting rings and between frame and pre-cast concrete riser as construction progresses.
- .4 Complete units as pipe laying progresses. Connect sewers to manhole bases at invert elevations shown on the Drawings and grout in place to make a watertight connection. Coat outside of PVC pipe ends for a length equal to the manhole wall thickness plus 150 millimetres with an approved cementing agent to which sand has been added and allow mixture to harden before grouting in place. Alternatively, PVC pipe may be connected using an approved pre-treated, gasketed PVC insert or an approved interference fit flexible rubber boot or gasket inserted into a hole cored in the manhole base.
- .5 Bench and channel manhole floor with mortar or concrete. Curve flow channels smoothly and provide smooth transition between inlet and outlet pipes.
- .6 Grout and plug lifting holes, joints, and frame to make watertight. Remove excess mortar from inside surface of manhole.
- .7 Set frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
- .8 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.

3.4 CLEANING

- .1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning
- .2 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 SECTION INCLUDES

- .1 Materials and installation for gravity sanitary sewers.

1.2 RELATED SECTIONS

- .1 Section 31 23 33.01 – Excavating, Trenching and Backfilling

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM), Latest Editions
 - .1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³)).
 - .2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .3 ASTM D3350], Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .2 Canadian Standards Association (CSA International) – Latest Editions
 - .1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .2 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).
 - .3 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .3 City of Winnipeg Standard Construction Standard Specifications (CW), Latest Editions.
 - .1 CW 2130 – Gravity Sewers
 - .2 CW 2140 – Sewer and Manhole Cleaning
 - .3 CW 2145 – Sewer and Manhole Inspection.
 - .4 CW 2160 – Concrete Underground Structures and Works
 - .5 List of Approved Products for Underground Use in the City of Winnipeg.

1.4 DEFINITIONS

- .1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.5 LAYOUT OF WORK

- .1 The Contract or shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contract or shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with Municipal regulations.
- .4 Dispose of unused asbestos cement pipe in accordance with regulations governing disposal of hazardous materials.

1.7 SCHEDULING

- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
- .2 Coordinate site sanitary sewer installation with Mechanical and Electrical Sub-Contractor's utility installations.
- .3 Submit schedule of expected interruptions to Contract Administrator and Municipal authority for approval and adhere to approved schedule.
- .4 Notify Contract Administrator, affected residents, businesses and facilities, 72 hours minimum in advance of any interruption in service.

Part 2 Products

2.1 PLASTIC PIPE

- .1 Polyvinyl Chloride Pipe (PVC): SDR 35 in accordance with CAN/CSA B182.2, ASTM D3034, and CW 2130 – Gravity Sewers, and List of Approved Products for Underground Use in the City of Winnipeg.
- .2 Pipe joints shall be bell and spigot push on type with rubber gaskets in accordance with ASTM F477

2.2 FITTINGS

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35, and CW 2130 – Gravity Sewers, and List of Approved Products for Underground Use in the City of Winnipeg.

2.3 CAST-IN-PLACE CONCRETE AND GROUT

- .1 Cast-in-place concrete, grout, mortar, and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

2.4 PIPE BEDDING AND BACKFILL MATERIALS

- .1 Bedding and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

- .1 Prior to commencement of sewer installation, expose and confirm locations and invert elevations of existing water mains, sewers, and other utilities at proposed pipe connection or crossing locations to determine if there will be a conflict with the proposed sewer. The Contract Administrator will modify proposed sewer alignment and design grades as required if there is a conflict.
- .2 The Contractor shall maintain service to affected residents, businesses, and facilities throughout construction. At no time shall raw sewage be allowed to discharge into any trenches. Bypass pumping will be required to divert sewer flows to permit continuity of sanitary sewer service.
- .3 Obtain Contract Administrator approval of pipes and fittings prior to installation.

3.2 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.

3.3 BEDDING

- .1 Place and compact sand bedding material in the bottom of the excavation in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.
- .2 Level across full width of excavation and leave ready for pipe installation.
- .3 Do not place material in frozen condition.

3.4 INSTALLATION

- .1 Lay and join pipes to: CW 2130 – Gravity Sewers.
- .2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Contract Administrator
- .3 Handle pipe using methods approved by Contract Administrator.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 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.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.

- .7 Do not allow water to flow through pipe during construction, except as may be permitted by Contract Administrator.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
- .10 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.
- .11 Make watertight connections to manholes, in accordance with Section 33 05 13 – Manholes and Catch Basin Structures
- .12 Use prefabricated saddles or field connections approved by Contract Administrator for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.5 BUILDING SERVICE CONNECTIONS

- .1 Install building sewer service as per details on the Drawings. Coordinate with Mechanical Drawings and Mechanical Contract or
- .2 Connection to existing sewer shall be done in accordance with CW 2130 – Gravity Sewers.

3.6 BACKFILL

- .1 Backfill trenches in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.

3.7 CLEANING

- .1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.8 SEWER AND MANHOLE INSPECTION

- .1 Conduct video inspections of all new sewers and manholes for the purposes of assessing thoroughness of cleaning, observing, and recording structural and service defects and construction features and to verify new sewer construction prior to acceptance.
- .2 Video inspection shall be done in accordance with CW 2145 – Sewer and Manhole Inspection. Existing sewers shall be televised from the nearest manhole to a minimum of 2 metres past the new connection.

3.9 SURFACE RESTORATION

- .1 After installing and backfilling over sewer mains, restore surface to original condition as directed by Contract Administrator.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for storm sewer.

1.2 RELATED SECTIONS

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 33 05 13 – Manholes and Catch Basin Structures

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM) – Latest Editions
 - .1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³).
 - .2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .3 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - .4 ASTM A536 grade 70-50-05, Standard Specification for Ductile Iron Castings
- .2 American Society OF State Highway and Transportation Officials (AASHTO) – Latest Editions
 - .1 AASHTO M 252, Standard Specification for Corrugated Polyethylene Drainage Pipe
- .3 Canadian Standards Association (CSA International) – Latest Editions
 - .1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .2 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).
 - .3 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .4 City of Winnipeg Standard Construction Standard Specifications (CW) – Latest Editions
 - .1 CW 2130 – Gravity Sewers
 - .2 CW 2140 – Sewer and Manhole Cleaning
 - .3 CW 2145 – Sewer and Manhole Inspection.
 - .4 CW 2160 – Concrete Underground Structures and Works
 - .5 CW 3120 – Installation of Subdrains

1.4 QUALITY ASSURANCE

- .1 The Contractor shall, at his expense, perform deflection testing and video inspection of all installed storm sewers in accordance with CW 2130 – Gravity Sewers and CW 2145 – Sewer and Manhole Inspection, under the direct supervision of the Contract Administrator.

1.5 LAYOUT OF WORK

- .1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management and Disposal Plan.
- .2 Place materials defined as hazardous or toxic in designated containers.

1.7 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services and maintain existing land drainage flows during construction.
- .2 Coordinate storm sewer installation with Mechanical and Electrical Sub-Contractor's utility installations.
- .3 Submit schedule of expected interruptions to City of Winnipeg for approval and adhere to interruption schedule as approved by Contract Administrator.
- .4 Notify City of Winnipeg, Contract Administrator and neighbouring businesses, a minimum of 48 hours in advance of interruption in service.
- .5 Advise local police department of anticipated interference with movement of traffic.

Part 2 PRODUCTS

2.1 PIPE

- .1 Polyvinyl Chloride Pipe (PVC): SDR 35 in accordance with CAN/CSA B182.2, and ASTM D1784 and Approved Products for Underground Use in the City of Winnipeg.
- .2 Polyvinyl Chloride (PVC) Profile Sewer Main Piping in accordance with CAN/CSA B182.2 and ASTM D1784 and Approved Products for Underground Use in the City of Winnipeg.
- .3 Pipe joints shall be bell and spigot push on type with rubber gaskets in accordance with ASTM F477.

2.2 FITTINGS

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, and Approved Products for Underground Use in the City of Winnipeg.

2.3 LANDSCAPE DRAINS

- .1 Landscape Drains shall be PVC in accordance ASTM D3034, with base diameters and heights as shown on the Drawings.
- .2 Drain basin covers shall be ductile iron in accordance with ASTM A536, with cover types as shown on the Drawings. Cover shall be made specifically to fit each drain basin diameter and be capable of supporting H-10 loading for pedestrian traffic.
- .3 PVC drain basin structures and covers shall be manufactured by Nyoplast, a division of Advanced Drainage Systems Inc.

2.4 CAST-IN-PLACE CONCRETE AND GROUT

- .1 Cast-in-place concrete, grout, mortar, and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

2.5 BEDDING AND BACKFILL MATERIAL

- .1 Bedding and backfill in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavation, Trenching and Backfill

3.2 BEDDING

- .1 Place and compact sand bedding material in the bottom of the excavation in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.
- .2 Level across full width of excavation and leave ready for pipe installation.
- .3 Do not place material in frozen condition.

3.3 PIPE INSTALLATION

- .1 Pipe Installation in a trench or using trenchless methods: to CW 2130 – Gravity Sewers
- .2 Handle and join pipes to manufacturer's standard instructions and specifications. Lay pipe with bell upgrade.

- .3 Make watertight connections to manholes and catch basins, in accordance with Section 33 05 13 – Manholes and Catch Basin Structures
- .4 Backfill remainder of trench in accordance with Section 31 23 10 – Excavation, Trenching and Backfill.

3.4 SERVICE CONNECTIONS

- .1 Connection to existing sewer shall be done in accordance with CW 2130 – Gravity Sewers.
- .2 Expose existing water mains, sewers, and other utilities at proposed connection or crossing locations as directed by the Contract Administrator, far enough in advance of sewer installation to allow existing inverts to be determined. The Contract Administrator will modify design grades as required if there is a conflict.

3.5 CLEANING

- .1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

3.6 SEWER INSPECTION

- .1 Conduct video inspections of all new sewers, manholes, catch basins, and drain basins for the purposes of assessing thoroughness of cleaning, observing, and recording structural and service defects and construction features and to verify new sewer construction prior to acceptance.
- .2 Video inspection shall be done in accordance with CW 2145 – Sewer and Manhole Inspection.
- .3 Existing sewers shall be televised from the nearest manhole to a minimum of 2 metres past the new connection.

3.7 SURFACE RESTORATION

- .1 After installing and backfilling over storm sewer mains, restore surface to original condition as directed by Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Building perimeter and under-slab drainage systems.

1.2 RELATED REQUIREMENTS

- .1 Section 07 16 16- Crystalline Waterproofing
- .2 Section 31 23 33.01 - Excavation, Trenching and Backfilling: Excavating and backfilling for subdrainage system piping, and surrounding filter aggregate.

1.3 REFERENCE STANDARDS

- .1 ASTM F667/F667M - Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings; 2016 (Reapproved 2021).

1.4 SUBMITTALS

- .1 See Section 01 33 00 - Submittal Procedures.
- .2 Product data: Provide data on pipe drainage products, pipe accessories.

Part 2 Products

2.1 PIPE MATERIALS

- .1 Corrugated HDPE tubing: ASTM F667/F667M flexible type; diameters indicated, perforated and with geotextile filter sock, and required fittings.
 - .1 Basis-of-Design Products:
 - .1 Armtec; Big O with filter sock.
 - .2 Prinsco; Goldline with wrap.
 - .3 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
 - .2 Use perforated pipe at subdrainage system; unperforated through sleeved walls, and where indicated.

2.2 AGGREGATE AND BEDDING

- .1 Bedding material: Granular fill as specified in Section 31 23 33.01.

2.3 ACCESSORIES

- .1 Pipe couplings, clean-outs: Solid plastic.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that trench cut 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. 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.

3.3 INSTALLATION

- .1 Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- .2 Place drainage pipe on prepared gravel bedding.
- .3 Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 3 mm in 3 m.
- .4 Place pipe with perforations facing down. Mechanically join pipe ends.
- .5 Install pipe couplings.
- .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 33.01 for compaction requirements. Do not displace or damage pipe when compacting.
- .9 Connect to sump pits with unperforated pipe, through installed sleeves.

3.4 SITE QUALITY CONTROL

- .1 Request inspection prior to and immediately after placing aggregate cover over pipe.

3.5 PROTECTION

- .1 Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION