NIAGARA FALLS TRAIN STATION UPGRADES
NIAGARA FALLS, ON

SPECIFICATIONS – ISSUED FOR BID/TENDER

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NIAGARA REGION

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Contents

DIVISION 02 - EXISTING CONDITIONS

DIVISION 04 - MASONRY

DIVISION 05 - METALS

DIVISION 06 - WOOD, COMPOSITES AND PLASTICS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

DIVISION 08 - OPENINGS

DIVISION 09 - FINISHES

DIVISION 10 - SPECIALTIES

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING

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

DIVISION 25 - INTEGRATED AUTOMATION

DIVISION 26 - ELECTRICAL

Part 1 General

1.1 LIST OF DRAWINGS

.1 List of Drawings

.1

DRAWING NO.	DESCRIPTION
A0050	BUILDING INFORMATION
A0100	NOTES ABBREVIATIONS LEGENDS
A0200	LIFE SAFETY PLANS
A0300	BUILDING CODE SEPARATION PLANS
A1000	SITE PLAN
A1100	EXISTING - FLOOR PLANS
A1200	DEMOLITION - FLOOR PLANS
A1201	DEMOLITION - RCP
A1202	DEMOLITION - BUILDING SECTIONS
A1300	GROUND FLOOR PLAN
A1301	SECOND FLOOR PLAN
A1302	ROOF PLAN
A1400	RCP GROUND FLOOR PLAN
A1401	RCP SECOND FLOOR PLAN
A1600	ENLARGED PLAN - GROUND FLOOR
A1601	ENLARGED PLAN - GROUND FLOOR 2
A1602	ENLARGED PLAN - SECOND FLOOR 2
A1602-A	ENLARGED PLAN 0 SECOND FLOOR 2
A1603	ENLARGEDPLAN - WASHROOMS
A1604	STAIR 2- PLAN & SECTION 1
A1610	FLOOR FINISHES PLANS
A2000	ELEVATIONS NORTH SOUTH
A2001	ELEVATIONS EAST WEST
A2100	INTERIOR ELEVATIONS 1
A2101	INTERIOR ELEVATIONS 2
A2102	INTERIOR ELEVATIONS 3
A2103	INTERIOR ELEVATIONS 4
A2104	INTERIOR ELEVATIONS 5

A2105	INTERIOR ELEVATIONS 6
A2106	INTERIOR ELEVATIONS 7
A2107	INTERIOR ELEVATIONS 8
A2108	INTERIOR ELEVATIONS 9
A3000	BUILDING SECTION 1
A3001	BUILDING SECTION 2
A4000	WALL SECTIONS 1
A4001	WALL SECTIONS 2
A4002	WALL SECTIONS 3
A5000	SECTION DETAILS 1
A5001	SECTION DETAILS 2
A5002	SECTION DETAILS 3
A5003	SECTION DETAILS 4
A5004	PLAN DETAILS
A6000	DOOR AND ROOM SCHEDULES
A6001	GLAZING SCHEDULE
A9000	3D VIEWS
M0001	MECHANICAL LEGENDS & NOTES
M0002	GENERAL MECHANICAL & HVAC NOTES
M0003	PLUMBING DEMOLTION PLANS
M0004	HVAC DEMOLITION PLANS
M0005	DRAINAGE PLANS
M0006	PLUMBING PLANS
M0007	HEATING PIPING PLANS
M0008	HVAC PIPING PLANS
M0009	VENTILATION PLANS
M0010	MECHANICAL DETAILS
M0011	MECHANICAL DETAILS
M0012	MECHANICAL DETAILS
M0013	MECHANICAL SCHEDULES
M0014	MECHANICAL SCHEDULES
M0015	MECHANICAL SCHEDULES
E0001	ELECTRICAL LEGENDS & GENERAL NOTES

E0002	ELECTRICAL DEMOLITION PLANS
E0003	LIGHTING DEMOLITIONPLANS
E0004	LIGHTING FIRST FLOOR PLAN - NEW
E0005	LIGHTING SECOND FLOOR PLAN - NEW
E0006	FIRE ALARM PLANS - NEW
E0007	POWER & DATA FIRST FLOOR PLAN - NEW
E0008	POWER & DATA SECOND FLOOR PLAN - NEW
E0009	SINGLE LINE DIAGRAM - NEW
E0010	UNIVERSAL WASHROOM DETAILS
E0011	PANEL SCHEDULES - NEW

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Documents and terminology.

.2 Associated requirements.

.3 Work expectations.

.4 Occupancy and premises usage.

1.2 RELATED REQUIREMENTS

.1 Section 01 21 00 - Allowances.

.2 Section 01 78 00 - Closeout Submittals.

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

.4 The requirements of Division 01, General Requirements, apply to and govern all aspects of the Work.

.5 Work described in this Specification is divided into Sections that are not intended to identify trade scopes of Work or contractual relationships or boundaries.

.6 The Contractor is solely responsible for organizing the division of labour and the supply of Products and services essential for the detailed coordination and execution of the Work in accordance with the Contract Documents.

1.3 RELATED DOCUMENTS

.1 Section 00 52 00 - Agreement Forms.

.2 Section 00 71 00 - Contracting Definitions.

.3 Section 00 73 00 - Supplementary Conditions.

.4 All other Division 01 specification sections.

.5 Division 01 sections describe requirements applicable to all Sections within Divisions 02 to 49 inclusive.

1.4 WORDS AND TERMS

.1 Refer to and acknowledge other words, terms, and definitions in CCDC 2 Definitions. Additional words and terms are cited in Section 00 71 00.

1.5 COMPLEMENTARY DOCUMENTS

.1 Drawings, specifications, and schedules are complementary each to the other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents that leave doubt as to the intent or meaning, abide by priority of documents established in the General Conditions or obtain direction from the Consultant.

.2 Drawings indicate general location and route of building services. Install building services not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.

.3 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 attention of Consultant.

1.6 DESCRIPTION OF THE WORK

.1 Work of this Contract comprises selective demolition of interiors, general construction and renovation of Niagara Falls Train Station, located at 4267 Bridge St, Niagara Falls, Ontario L2E 2R6; and identified as Niagara Falls Train Station.

.2 Division of the Work among Subcontractors, suppliers/vendors and other contractors is solely the Contractor's responsibility. Neither the Owner nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

.3 Designated Substances and PCBs Survey Report:

.1 Refer to the Designated Substances and PCBs Survey Report appended to the Contract Documents as Appendix A and as indicated in Sections 02 81 00 and prepare the Site for safe construction operations prior to engaging in other Work, as required by governing legislation.

.2 Safely remove and dispose of designated substances and hazardous materials as required, in accordance with governing legislation, and the requirements of authorities having jurisdiction. Should concealed or unknown conditions be found to vary from those identified in the Designated Substances and PCBs Survey Report, notify Niagara Region immediately.

.4 Existing Site Conditions

.1 Verify Site conditions as they relate to the execution of the Work.

.2 Submit a written report to Region detailing inconsistencies between Site conditions and Contract Documents no later than ten (10) Business Days after completing the investigations.

.3 Canada Border Services Agency (CBSA) occupies the west wing of the building. No disruption of services will be allowed to the CBSA at anytime during project.

.5 Provisional Items:

PROVISIONAL ITEM#1
The removal & installations of new concrete/brick walkways shall be priced as a provisional cost item (Base Bid – existing walkways to remain).

PROVISIONAL ITEM#2
The supply & installation of indicated re-pointing of existing brick shall be priced as a provisional cost item (Base Bid – existing brick to remain in current condition).

PROVISIONAL ITEM#3
The supply & installation of indicated painting/repairs of existing soffits, fascia, lookouts & trims shall be priced as a provisional cost item (Base Bid – existing soffits, fascia, lookouts & trims to remain in current condition).

PROVISIONAL ITEM#4
The supply & installation of conc.sealer & epoxy floor shall be priced as a provisional cost item (Base Bid – existing room conditions to remain current condition).

PROVISIONAL ITEM#5
The supply & installations of the custom millwork charge stations shall be priced as a provisional cost item (Base Bid – show allow for the columns to be finished as per wall type W6 and painted).

1.7 CONTRACT METHOD

.1 Construct Work under single, stipulated price contract.

.2 Relations and responsibilities are between the Contractor and the Owner.

.3 Provide the required bonds and liability insurance to ensure such specified assurances to the Owner.

.4 Assigned Subcontractors are required to provide requested bonds covering faithful performance of subcontracted work, to the Owner plus payment of related obligations.

.5 Refer to Section 01 21 00 for cash allowance amounts applicable to assignable contracts.

.6 Assume responsibility for assigned contracts as Subcontracts forming part of the Work.

.7 Contract Documents were prepared by the Consultant for the Owner. 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 Consultant accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions based on the Contract Documents.

.8 For purposes of reference in these Contract Documents, the term "Contractor" shall mean the party in contract with the Owner.

1.8 DOCUMENTS PROVIDED

.1 Owner will supply the Contractor with:

.1 Electronic documents, in electronically delivered Adobe PDF formats.

.2 An electronic set of documents will be provided near the end of the Project for purposes of transferring changed information recorded on as-built documents to the electronic Record Documents.

1.9 PERFORMANCE OF THE WORK

.1 Substantial Performance shall be as noted in Niagara Region RFT Appendix B - Deliverables.

1.10 READY-FOR-TAKEOVER

.1 Ready-for-Takeover shall be as noted in Niagara Region RFT Appendix B - Deliverables.

.2 Perform all prerequisite activities identified in the General Conditions, including a list of incomplete items, before applying for Ready-for-Takeover.

1.11 WORK SEQUENCE

.1 Construct Work in to accommodate Owner's usage requirements during the construction period, coordinate construction schedule and operations with Consultant.

.2 Construct Work in stages during the construction period, coordinate construction schedule and operations with Consultant.

.1 Stage 1: Hazmat abatement.

.1 Maintain station operation throughout the period of work.

.2 Stage 2: Construct new washroom and 2nd floor renovation.

.3 Stage 3: Demolish existing washroom.

.4 Stage 4: All remainder works.

.3 Coordinate Progress Schedule and with Owner use during construction.

.4 Maintain fire access and control of fire protection equipment.

1.12 CONTRACTOR USE OF PREMISES

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

.2 Limit use of site and premises to allow:

.1 Owner and public occupancy.

.2 Use of site and premises by the public.

.3 Canadian Border Services Agency (CBSA) occupies the west wing of the building. Access is restricted in the area.

.3 Construction Operations: Limited to areas noted on Drawings.

.4 Time Restrictions for Performing Interior Work: 7:00am - 5:00pm.

.5 Utility Outages and Shutdown: to VIA Rail timetable and CBSA work hours. Shutdowns require approvals by Region Project Manager.

1.13 OWNER OCCUPANCY

.1 Owner and their tenants will occupy premises during entire construction period for execution of normal operations.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

.3 Maintain fire and life safety systems and public access to exits during all stages of the Work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Connecting to existing services.

.2 Special scheduling requirements.

1.2 RELATED REQUIREMENTS

.1 Section 01 56 00 - Temporary Barriers and Enclosures.

.2 Section 01 33 00 - Submittal Procedures.

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

1.3 EXISTING SERVICES

.1 Notify Niagara Region and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Niagara Region, forty-eight (48) hours of notice for necessary interruption of mechanical or electrical service throughout course of work.

.1 Keep duration of interruptions to a minimum.

.2 Perform interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for pedestrian traffic.

.4 Construct barriers in accordance with Section 01 56 00.

1.4 SPECIAL REQUIREMENTS

.1 Perform painting at Owner-occupied areas:

.1 From Monday to Friday from 18:00 to 07:00 hours only.

.2 On Saturdays, Sundays, and statutory holidays to Owner approval.

.2 Perform noise generating work:

.1 From Monday to Friday from 18:00 to 07:00 hours.

.2 On Saturdays, Sundays, and statutory holidays to Owner approval.

.3 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.

.4 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.5 Keep within limits of work and avenues of ingress and egress.

.6 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Owner.

1.5 SECURITY

.1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

.2 Security clearances:

.1 Personnel employed on this project may be subject to security check. Obtain clearance, as instructed, for each individual who will require to enter premises.

.2 Obtain requisite clearance, as instructed, for each individual required to enter premises.

.3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

.4 Contractor's personnel will require satisfactory RCMP initiated security screening in order to complete Work in premises and on site.

1.6 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.2 CASH ALLOWANCES

.1 Refer to CCDC 2.

.2 Include in Contract Price specified cash allowances.

.3 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing Work.

.4 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.

.5 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.

.6 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.7 Include progress payments on accounts of work authorized under cash allowances in Niagara Region's monthly certificate for payment.

.8 Prepare schedule jointly with Niagara Region and Contractor to show when items called for under cash allowances must be authorized by Niagara Region for ordering purposes so that progress of Work will not be delayed.

.9 Cash Allowance to be carried by General Contractor:

.1 Include $45,000 for Card Access & Security Upgrades.

.2 Include $15,000 for Wayfinding Upgrades.

.3 Include $15,000 for Testing & Inspections.

.4 Include $15,000 allowance for Door Hardware Upgrades.

1.3 CONTINGENCY ALLOWANCE

.1 Do not include in Contract Price, additional contingency allowances for products, installation, overhead or profit.

.2 Expenditures under contingency allowance will be authorized in accordance with procedures provided in CCDC 2, GC 6.1 - Changes CCDC 2, 6.2 Change Order and CCDC 2, 6.3 Change Directive.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Owner/Contractor Agreement.

.2 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.2 DEFINITIONS

.1 Provisional Item; means work or a portion of work Niagara Region may wish to have performed but which may be removed, at no additional cost to Niagara Region from the scope of the Work at any time. Where such item is removed, Niagara Region will deduct the relevant Provisional Price from the Base Bid Price after the award of the Contract.

1.3 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Make applications for payment on account as provided in Agreement as Work progresses.

.3 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.4 Submit to Niagara Region, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

1.4 SCHEDULE OF VALUES

.1 Refer to CCDC 2.

.2 Provide schedule of values supported by evidence as Niagara Region may reasonably direct and when accepted by Niagara Region, be used as basis for applications for payment.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Niagara Region may reasonably require to establish value and delivery of products.

.5 Include Stipulated Price Schedule of Value for each provisional items.

1.5 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS

.1 Submit separate schedule of unit price items of Work requested in Bid form.

.2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:

.1 Cost of material.

.2 Delivery and unloading at site.

.3 Sales taxes.

.4 Installation, overhead and profit.

.3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.6 PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Niagara Region will issue to Owner, no later than 15 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Niagara Region determines to be due. If Niagara Region amends application, Niagara Region will give notification in writing giving reasons for amendment.

1.7 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 Prepare and submit to Niagara Region comprehensive list of items to be completed or corrected and apply for a review by Niagara Region to establish Substantial Performance of Work or substantial performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Owner agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.

.3 No later than 15 days after receipt of list and application, Niagara Region will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.4 Niagara Region: state date of Substantial Performance of Work or designated portion of Work in certificate.

.5 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Niagara Region, establish reasonable date for finishing Work.

1.8 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 After issuance of certificate of Substantial Performance of Work:

.1 Submit application for payment of holdback amount.

.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.3 After receipt of application for payment and sworn statement, Niagara Region will issue certificate for payment of holdback amount.

.4 Where holdback amount has not been placed in a separate holdback account, Owner will, 15 days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.

.5 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.9 PROGRESSIVE RELEASE OF HOLDBACK

.1 Refer to CCDC 2.

.2 Where legislation permits, if Niagara Region has certified that Work of subcontractor or supplier has been performed prior to Substantial Performance of Work, Owner will pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

.3 In addition to provisions of preceding paragraph, and certificate wording, ensure that such subcontract Work or products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.10 FINAL PAYMENT

.1 Refer to CCDC 2.

.2 Submit application for final payment when Work is completed.

.3 Niagara Region will, no later than 15 days after receipt of application for final payment, review Work to verify validity of application. Niagara Regionwill give notification that application is valid or give reasons why it is not valid, no later than 10 days after reviewing Work.

.4 Niagara Region will issue final certificate for payment when application for final payment is found valid.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Coordination Work with other contractors and work by Owner under administration of Niagara Region.

.2 Pre-installation and scheduled progress meetings.

1.2 RELATED REQUIREMENTS

.1 Section 01 32 00 - Construction Progress Documentation.

.2 Section 01 33 00 - Submittal Procedures.

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

1.3 COORDINATION

.1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities and construction Work, with progress of Work of by Owner, and other contractors, under instructions of Niagara Region.

1.4 PROJECT MEETINGS

.1 Schedule and administer weekly project meetings throughout progress of Work as determined by Niagara Region.

.2 Schedule and administer pre-installation meetings when specified in sections and when required to coordinate related or affected Work.

.3 Prepare agenda for meetings.

.4 Distribute written notice of each meeting four (4) days in advance of meeting date to Niagara Region.

.5 Provide physical space and make arrangements for meetings.

.6 Preside at meetings.

.7 Record minutes. Include significant proceedings and decisions. Identify action by parties.

.8 Reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants, affected parties not in attendance, and Niagara Region.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

.1 Within fifteen (15) days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of the Niagara Region, Contractor, major Subcontractors, field inspectors and supervisors are to be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling as specified in Section 01 32 00.

.3 Schedule of submission of shop drawings, samples, colour chips as specified in Section 01 33 00.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences as specified in Section 01 52 00.

.5 Delivery schedule of specified equipment as specified in Section 01 32 00.

.6 Site safety and security as specified in Section 01 35 29.06.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.8 Owner-furnished Products.

.9 Record drawings as specified in Section 01 78 23.

.10 Maintenance material and data as specified in Section 01 78 23.

.11 Take-over procedures, acceptance, and warranties as specified Section 01 78 23.

.12 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.13 Appointment of inspection and testing agencies or firms as specified in Section 01 43 00 and 01 45 00.

.14 Insurances and transcript of policies.

.6 Comply with Niagara Region's allocation of mobilization areas of site; for field offices and sheds, for storing and laydown of construction material, access, traffic, and parking facilities.

.7 During construction, coordinate use of site and facilities through Niagara Region's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.

.8 Comply with instructions of Niagara Region for use of temporary utilities and construction facilities.

.9 Coordinate field engineering and layout work with Niagara Region.

1.6 ON-SITE DOCUMENTS

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

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 Change orders.

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved Work schedule.

.9 Manufacturers' installation and application instructions.

.10 Labour conditions and wage schedules.

.11 Applicable current editions of municipal regulations and by-laws. Current building codes, complete with addenda bulletins applicable to the Place of the Work.

1.7 SCHEDULES

.1 Submit preliminary construction progress schedule as specified in Section 01 32 00 to Consultant coordinated with Niagara Region's project schedule.

.2 After review, revise and resubmit schedule to comply with revised project schedule.

.3 During progress of Work revise and resubmit as directed by Niagara Region.

1.8 CONSTRUCTION PROGRESS MEETINGS

.1 During course of Work and one weeks prior to project completion, schedule progress meetings weekly.

.2 Contractor, major subcontractors involved in Work Niagara Region are to be in attendance.

.3 Notify parties minimum of 5 days prior to meetings.

.4 Record minutes of meetings, and circulate to attending parties and affected parties not in attendance within 5 days after meeting.

.5 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 Problems that impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Review site safety and security issues.

.13 Other business.

1.9 SUBMITTALS

.1 Prepare and issue submittals to Niagara Region for review.

.2 Submit preliminary Shop Drawings, product data and samples as specified in Section 01 33 00 for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Niagara Region.

.3 Submit requests for payment for review, and for transmittal to Niagara Region.

.4 Submit requests for interpretation of Contract Documents, and obtain instructions through Niagara Region.

.5 Process substitutions through Niagara Region.

.6 Process change orders through Niagara Region.

.7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Niagara Region.

1.10 COORDINATION DRAWINGS

.1 Provide information required by Niagara Region for preparation of coordination Drawings.

.2 Review and approve revised Drawings for submittal to Niagara Region.

1.11 CLOSEOUT PROCEDURES

.1 Notify Consultant when Work is considered ready for Substantial Performance.

.2 Accompany Niagara Region on preliminary inspection to determine items listed for completion or correction.

.3 Comply with Niagara Region's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner-occupied areas as to be completed or corrected with the Ready-For-Takeover application as to be completed or corrected with the Ready-For-Takeover application.

.4 Notify Niagara Region of instructions for completion of items of Work determined in Niagara Region's final inspection.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Schedules, form, content, submission.

.2 Critical path scheduling.

.3 Recording As-Built documents.

.4 Progress photographs.

.5 Submittals schedule.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

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

1.3 SCHEDULES

.1 Submit schedules as follows:

.1 Submittal Schedule for Shop Drawings and Product Data.

.2 Submittal Schedule for Samples.

.3 Submittal Schedule for timeliness of Owner-furnished Products.

.4 Product Delivery Schedule.

.5 Cash Allowance Schedule for acquiring Products only or Products and Installation, or Installation only.

.6 Shutdown or closure activity.

.2 Schedule Format.

.1 Prepare schedule in form of a horizontal GANTT bar chart.

.2 Provide a separate bar for each major item of work and subcontract.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying first Working Day of each week.

.5 Format for listings: Table of Contents of the Project Manual Chronological order of start of each item of work.

.6 Identification of listings: By specification Section, numbers specification subjects and systems description.

.3 Schedule Submission.

.1 Submit initial format of schedules within fifteen (15) days after award of Contract.

.2 Submit schedules in electronic format, forward through e-mail as *.pdf files.

.3 Submit one (1) opaque reproduction, plus two (2) copies to be retained by Consultant.

.4 Consultant will review schedule and return review copy within ten (10) days after receipt.

.5 Resubmit finalized schedule within seven (7) days after return of review copy.

.6 Submit revised progress schedule with each application for payment.

.7 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

.8 Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.4 CONSTRUCTION PROGRESS SCHEDULING

.1 Submit initial schedule in duplicate within fifteen (15) days after date established in Notice to Proceed.

.2 Revise and resubmit as required.

.3 Submit revised schedules with each Application for Payment, identifying changes since previous version.

.4 Submit a computer generated chart with separate line for each major portion of Work or operation, identifying first workday of each week.

.5 Submit computer generated network analysis diagram using the critical path method.

.6 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

.7 Indicate estimated percentage of completion for each item of Work at each submission.

.8 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.

.9 Include dates for commencement and completion of each major element of construction as follows.

.1 Site clearing.

.2 Site utilities.

.3 Foundation Work.

.4 Structural framing.

.5 Special Subcontractor Work.

.6 Equipment Installations.

.7 Finishes.

.10 Indicate projected percentage of completion of each item as of first day of month.

.11 Indicate progress of each activity to date of submission schedule.

.12 Indicate changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.13 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.5 CRITICAL PATH SCHEDULING

.1 Include complete sequence of construction activities.

.2 Include dates for commencement and completion of each major element of construction as follows.

.1 Site clearing.

.2 Site utilities.

.3 Foundation work.

.4 Structural framing.

.5 Special subcontractor work.

.6 Equipment installations.

.7 Finishes.

.3 Show projected percentage of completion of each item as of first day of month.

.4 Indicate progress of each activity to date of submission schedule.

.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.6 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.6 RECORDING ACTUAL CONDITIONS ON AS-BUILT DOCUMENTS

.1 Record updated information on drawings and Project Manual provided by Consultant.

.2 Record changed information by annotating with separate colours for each major system.

.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: record actual construction of each item, including :

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not indicated 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 required by individual specifications sections.

.7 Electronic as built document format

.1 Make as-built documents available electronically, accessible by all project personnel who require access, including Consultant.

.2 Enable navigation of electronic documents accessed from mobile devices such as computer tablets.

.3 Label as-built documents in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS on every page.

.8 Physical as built document format

.1 Store as-built documents in field office apart from documents used for construction. Provide files, racks, and secure storage. Length of time 6 months

.2 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS in neat, large, printed letters.

.3 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.

.4 Keep as-built documents and samples available for inspection by Consultant.

.9 Samples: Maintain physical samples of products installed in the project at field office in clean, dry condition. Keep samples available for inspection by Consultant. Do not use samples for construction purposes.

1.7 PROGRESS PHOTOGRAPHS

.1 Digital Photography.

.1 Submit electronic and hardcopy of colourdigital photography in jpgformat, minimum 6megapixel resolution.

.2 Identification: Name and number of project and date of exposure indicated.

.2 Number of Viewpoints: Four (4)Locations of viewpoints determined by Consultant.

.3 Frequency: Monthly with progress statement.

.4 Frequency: At completion of as directed by Consultant

1.8 SUBMITTALS SCHEDULE

.1 Include schedule for submitting Shop Drawings, product data, samples.

.2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

.3 Include dates when submittals will be required for Owner-furnished products.

.4 Include dates when reviewed submittals will be required from Consultant.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Contractor is responsible for providing the overall Master Plan and detailed Project Schedule to the Consultant for this Contract based on the requirements of this specification. Sub-Contractors are responsible to provide schedule information for their specific Work to the Contractor as requested over the contract duration. Specific requirements are specified herein.

1.2 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, expected cost, and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar charts, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars.

.3 Baseline: original approved plan (for Project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, Inclusive, will provide five-day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other non-working periods) required to complete activity or another Project element. Usually expressed as workdays or work weeks.

.6 Inclement Weather: The existence of rain or abnormal climatic conditions (hail, snow, high wind, severe dust, extreme high temperature) by virtue of which it is either not reasonable or not safe for employees exposed thereto to continue working whilst the same prevail.

.7 Master Plan: summary-level schedule that identifies major activities and key milestones.

.8 Milestone: significant event in Project, usually completion of major deliverable.

.9 Project Planning, Monitoring and Control System: overall system operated by Contractor to enable monitoring of Project Work in relation to established milestones.

.10 Project Schedule: planned dates for performing activities and planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy project objectives. Monitoring and control process involves using project schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

1.3 REQUIREMENTS

.1 The Contractor shall develop the Master Plan and detailed Project Schedule. Sub-Contractors are required to provide sufficient details, as requested by the Contractor, for their scope of work.

.1 Ensure Master Plan and Project Schedule information provided is practical and remains within specified Contract duration.

.2 Master Plan and Project Schedule information provided to Consultant deemed impractical shall be revised and resubmitted for approval immediately.

.1 Any delays to construction or approvals resultant from a rejected submittal are not grounds for cost/schedule claims.

.3 Acceptance of Master Plan and Project Schedule information provided to Consultant showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract. Duration of Contract may only be changed through bilateral Agreement.

.1 Consider Master Plan and Project l Schedule information provided to and deemed practical by Consultant, showing Work completed in less than specified Contract duration, to have float.

.4 Plan to complete Work in accordance with prescribed milestones and time frames.

.5 Contractor to calculate dates for completion milestones from Plan and Schedule information using specified time periods for Contract.

.6 Delays to non-critical activities, those with float may not be basis for time extension.

.7 Contractor to allow for and show in Master Plan and Project Schedule information to Consultant adverse weather conditions normally anticipated. Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

.8 Contractor and Sub-Contractor's to provide necessary crews and personnel to meet schedule requirements for performing Work within specified Contract duration. Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

.9 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 SUBMITTALS

.1 Contractor to provide submittals to Consultant in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit to Consultant for review, within 5 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, scheduling, monitoring and reporting of project progress. Sub-Contractors to provide all information for their scope of work to the Contractor.

.1 Submit Project Schedule to Consultant within 5 working days of receipt of acceptance of Master Plan.

.2 Contractor shall submit letter ensuring that schedule has been prepared in co-ordination with major sub-Contractors and Suppliers.

1.5 QUALITY ASSURANCE

.1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate.

1.6 PROJECT MILESTONES

.1 Mandatory and recommended project milestones will be provided by Consultant to form targets for both Master Plan and Project Schedule.

.1 Mandatory:

.1 Award,

.2 Shop Drawings, Samples,

.3 Permits,

.4 Mobilization,

.5 Each spec sections and components,

.6 Major equipment/material deliveries

.7 Testing and commissioning,

.8 Substantial performance

.9 Total performance

1.7 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Consultant will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and used as baseline for updates.

1.8 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.

.2 Shop drawings.

.3 Samples.

.4 Permits

.5 Mobilization

.6 Hazardous Material Abatement

.7 Excavation

.8 Backfilling

.9 Slab on grade

.10 Steel work

.11 Roofing

.12 Interior Architecture (Walls, Floors, and Ceiling)

.13 Plumbing

.14 Lighting.

.15 Electrical

.16 Piping

.17 Controls

.18 Heating, Ventilation, and Air Conditioning.

.19 Millwork.

.20 Fire System.

.21 Product delivery.

.22 Shutdowns / Road Closures.

.23 Testing and commissioning.

.24 Supplied equipment long delivery times.

.25 Engineer required dates.

.26 Contract closeout submissions.

.27 Substantial completion.

.28 Final inspection and completion.

.3 Contractor to insert Change Orders in appropriate and logical location of Project Schedule.

1.9 REVIEW OF THE PROJECT SCHEDULE

.1 Contractor to allow 5 work days for review by Consultant of proposed detailed Project Schedule.

.2 Upon receipt of reviewed detailed Project Schedule, Contractor will make necessary revisions and resubmit to Consultant for review within 5 work days.

.3 Contractor to promptly provide additional information to validate practicability of Project Schedule as required by Consultant.

.4 Contractor's submittal of detailed Project Schedule shall indicate that the Contract requirements are met and will be executed generally in sequence.

1.10 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on a weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, a narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

.3 Contractor to submit to Consultant copies of updated Project Schedule.

.4 Contractor's requirements for progress monitoring and reporting are basis for progress payment request. Delays in receiving updated schedule/reporting information from Contractors may constitute payment delays.

.5 Contractor to submit monthly written report to Consultant based on Project Schedule, showing Work to date performed, comparing Work progress to planned baseline, and presenting current forecasts. Report will summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Contractor's report will include:

.1 Description of progress made.

.2 Pending items and status of: permits, shop drawings, Change Orders, possible time extensions.

.3 Status of Contract completion date and milestones.

.4 Current and anticipated problem areas, potential delays and corrective measures.

.5 Review of progress and status of Critical Path activities.

1.11 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later that current approved dates shown on the baseline schedule.

.2 Inclement weather-related delays with their remedial measures will be discussed and negotiated with Consultant.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop Drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 RELATED REQUIREMENTS

.1 Section 01 32 00 - Construction Progress Documentation.

.2 Section 01 78 00 - Closeout Submittals.

.3 Other sections requesting submittals.

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

1.3 ADMINISTRATIVE

.1 Submit to Niagara Region 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.

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

.3 Present Shop Drawings, product data, samples and mock-ups in SI (metric) units.

.4 Where items or information is not manufactured or produced in SI metric units, converted values within the metric measurement tolerances are acceptable.

.5 Review submittals prior to submission to Niagara Region. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

.7 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.8 Verify field measurements and affected adjacent Work are coordinated.

.9 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.11 Keep one (1) reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

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

.4 Allow fourteen (14) days for Consultant's review of each submission.

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

.6 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.7 Accompany submissions with duplicate transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.8 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.

.9 After Consultant's review, distribute copies.

.10 Submit electronic copy of Shop Drawings for each requirement requested in specification Sections and as consultant may reasonably request.

.11 Submit electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Niagara Region.

.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 Contract complete with project name.

.13 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Niagara Region.

.1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.14 Submit electronic copies of Manufacturer's Site Reports for requirements requested in specification Sections and as requested by Niagara Region.

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

.16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Niagara Region.

.17 Delete information not applicable to project.

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

.19 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, electronic copies will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 SAMPLES

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

.2 Deliver samples prepaid to Niagara Region's business address.

.3 Notify Niagara Region 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 Niagara Region are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Niagara Region prior to proceeding with Work.

.6 Make changes in samples that Niagara Region 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.

1.6 MOCK-UPS

.1 Erect mock-ups to Section 01 43 00 - Quality Assurance.

1.7 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Safety requirements and adherence.

1.2 RELATED REQUIREMENTS

.1 Section 01 31 00 - Project Management and Coordination.

.2 Section 01 33 00 - Submittal Procedures.

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

1.3 REFERENCE STANDARDS

.1 Province of Ontario: Occupational Health and Safety Act, including requirements for a "Prime Contractor" as defined by the Act.

1.4 SAFETY PLAN

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.5 RESPONSIBILITY

.1 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.3 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Consultant verbally and in writing.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00.

.2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit two copies of Contractor's authorized representative's work site health and safety inspection reports to Niagara Region, weekly.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit Material Safety Data Sheets (MSDS) to Niagara Region.

.7 Niagara Region will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Niagara Region within 5 days after receipt of comments from Niagara Region.

.8 Niagara Region's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Niagara Region's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Niagara Region.

.10 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergencies.

.11 File Notice of Project with Provincial authorities prior to commencement of Work.

1.7 SAFETY ACTIVITIES

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

.2 Schedule and administer Health and Safety meeting with Niagara Region prior to commencement of Work.

.3 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

1.8 HEALTH AND SAFETY COORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:

.1 Have minimum two (2) years' site-related working experience specific to activities associated with the project work and conditions.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work, and report directly to and be under direction of site supervisor.

1.9 POSTING OF DOCUMENTS

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

1.10 CORRECTION OF NON-COMPLIANCE

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

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

.3 Niagara Region may stop Work if non-compliance of health and safety regulations is not corrected.

1.11 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Known designated substances .

.2 Operation of existing station must be maintained for public. Utilize staged construction. Protect work zone.

.3 Canada Boder Security Agency occupies the west wing of the building. Interruptions will not be allowed.

1.12 HAZARDOUS WORK

.1 Blasting or other use of explosives is not permitted.

.2 Use powder actuated devices only after receipt of written permission from Niagara Region.

.3 Refer to specification related to designated substances and hazardous materials removal and abatement.

1.13 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

1.14 FIRE PROTECTION

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

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

.3 Maintain placed or installed fire resistive construction to protect the portions of the Work during construction.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Site fires.

.2 Site Drainage.

.3 Site clearing and plant protection.

.4 Work adjacent to waterways.

.5 Pollution control.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 19 – Waste Management and Disposal.

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

1.3 FIRES

.1 Fires and burning of rubbish on site permitted only when approved by Niagara Region.

.2 Where fires or burning are permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved. Restore, clean and return to new condition stained or damaged work.

.3 Provide supervision, attendance and fire protection measures as directed.

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

1.4 DRAINAGE

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

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

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.3 Protect roots of designated trees to drip-line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

.5 Restrict tree removal to areas indicated, or as designated by Niagara Region.

1.6 WORK ADJACENT TO WATERWAYS

.1 Do not operate construction equipment in waterways.

.2 Do not use waterway beds for borrow material without Niagara Region's approval.

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

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

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

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

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

1.7 POLLUTION CONTROL

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Laws, notices, permits and fees.

.2 Discovery of hazardous materials.

1.2 RELATED REQUIREMENTS

.1 Section 02 81 00 - Hazardous Material.

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

1.3 LAWS, NOTICES, PERMITS AND FEES

.1 The laws of the Place of the Work shall govern the Work.

.2 The Niagara Region shall obtain and pay for the building permit, permanent easements and rights of servitude. The Contractor shall be responsible for permits, licenses or certificates necessary for the performance of the Work that were in force at the date of executing the Agreement.

.3 Give the required notices and comply with the laws, ordinances, rules, regulations or codes which are or become in force during the performance of the Work and which relate to the Work, to the preservation of the public health and to construction safety.

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

.5 Determine detailed requirements of authorities having jurisdiction.

.6 Pay construction damage deposits levied by municipality in connection with the issuance of a building permit.

1.4 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: If material resembling asbestos is encountered in course of demolition work, immediately stop work and notify Niagara Region.

1.5 PERSONNEL SMOKING

.1 Comply with regulatory and Niagara Region imposed smoking restrictions during execution of the Work within or outside the premises.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Quality assurance criteria.

1.2 RELATED REQUIREMENTS

.1 Section 01 45 00 - Quality Control.

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

1.3 REFERENCE STANDARDS

.1 AABC (Associated Air Balance Council): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems.

1.4 QUALITY ASSURANCE

.1 Cooperate with and Provide testing organization services as specified in Section 01 45 00.

.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 Have someone on site with deconstruction experience throughout project for consultation and supervision purposes.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 21 00 - Allowances.

.2 Section 01 43 00 - Quality Assurance.

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

1.2 REFERENCE STANDARDS

.1 ISO/IEC 17025-2017 - General Requirements for the Competence of Testing and Calibration Laboratories.

.2 SCC (Standards Council of Canada).

1.3 INSPECTION BY AUTHORITY

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

.2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.

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

1.4 REVIEW BY CONSULTANT

.1 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.

.2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

.3 If such Work is found in accordance with Contract Documents, Niagara Region will pay cost of review and replacement.

1.5 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection and Testing Agencies will be engaged by Niagara Region for purpose of inspecting and testing portions of Work. Cost of such services will be included as Cash Allowance.

.2 Testing Organizations: Listed by SCC within info.palcan@scc.ca listings.

.3 Allocate Costs: To Section 01 21 00.

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

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

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

1.6 ACCESS TO WORK

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

.2 Cooperate to provide reasonable access and facilities for such access.

1.7 PROCEDURES

.1 Notify appropriate agency and Niagara Region in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.8 REJECTED WORK

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

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

.3 If in opinion of Niagara Region it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Niagara Region may deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Niagara Region.

1.9 REPORTS

.1 Submit one (1) electronic copy of signed inspection and test reports to Niagara Region.

.2 Provide signed paper copies to Subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.10 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 Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.11 MOCK-UPS

.1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Niagara Region.

.3 Prepare mock-ups for Niagara Region review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Consultant will assist in preparing a schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to Consultant. Repair any damage and clean-up at place of mock-up.

.7 Approved mock-up may remain as part of Work.

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

1.12 MILL TESTS

.1 Submit mill test certificates as requested.

1.13 EQUIPMENT AND SYSTEMS

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 51 00 - Temporary Utilities.

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

1.2 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 SCAFFOLDING

.1 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs.

1.4 HOISTING

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

.2 Hoists and cranes shall be operated by qualified operator.

1.5 USE OF THE WORK

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

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

1.6 CONSTRUCTION PARKING

.1 Parking will not be permitted on site.

.2 Parking will be permitted on site provided it does not disrupt performance of Work and continuing operation of the facility.

.3 Provide and maintain adequate access to project site.

.4 Build and maintain temporary roads where directed by Niagara Region and provide snow removal during period of Work.

.5 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.

.6 Clean runways and taxi areas where used by Contractor's equipment.

1.7 SECURITY

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

1.8 OFFICE JOB TRAILERS

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.

.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 Office job site trailer.

.1 Provide temporary site trailer to act as office.

.2 Office trailer to accommodate site meetings for up to 10 persons.

.3 Inside dimensions minimum 12 m long x 3.6 m wide x 2.4 m high, with floor 300 mm above grade, complete with four (4) 50% opening windows and one (1) lockable door.

.4 Office trailer to be equipped with extra security features including bars on windows, monitored alarm system, site video cameras, exterior security lights, and deadbolting security locks.

.5 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.

.6 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.

.7 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.

.8 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.

.9 Equip office with 900 x 3050 mm table, ten (10) chairs, 6 m of shelving, 300 mm wide, three (3) drawer filing cabinet, one (1) plan rack and one (1) coat rack and shelf.

.10 Maintain in clean condition.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

.3 Sheds to include security features including monitored alarm system, site video cameras, exterior security lights, and deadbolting security locks.

1.10 SANITARY FACILITIES

.1 Provide sanitary facilities for workforce in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities.

.3 Except where connected to municipal sewer system, periodically remove wastes from Site.

.4 Existing and new permanent facilities may not be used by workers.

.5 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

.6 Sanitary facilities to locked at all times, provide workers with keyed access.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CSA Group (CSA)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

.3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically flush and butt jointed.

.3 Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.

.6 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Provide one lockable truck gate. Maintain fence in good repair.

.7 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and other conditions with greater than 600 mm otherwise unguarded edge.

.2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

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

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

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

1.6 DUST TIGHT SCREENS

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

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

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Niagara Region. locations and installation schedule 3 days prior to installation.

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

1.12 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Product substitution procedures.

.3 Manufacturer's instructions.

.4 Quality of Work, coordination and fastenings.

.5 Existing facilities.

1.2 RELATED REQUIREMENTS

.1 Section 01 42 00 - References: Other terms used in the Project Manual.

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

1.3 TERMINOLOGY

.1 New: Produced from new materials.

.2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.3 Defective: A condition determined exclusively by the Niagara Region.

1.4 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 Niagara Region.

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

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

1.5 AVAILABILITY

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

.2 If delays in supply of Products are foreseeable, notify Niagara Region 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 Niagara Region at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Niagara Region reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE AND PROTECTION

.1 Store and protect Products in accordance with manufacturers' written instructions.

.2 Store with seals and labels intact and legible.

.3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

.4 For exterior storage of fabricated Products, place on sloped supports above ground.

.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

.6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

.7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

.8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.7 TRANSPORTATION AND HANDLING

.1 Transport and handle Products in accordance with manufacturer's written instructions.

.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.8 PRODUCT CHANGES

.1 Change in Product/Products: Submit request for substitution or alternative.

1.9 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, pedestrians, vehicular traffic, and building occupants.

.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.

1.10 MANUFACTURER'S WRITTEN INSTRUCTIONS

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

.2 Notify Niagara Region in writing, of conflicts between specifications and manufacturer's instructions, so that Niagara Region may establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Niagara Region to require removal and re-installation at no increase in Contract Price or Contract Time.

1.11 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 Niagara Region if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in his or her required duties. Niagara Region 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 Niagara Region, whose decision is final.

1.12 COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.13 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is interference. Install as directed by Niagara Region.

1.14 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.

1.15 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Niagara Region of conflicting installation. Install as directed.

1.16 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.

1.17 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.

1.18 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 Niagara Region.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Field engineering survey services to measure and stake site.

.2 Recording of subsurface conditions found.

.3 Survey services to determine measurement inverts for the Work.

.4 Requirements and limitations for cutting and patching the Work.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCE STANDARDS

.1 Owner's identification of existing survey control points and property limits.

1.4 SUBMITTALS

.1 Submit name and address of Surveyor.

.2 On request of Niagara Region, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.5 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in the Place of the Work, acceptable to Niagara Region.

1.6 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on Drawings.

.2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Niagara Region.

.4 Report to Niagara Region when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.7 SURVEY REQUIREMENTS

.1 Establish two (2) permanent benchmarks on site, referenced to established benchmarks by survey control points.

.2 Record locations, with horizontal and vertical data in Project Record Documents.

.3 Establish lines and levels, locate and layout, by instrumentation.

.4 Stake for grading and landscaping features.

.5 Stake slopes and berms.

.6 Establish pipe invert elevations.

.7 Stake batter boards for foundations.

.8 Establish foundation column locations and floor elevations.

.9 Establish lines and levels for mechanical and electrical work.

1.8 SUBSURFACE CONDITIONS

.1 Promptly notify Niagara Region in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.

.2 Advise the Niagara Region of a reasonable assumption of probable conditions when determined.

.3 After prompt investigation, should Niagara Region determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes or Change Orders set out in Section 01 29 00.

1.9 EXAMINATION

.1 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of the Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

1.10 PREPARATION

.1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.2 Provide protection from elements for areas that may be exposed by uncovering work; maintain excavations free of water.

1.11 EXISTING SERVICES

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

.2 Remove abandoned service lines within 2 m of structures. Cap or seal lines at cut-off points as directed by Niagara Region.

1.12 LOCATION OF EQUIPMENT AND FIXTURES

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

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

.3 Inform Niagara Region of impending installation and obtain approval for actual location.

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

1.13 SURVEY RECORD

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Submittal requirements associated with connecting to new and existing facilities.

.2 Execution requirements for all Work.

1.2 RELATED REQUIREMENTS

.1 Section 01 71 00 - Examination and Preparation.

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

1.3 SUBMITTALS - ATTACHING TO EXISTING EORK

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

.1 Structural integrity of any element of Project.

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

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 Work of Owner or separate contractor.

.2 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed Work, and products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on Work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.4 TOLERANCES

.1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

.2 Do not permit tolerances to accumulate beyond effective or practical limits.

.3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Niagara Region before proceeding.

.4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.5 EXECUTION

.1 Execute cutting, fitting, and patching to complete the Work.

.2 Perform all required excavation and fill to complete the Work.

.3 Fit several parts together, to integrate with other Work.

.4 Uncover Work to install ill-timed Work.

.5 Remove and replace defective or non-conforming Work.

.6 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.

.7 Provide openings in non-structural elements of Work for penetrations of associated Work. Limit opening dimensions to minimal sizes required, and performed in a neat and clean fashion.

.8 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.9 Employ competent workers to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

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

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

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

.13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, for full thickness of the constructed element.

.14 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2008, Stipulated Price Contract.

1.2 PROJECT CLEANLINESS

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

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

.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 waste containers for collection of waste materials and debris.

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

.7 Dispose of waste materials and debris off site.

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

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

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

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

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

1.3 FINAL CLEANING

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

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

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

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

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Niagara Region. Do not burn waste materials on site, unless approved by Niagara Region.

.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, ceilings, floors and other installed components.

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

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

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

.18 Clean roofs, downspouts, and drainage systems.

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

.20 Remove snow and ice from access to building.

1.4 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

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor 's commitment to reduce and divert waste materials from landfill and includes the following:

.1 Preparation of a Draft Construction Waste Management Plan that will be used to track the success of the Construction Waste Management Plan against actual waste diversion from landfill.

.2 Preparation of a Construction 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 Preparation of monthly progress reports indicating cumulative totals representing progress towards achieving diversion and reduction goals of waste materials away from landfill and identifying any special programs, landfill options or alternatives to landfill used during construction.

.4 Preparation of a Construction Waste Management Report containing detailed information indicating total waste produced by the Project, types of waste material and quantity of each material, and total waste diverted and diversion rates indicated as a percentage of the total waste produced.

.2 Niagara Region 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.

1.2 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re-modeling, repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.5 Non-toxic: Not poisonous to humans either immediately or after a long period of exposure.

.6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the Project site to another site for remanufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the Project site.

.11 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:

.1 Solvents in paints and other coatings;

.2 Wood preservatives; strippers and household cleaners;

.3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.

.4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

.18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E1609 01, Standard Guide for Development and Implementation of a Pollution Prevention Program

.2 Recycling Certification Institute (RCI)

.1 RCI Certification Construction and Demolition Materials Recycling

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the Project, and ensure that requirements of the Construction Waste Management Plan are followed.

.2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 - Project Meetings before starting any Work of the Contract attended by the Contractor, affected Subcontractor 's and Niagara Region to discuss the Contractor 's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit required information in accordance with Section 01 33 00 - Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to Niagara Region a preliminary analysis of anticipated site generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; Niagara Region will provide commentary before development of Contractor 's Construction Waste Management Plan.

.2 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this Project before any waste removal from site and that includes the following information:

.1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the Draft CWM Plan; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.

.2 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.

.3 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled or composted during the course of the Project, and the proposed local market for each material.

.4 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification; energy will be considered as a viable alternative diversion strategy for these materials where facilities exist and are operated in accordance with Construction and Demolition Waste Management requirements.

.5 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the Project.

.6 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

.7 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

1.6 PROJECT CLOSEOUT SUBMITTALS

.1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 Construction Waste Management Report (CWM Report): Submit a CWM Report for this Project in a format acceptable to Niagara Region submittal requirements and that includes the following information:

.1 Accounting: Submit information indicating total waste produced by the Project.

.2 Composition: Submit information indicating types of waste material and quantity of each material.

.3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the Project.

.4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.

.5 Alternative Daily Cover (ADC): Submit quantities of material that were used as ADC at landfill sites, and that form a part of the total waste generated by the Project.

.6 Multiple Waste Hauling: Compile all information into a single CWM Report where multiple waste hauling and diversion strategies were used for the project.

.7 Photographs: Submit photographs of waste diversion facilities documenting location and signage describing usage of waste separation containers.

1.7 QUALITY ASSURANCE

.1 Resources for Development of Construction Waste Management Report (CWM Report): The following sources may be useful in developing the Draft Construction Waste Management Plan:

.1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.

.2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.

.2 Certifications: Provide proof of the following during the course of the Work:

.1 Compliance Certification: Provide proof that recycling center is third party verified and is listed as a Certified Facility through the registration and certification requirements of the Recycling Certification Institute.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the Project waste and the available recycling and reuse programs in the Project area.

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 (CWM PLAN) IMPLEMENTATION

.1 Manager: Contractor is responsible for designating an on site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the Project.

.2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, the Niagara Region and other site personnel as required to maintain CWM Plan.

.3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the Project to Subcontractor 's at appropriate stages of the Project.

.4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:

.1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.

.5 Progressive Documentation: Submit a monthly summary of waste generated by the Project to ensure that waste diversion goals are on track with Project requirements:

.1 Submittal of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Contractor and Niagara Region.

.2 Monthly waste summary shall contain the following information:

.1 The amount in tonnes or m^3 and location of material landfilled,

.2 The amount in tonnes or m^3 and location of materials diverted from landfill, and

.3 Indication of progress based on total waste generated by the Project with materials diverted from landfill as a percentage.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

.1 Subcontractor 's shall cooperate fully with the Contractor to implement the CWM Plan.

.2 Failure to cooperate may result in the Niagara Region not achieving their environmental goals, and may result in penalties being assessed by the Contractor to the responsible Subcontractor 's.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2- 2020, Stipulated Price Contract.

.2 Canadian Environmental Protection Act (CEPA)

.1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

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

.1 Notify Niagara Region in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Niagara Region inspection.

.2 Niagara Region Inspection:

.1 Niagara Region and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted, balanced, and fully operational.

.4 Certificates required by Fire Commissioner, and Utility companies: submitted.

.5 Operation of systems: demonstrated to Owner's personnel.

.6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning Requirements and other requirements and copies of final Commissioning Report submitted to Niagara Region.

.7 All storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.

.8 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Niagara Region, and Contractor.

.2 When Work incomplete according to Niagara Region, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Niagara Region considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When Niagara Region considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 Refer to CCDC 2: when Work deemed incomplete by Niagara Region, complete outstanding items and request re-inspection.

.8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Inspections and declarations.

.2 Closeout submittals.

.3 Operation and maintenance manual format.

.4 Contents each volume.

.5 Recording actual site conditions.

.6 Record (as-built) documents and samples.

.7 Record documents.

.8 Final survey.

.9 Warranties and bonds.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 79 00 - Demonstration and Training.

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

1.3 INSPECTIONS AND DECLARATIONS

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

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

.2 Request Consultant's Inspection.

.2 Niagara Region's Inspection: Niagara Region and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.

.3 Completion: Submit written certificate that following have been performed:

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

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

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

.4 Certificates required by authorities having jurisdiction have been submitted.

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

.6 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by Niagara Region, and Contractor. If Work is deemed incomplete by Niagara Region, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: When Niagara Region considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.

.6 Commencement of Warranty Periods: The date of Substantial Performance of the Work shall be the date for commencement of the warranty period.

.7 Commencement of Lien Periods: The date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

.8 Final Payment: When Niagara Region considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

.9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

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

.2 Copy will be returned after final inspection with Niagara Region's comments.

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

.4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Niagara Region, four (4) final copies of operating and maintenance manuals in Canadian English.

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

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

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

.8 Pay costs of transportation.

1.5 OPERATION AND MAINTENANCE MANUAL FORMAT

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

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 216 x 289 mm (8"x11") with spine and face pockets.

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

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

.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in *.dwg AutoCAD Release 2013 format on USB (Universal Serial Bus) flash drive memory stick.

1.6 CONTENTS - EACH VOLUME

.1 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.4 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. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

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

.5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate and life safety systems performance certificate.

.6 Training: Refer to Section 01 79 00.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Niagara Region.

.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 depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain manufacturer's certifications, inspection certifications, and field test records required by individual specifications sections.

1.8 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Niagara Region, one (1) 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 as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document AS-BUILT DOCUMENTS in neat, large, printed letters.

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

.5 Keep as-built documents and samples available for inspection by Niagara Region.

1.9 RECORD DOCUMENTS

.1 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of Drawing and specification files provided by the Consultant, as follows:

.1 Drawings: AutoCAD.

.2 Specifications: Adobe Acrobat.

.2 Mark revised documents as RECORD DOCUMENTS. Include all revisions, with special emphasis on structural components, electrical systems, and mechanical systems.

.3 Employ a competent computer draftsperson to indicate changes on the electronic set of record drawings. Provide updated Record Drawings in AutoCAD and Adobe Acrobat.

.4 Employ a competent specification writer to indicate changes to the electronic set of record specifications. Provide updated record specifications in Adobe Acrobat on USB (Universal Serial Bus) flash drive memory stick.

.5 Submit completed record documents to Niagara Region on a USB (Universal Serial Bus) flash drive memory stick, accompanied by three (3) hard copy sets.

1.10 FINAL SURVEY

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

.2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.11 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of the responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Niagara Region's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and systems.

.2 Materials and finishes.

.3 Spare parts.

.4 Maintenance manuals.

.5 Special tools.

.6 Storage, handling and protection.

1.2 RELATED REQUIREMENTS

.1 Section 01 45 00 - Quality Control

.2 Section 01 91 13 - General Commissioning Requirements.

1.3 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination Drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Sections .

.15 Additional requirements: As specified in individual specification sections.

Part 2 Products

2.1 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.

.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 Building Envelope: include copies of drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

.5 Additional Requirements: as specified in individual specifications sections.

2.2 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Receive and catalogue all items. Submit inventory listing to Niagara Region. Include approved listings in Maintenance Manual.

.4 Obtain receipt for delivered products and submit prior to final payment.

2.3 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Receive and catalogue all items. Submit inventory listing to Niagara Region. Include approved listings in Maintenance Manual.

.4 Obtain receipt for delivered products and submit prior to final payment.

2.4 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 Receive and catalogue all items. Submit inventory listing to Niagara Region. Include approved listings in Maintenance Manual.

Part 3 Execution

3.1 DELIVER TO SITE

.1 Deliver to location as directed; place and store.

3.2 STORAGE, HANDLING AND PROTECTION

.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 Niagara Region.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.

.2 Seminars and demonstrations.

1.2 RELATED REQUIREMENTS

.1 Section 01 91 13 - General Commissioning Requirements

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

1.3 QUALITY CONTROL

.1 Ensure that only personnel from own forces, Subcontractors or Suppliers competent and fully knowledgeable in the particular material component, equipment or system installation are used to provide training and demonstrations.

.2 When specified in individual Sections, obtain the manufacturers authorized representative to demonstrate operation of equipment and systems, instruct Niagara's personnel, and provide written report that demonstration and instructions have been completed.

.3 Provide evidence to Niagara Region when deemed required of individual Trainer's knowledge and qualifications.

1.4 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment, systems, and building envelope to Niagara Region's personnel two (2) weeks prior to date of substantial performance.

.2 Niagara Region will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

.3 Cooperate with Niagara Region in coordinating time and attendance of Niagara Region's personnel with manufacturer's training representative(s).

1.5 COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

.2 Instruct Niagara Region's personnel, and provide written report that demonstration and instructions have been completed.

1.6 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Niagara Region's approval.

.2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present.

1.7 CONDITIONS FOR DEMONSTRATIONS

.1 Testing, adjusting, and balancing have been performed in accordance with Section 01 91 13 - General Commissioning Requirements, and equipment and systems are fully operational.

.2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.

.2 Verify that designated personnel are present.

.3 Prepare agendas and outlines.

.4 Establish seminar organization.

.5 Explain component design and operational philosophy and strategy.

.6 Develop equipment presentations.

.7 Present system demonstrations.

.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

.1 Prepare agendas and outlines including the following:

.1 Equipment and systems to be included in seminar presentations.

.2 Name of companies and representatives presenting at seminars.

.3 Outline of each seminar's content.

.4 Time and date allocated to each system and item of equipment.

.5 Provide separate agenda for each system.

3.3 SEMINAR ORGANIZATION

.1 Coordinate content and presentations for seminars.

.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.

.4 Coordinate proposed dates for seminars with Niagara Region and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.

.2 Description of design parameters, constraints and operational requirements.

.3 Description of system operation strategies.

.4 Information to help in identifying and troubleshooting system problems.

3.5 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.

.4 Review contents of manual in detail to explain all aspects of operation and maintenance.

.5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes general requirements relating to commissioning (Cx) of project components and systems, specifying general requirements for performance verification (PV) of components, equipment, sub-systems, systems, and integrated systems.

1.2 ABBREVIATIONS

.1 AFD: Alternate Forms of Delivery, service provider

.2 BMM: Building Management Manual

.3 Cx: Commissioning

.4 EMCS: Energy Monitoring and Control Systems

.5 O&M: Operation and Maintenance

.6 PI: Product Information

.7 PV: Performance Verification

.8 TAB: Testing, Adjusting and Balancing

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Niagara Region will observe some or all commissioning activities at their discretion.

.2 Owner's Performance Testing: Performance testing of equipment or systems by Niagara Region will not relieve Contractor from compliance with specified start-up and testing procedures.

.3 Cooperate fully with Niagara Region during stages of acceptance and occupancy of facility.

.4 Coordination with Authorities Having Jurisdiction (AHJ):

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of AHJ, arrange for authority to witness procedures to avoid duplication of tests and to facilitate an earlier acceptance of facility.

.2 Obtain certificates of approval, acceptance, and compliance with rules and regulations of AHJ.

.3 Submit copies to Niagara Region within 5 days of test and with Cx report.

.2 Commissioning Meetings:

.1 Hold Cx meetings after project meetings in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart and as indicated in this Section.

.2 Use Cx meetings to resolve issues, monitor progress, and identify defects and deficiencies relating to Cx.

.3 Continue Cx meetings on a regular basis, including during equipment start-up period, and functional testing period until commissioning deliverables have been addressed.

.4 At 60% construction completion stage: Niagara Region will request a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Agenda topics include the following:

.1 Review duties and responsibilities of Contractor and Subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of Subcontractors and manufacturer's representatives in the Cx process.

.5 Meeting will be chaired by Niagara Region, who will record and distribute minutes.

.6 Ensure Subcontractors and relevant manufacturer representatives are present at 60% construction completion stage, at subsequent Cx meetings, and when otherwise required.

.3 Observation of Starting and Testing:

.1 Give 14 days notice before beginning commissioning.

.2 Niagara Region will observe start-up and testing.

.3 Owner's Cx Agent to be present at tests performed and documented by Subcontractors, suppliers, and equipment manufacturers.

.4 Conflicts:

.1 Report conflicts between requirements of this Section and other Sections to Niagara Region and obtain interpretation or clarification before starting commissioning work.

.2 Failure to report conflicts and obtain interpretation or clarification will result in application of the more stringent requirement.

.5 Excess Administration:

.1 Contractor shall pay the Owner costs related to Niagara Region's excess contract administration if third and subsequent verifications occur where:

.1 Verification of reported results fail to receive Niagara Region's acceptance.

.2 Repetition of second verification again fails to receive acceptance.

.3 Niagara Region deems Contractor's request for second verification was premature.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than 4 weeks after award of Contract:

.1 name of Owner's Cx agent,

.2 draft Cx documentation, and

.3 preliminary Cx schedule.

.2 Request changes to submittals in writing to Niagara Region and obtain written acceptance or rejection at least 8 weeks before start of Cx.

.3 Where Cx procedures are not specified, submit proposed ones to Niagara Region and obtain written acceptance or rejection at least 8 weeks before start of Cx.

.4 Submit additional documentation relating to Cx process as required by Niagara Region.

.5 If instruments installed in Contract will be used for Cx of TAB and PV, then submit TAB and PV instrument calibration certificates for review and acceptance.

.6 Submit EMCS sensor calibration certificates.

.2 Commissioning Schedule:

.1 Create and submit detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.

.2 Allow in the schedule adequate time for Cx activities prescribed in technical specification Sections and commissioning Sections including:

.1 acceptance of Cx reports

.2 verification of reported results

.3 repairs, retesting, re-commissioning, and re-verification

.4 training

.3 Start-Up Documentation:

.1 Assemble start-up documentation and submit to Niagara Region for review and acceptance before beginning commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up checklists.

.4 Start-up reports.

.5 Step-by-step description of complete start-up procedures so Niagara Region can repeat start-up at any time.

.4 Submit for review and acceptance:

.1 Complete list of proposed instruments and equipment to perform commissioning.

.2 List data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.5 Commissioning Documentation:

.1 Submit completed Cx documentation to Niagara Region for review and acceptance.

1.5 MAINTENANCE MATERIALS SUBMITTALS

.1 Supply and document maintenance materials, spare parts, and special tools as specified in other specification Sections.

1.6 SITE CONDITIONS

.1 Where Cx of weather-dependent, occupancy-dependent, or seasonally-dependent equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions if acceptable to Niagara Region with manufacturer's assistance in accordance with equipment manufacturer's instructions, data, and approved formulae.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Perform Cx after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

.1 Objectives: Verify that installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Perform Cx throughout various seasons to calibrate and optimize systems under changing conditions.

.3 Ensure appropriate documentation is compiled into the BMM.

.4 Effectively train O&M staff.

.2 Contractor shall assist in Cx process, operating equipment and systems, troubleshooting, and making adjustments as required.

.1 Operate systems at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems should interact with each other as intended in accordance with Contract Documents and design criteria.

.2 Make adjustments as needed, during these checks, to enhance performance and meet environmental or user requirements.

.3 Design Criteria: In accordance with Owner's requirements or as determined by Niagara Region. To meet Project functional and operational requirements.

.4 In AFD managed projects, the term Niagara Region in Cx specifications is referring to as the AFD Service Provider.

3.2 COMMISSIONING OVERVIEW

.1 Include Cx as a line item in Contractor's cost breakdown.

.2 Cx activities supplement the site quality control and testing procedures described in relevant technical specification Sections.

.3 Conduct Cx at the same time as other activities during the construction stage.

.4 Cx identifies issues in the Design stages, which are addressed during Construction and Cx stages. This step ensures the built facility meets functional and operational requirements while operating as intended under weather, environmental and occupancy conditions. Cx activities include the transfer of critical knowledge to the Owner's facility operations personnel.

.5 Niagara Region will issue Interim Acceptance Certificate only after:

.1 Cx documentation has been received, reviewed for suitability, and reviewed and accepted by Niagara Region,

.2 equipment, components and systems have been commissioned, and

.3 O&M training has been completed.

3.3 PRE-COMMISSIONING REVIEW

.1 Before Construction:

.1 Review Contract Documents and confirm in writing to Niagara Region the following:

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Coordinate provision, location, and installation of provisions for Cx.

.3 Before Beginning Cx:

.1 Verify Cx Plan and schedules are up-to-date.

.2 Verify installation of related components, equipment, systems, and sub-systems are complete.

.3 Review Cx requirements and procedures.

.4 Verify documentation used for the Cx process is shelf-ready (bound, organized, indexed, etc.).

.5 Review design criteria and intent, and special features to ensure full understanding.

.6 Submit complete start-up documentation to Niagara Region.

.7 Verify systems have been cleaned thoroughly.

.8 Complete TAB procedures on systems and submit TAB reports to Niagara Region for review and acceptance.

.9 Verify "As-Built" system schematics are available.

.4 Inform Niagara Region in writing of defects and deficiencies in installed Work.

3.4 STARTING AND TESTING

.1 Contractor to provide and pay costs of the following:

.1 inspections, including disassembly and re-assembly after approval, and for starting, testing, adjusting, and;

.2 temporary testing equipment.

3.5 PERFORMANCE VERIFICATION TOLERANCES

.1 Application Tolerances:

.1 A specified range of acceptable deviations of measured values from specified values or specified design criteria except for special areas that shall be within +/- 10% of specified values.

.2 Instrument Accuracy Tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement Tolerances During Verification:

.1 Unless otherwise specified, actual values shall be within +/- 2% of recorded values.

3.6 MANUFACTURER SERVICES

.1 During factory testing, manufacturer to:

.1 Coordinate time and location of testing.

.2 Arrange for Niagara Region to observe testing.

.3 Submit testing documentation for review and acceptance by Niagara Region.

.4 Obtain written acceptance of test results and documentation from Niagara Region before delivery to site.

.2 Obtain manufacturer's installation, start-up and operations instructions before start-up of components, equipment and systems, and review with Niagara Region.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures that may be detrimental to equipment performance and review with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified in other divisions or where required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 Report results in clear, concise, logical manner.

3.7 COMMISSIONING PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in a normal and safe manner before conducting start-up, testing and Cx.

.2 Conduct start-up and testing in the following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, reviewed and accepted shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: Follow accepted start-up procedures.

.3 Operational testing: Document equipment performance.

.4 System PV: Include repetition of tests after correcting deficiencies.

.5 Post-Substantial Performance Verification: To include fine-tuning.

.3 Correct deficiencies and obtain acceptance from Niagara Region after distinct phases have been completed and before beginning the next phase.

.4 Document required tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Niagara Region. If evaluation report indicates that equipment start-up procedure was deficient and resulted in equipment damage, perform the following:

.1 Minor equipment/systems: Perform corrective measures acceptable to Niagara Region.

.2 Major equipment/systems: If evaluation report indicates that equipment damage is minor, perform corrective measures acceptable to Niagara Region.

.3 If evaluation report indicates that major equipment damage has occurred, Niagara Region will reject equipment.

.1 Remove rejected equipment from site and replace with new equipment.

.2 Perform specified start-up procedures on new equipment/systems.

3.8 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed or recommended by equipment/system manufacturer.

.2 With manufacturer's assistance, develop written maintenance program and submit to Niagara Region for review and acceptance before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

3.9 TEST RESULTS

.1 If start-up, testing, or PV produce unacceptable results, repair, replace or repeat specified starting or PV procedures until acceptable results are achieved.

.2 Provide labour and materials, and assume costs for re-commissioning.

3.10 START OF COMMISSIONING

.1 Notify Niagara Region at least 21 days before start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

3.11 TEMPORARY INSTRUMENTS AND EQUIPMENT

.1 Provide the following instruments and equipment as required:

.1 2-way radios

.2 ladders

.3 other instruments and equipment required to complete commissioning

3.12 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 under accepted simulated operating conditions, over entire operating range, and in all modes, and

.2 on independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 Make EMCS trending information available as supporting documentation for performance verification.

3.13 EXTENT OF VERIFICATION

.1 Laboratory areas:

.1 Provide labour and instrumentation to verify up to 100% of reported results.

.2 Elsewhere:

.1 Provide labour and instrumentation to verify up to 30% of reported results, unless otherwise specified in other specification Sections.

.3 Number and location to be at discretion of Niagara Region.

.4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, and instrumentation.

.5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.6 Perform additional commissioning until results are acceptable to Niagara Region.

3.14 INSTALLED INSTRUMENTATION

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

.1 Accuracy complies with this specification Section.

.2 Calibration certificates have been submitted to Niagara Region.

.2 Calibrated EMCS sensors may be used to obtain performance data if sensor calibration has been completed and accepted.

3.15 PROCEDURES FOR DEFICIENCIES DISCOVERED DURING COMMISSIONING

.1 Correct defects and deficiencies found during the Cx process. Re-verify equipment and components within the defective or deficient system to verify proper performance, including related systems if requested by Niagara Region.

.2 Costs associated with re-commissioning defective and deficient work is the responsibility of Contractor. Above costs to be in the form of progress payment reductions or hold-back assessments.

3.16 COMMISSIONING CONSTRAINTS

.1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

3.17 MISCELLANEOUS CHECKS AND ADJUSTING

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

3.18 DEFICIENCIES AND DEFECTS

.1 Correct deficiencies and defects found during start-up and Cx to satisfaction of Niagara Region.

.2 Report concerns, deficiencies, and defects affecting Cx to Niagara Region in writing. Stop Cx until problems are rectified. Proceed with written acceptance from Niagara Region.

3.19 CLOSEOUT ACTIVITIES

.1 Completion of Commissioning:

.1 Upon completion of Cx, leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx before issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Niagara Region.

.2 Activities Upon Completion of Commissioning:

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

.3 Training:

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This section is limited to portions of the Building Management Manual (BMM) provided to Niagara Region by Contractor.

.2 Acronyms:

.1 BMM - Building Management Manual.

.2 Cx - Commissioning.

.3 HVAC - Heating, Ventilation and Air Conditioning.

.4 PI - Product Information.

.5 PV - Performance Verification.

.6 TAB - Testing, Adjusting and Balancing.

.7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams and schematics to be professionally developed.

.4 Electronic copy of data to be in a format accepted and approved by Niagara Region.

1.3 APPROVALS

.1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Niagara Region.

1.4 GENERAL INFORMATION

.1 Provide Niagara Region the following for insertion into appropriate Part and Section of BMM:

.1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.

.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.

.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.

.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.

.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM..

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

.8 Operating and maintenance manual - Section 3.2 of BMM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Niagara Region.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.

.2 Niagara Region to review and approve format and organization within 12 weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Record and organize for easy access and retrieval of information contained in BMM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:

.1 Recommended maintenance procedures and schedule.

.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

.1 Samples of LSC Manual will be available from Niagara Region.

.2 Content of Manual:

.1 All possible Emergency situations modes including: presence of fire and smoke, power failure, lose of water or pressure, chemical spills and refrigerant release.

.2 Failure of elevators and escalators.

.3 HVAC emergencies and fuel supply failures.

.4 Intrusion and security breach.

.5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.

.6 Dedicated emergency generators for high security projects, medical facilities and computer systems.

.7 Emergency control procedures for fire, power and major equipment failure.

.8 Emergency contacts and numbers.

.9 Manual to be readily available and comprehensible to non- technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Niagara Region supporting documentation relating to installed equipment and system, including:

.1 General:

.1 Finalized commissioning plan.

.2 WHMIS information manual.

.3 Approved "as-built" drawings and specifications.

.4 Procedures used during commissioning.

.5 Cross-Reference to specification sections.

.2 Architectural and structural:

.1 Inspection certificates, construction permits.

.2 Roof anchor log books.

.3 PV reports.

.3 Fire prevention, suppression and protection:

.1 Test reports.

.2 Smoke test reports.

.3 PV reports.

.4 Mechanical:

.1 Installation permits, inspection certificates.

.2 Piping pressure test certificates.

.3 Ducting leakage test reports.

.4 TAB and PV reports.

.5 Charts of valves and steam traps.

.6 Copies of posted instructions.

.5 Electrical:

.1 Installation permits, inspection certificates.

.2 TAB and PV reports.

.3 Electrical work log book.

.4 Charts and schedules.

.5 Locations of cables and components.

.6 Copies of posted instructions.

.2 Assist Niagara Region with preparation of BMM.

1.8 LANGUAGE

.1 English Language.

1.9 IDENTIFICATION OF FACILITY

.1 When submitting information to Niagara Region for incorporation into BMM, use following system for identification of documentation:

.1 In accordance with MsterFormat.

1.10 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.

.2 Obtain Niagara Region approval before starting Work.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Alteration project procedures.

.2 Removal of designated building equipment and fixtures.

.3 Removal of designated construction.

.4 Disposal of materials.

.5 Identification of utilities.

.6 Refer to items as indicated.

1.2 ALTERATION PROJECT PROCEDURES

.1 Materials: As specified in Product sections; match existing Products and work for patching and extending work.

.2 Employ skilled and experienced installer to perform alteration work.

.3 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

.4 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to specified condition.

.5 Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

.6 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

.7 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Consultant for review.

.8 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Consultant for review.

.9 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.

.10 Finish surfaces as specified in individual Product sections.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing: Sequence work to requirements of Section 01 11 00.

.2 Scheduling: Schedule work to requirements of Section 01 31 00.

.1 Describe demolition removal procedures and schedule.

.3 Perform noisy, malodorous, or dusty work:

.1 Between the hours of 8 pm and 5 am.

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Record Documentation: Accurately record actual locations of capped utilities and subsurface obstructions.

1.7 SITE CONDITIONS

.1 Conduct demolition to minimize interference with adjacent and occupied building areas.

.2 Cease operations immediately if structure appears to be in danger and notify Consultant. Do not resume operations until directed.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for demolition work, dust control, products requiring electrical disconnection or reconnection.

.2 Obtain required permits from authorities.

.3 Do not close or obstruct egress width to any building or site exit.

.4 Do not disable or disrupt building fire or life safety systems without three (3) days prior written notice to Owner.

.5 Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

2.2 MATERIALS

.1 Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Provide, erect, and maintain temporary barriers at locations indicated.

.2 Erect and maintain weatherproof closures for exterior openings.

.3 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.

.4 Protect existing materials which are not to be demolished.

.5 Prevent movement of structure; provide bracing and shoring.

.6 Notify affected utility companies before starting work and comply with their requirements.

.7 Mark location and termination of utilities.

.8 Provide appropriate temporary signage including signage for exit or building egress.

3.2 DEMOLITION

.1 Disconnect , remove, cap, and identify designated utilities within demolition areas.

.2 Demolish in an orderly and careful manner. Protect existing supporting structural members.

.3 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

.4 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

.5 Remove temporary Work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants

.2 Section 09 91 23 - Interior Painting

1.2 DEFINITIONS

.1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into environment.

.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

1.3 REFERENCE STANDARDS

.1 Canadian Environmental Protection Act,1999 (CEPA 1999)

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Department of Justice Canada (Jus)

.1 Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

.3 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.2 GS-36-00, Commercial Adhesives.

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 WHMIS Safety Data Sheets (SDS).

.5 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2015 (NFC).

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS Safety Data Sheets (SDS) in accordance with Section 01 35 43 - Environmental Procedures and 01 35 29.06 - Health and

Safety Requirements to Niagara Region for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Niagara Region that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.4 Hazardous waste classification: identify waste codes applicable to each hazardous waste material based on applicable federal and provincial acts, regulations, and guidelines. Waste profiles, analyses, and classification submitted to contract offices for review and approval.

.3 Sustainable Design Submittals:

.1 Spill response: establish spill response procedures. Comply with applicable requirements according to classification of waste material. Designate an emergency coordinator and emergency contacts for comprehensive emergency response and incident mitigation.

.2 Record keeping: contractor is responsible for maintaining adequate records of handling, storing, and shipping of hazardous materials.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.

.4 Storage and Handling Requirements:

.1 Co-ordinate storage of hazardous materials with Niagara Region and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada (NFC) requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Niagara Region.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.

.7 Solvents or cleaning agents: non-flammable or have flash point above 38 degrees C.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 When hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with Niagara Region.

.2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by provincial authorities to accept subject material.

.4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.

.5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

.6 Only trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide photocopy of shipping documents and waste manifests to Niagara Region.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Niagara Region.

.9 Report discharge, emission, or escape of hazardous materials immediately to Niagara Region and appropriate provincial authority. Take reasonable measures to control release.

.12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.13 Report spills or accidents immediately to Niagara Region. Submit a written spill report to Niagara Region within 24 hours of incident.

Part 2 Products

2.1 MATERIALS

.1 Description:

.1 Bring on site only quantities hazardous material required to perform Work.

.2 Maintain WHMISSafety Data Sheets (SDS) in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

.3 Spill Response Materials: provide spill response materials which can be used for absorbing/shoveling and containing hazardous materials.

.4 Provide personal protective equipment.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements and procedures for removal, encapsulation, disturbing, or enclosure of specified amounts of asbestos containing materials of the type described within.

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 SOR/2018-196 Prohibition of Asbestos and Products Containing Asbestos Regulations.

.2 .1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.205, Sealer for Application of Asbestos Fibre Releasing Materials.

.3 Health Canada/Workplace Hazardous Materials .1 Information System (WHMIS)

.1 WHMIS Safety Data Sheets (SDS).

.4 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 ADMINISTRATION REQUIREMENTS

.1 Comply with requirements of this Section when performing following Work:

.1 Removing more than 7.5 square metres of asbestos containing suspended ceiling tiles, as indicated.

.2 Removal of asbestos containing material from piping, equipment as indicated on drawings.

.3 Removal or disturbance of one square metre or less of friable asbestos containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment, or of a building.

.4 Enclosure of friable asbestos containing material.

.5 Application of tape or sealant or other covering to pipe and boiler insulation containing asbestos.

.6 Removal all or part of a false ceiling to obtain access to a work area, if asbestos containing is likely to be lying on the surface of the false ceiling.

.7 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating if:

.1 The material is not wetted to control the spread of dust or fibres, and the work is done only by means of non-powered hand-held tools.

.8 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at [locations indicated on drawings] if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.

.9 Removing more than one square metre of drywall in which joint-filling compounds that are asbestos containing materials have been used.

.10 Removing of asbestos containing material from a pipe, duct or similar structure using a glove bag.

.11 Cleaning or removing filters used in an air handling unit in a building that has sprayed-on asbestos containing fireproofing.

1.4 DEFINITIONS

.1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.2 Asbestos Containing Materials (ACMs): materials that contain provincial regulated amount per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

.4 Authorized Visitors: Niagara Region, or designated representatives, and representatives of regulatory agencies.

.5 Competent worker / person: in relation to specific work, means a worker who:

.1 Is qualified because of knowledge, training and experience to perform the work.

.2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.

.3 Has knowledge of all potential or actual danger to health or safety in the work.

.6 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.7 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.5 SUBMITTALS FOR REVIEW

.1 Submittals in accordance with Division 01.

.2 Submit proof satisfactory to Niagara Region that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.

.3 Submit Provincial and/or local requirements for Notice of Project Form.

.4 Submit proof of Contractor's Asbestos Liability Insurance.

.5 Submit to Niagara Region necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.

.6 Submit proof satisfactory to Niagara Region that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Niagara Region. Minimum of one supervisor for every ten workers.

.8 Submit Worker's Compensation Board status and transcription of insurance.

.9 Submit documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including:

.1 Encapsulants;

.2 Amended water;

.3 Slow drying sealer.

.10 Submit proof satisfactory to Niagara Region that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are to be located one site.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.

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

1.8 EXISTING CONDITIONS

.1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.

.2 Notify Niagara Region of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Niagara Region.

1.9 PERSONNEL TRAINING

.1 Before beginning Work, provide Niagara Region satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

Part 2 Products

2.1 MATERIALS

.1 Drop and Enclosure Sheets:

.1 Polyethylene: 0.15 mm thick.

.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.

.3 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Glove bag:

.1 The glove bag to be equipped with:

.1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.

.2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.

.3 A tool pouch with a drain.

.4 A seamless bottom and a means of sealing off the lower portion of the bag.

.5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.

.5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.7 Sealer: flame spread and smoke developed rating less than 50.

.8 Encapsulant: surface film forming or penetrating type conforming to **CAN/CGSB-1.205, and** ULC listed.

Part 3 Execution

3.1 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

.1 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.2 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.

.1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.

.2 Do not use compressed air to clean up or remove dust from any surface.

.3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.

.2 When removing suspended ceilings and walls themselves do not enclose work area and when removing asbestos containing material from piping or equipment and "glove bag" method is not used erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.

.4 Before removing suspended ceilings, remove friable material on upper surfaces using HEPA vacuum equipment.

.1 Remove and clean surfaces of ceiling panels using HEPA vacuum, wrap clean panels in 0.10 mm thick polyethylene, and store in building as directed by Niagara.

.2 Clean "T" grid suspension system, disconnect, wrap in 0.10 mm thick polyethylene, and store in building as directed by Engineer

.5 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.

.2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.6 Pipe Insulation Removal Using Glove Bag:

.1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:

.1 It may not be possible to maintain a proper seal for any reason including, without limitation:

.1 The condition of the insulation.

.2 The temperature of the pipe, duct or similar structure.

.2 The bag could become damaged for any reason including, without limitation.

.1 The type of jacketing.

.2 The temperature of the pipe, duct or similar structure.

.2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.

.3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.

.5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

.6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

.7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.

.8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

.7 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.8 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Niagara Region to take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with Provincial Occupational Health and Safety Regulations.

.2 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.3 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.

.4 Ensure that respiratory safety factors are not exceeded.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements and procedures for removal of lead based paints of the type described within.

.2 Removal of lead based paint from walls, ceilings and other painted surfaces by scraping or sanding using non-powered hand tools.

.3 Manual demolition of lead-painted plaster walls or building components by striking wall with sledgehammer or similar tool.

1.2 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Niagara Region or designated representative[s] and representatives of regulatory agencies.

.3 Occupied Area: areas of building or work site that is outside Work Area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows:

.1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic metre of air within Work Area.

.8 Competent person: individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.9 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

.10 Application Specialist: An individual who performs surface preparation and application of protective coatings and linings to steel and concrete surfaces of complex industrial structures.

1.3 REFERENCES

.1 Canadian Environmental Protection Act, 1999 (CEPA). Department of Justice Canada

.2 Workplace Hazardous Materials Information System (WHMIS), Safety Data Sheets (SDS). Health Canada

.3 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations. Human Resources and Social Development Canada (HRSDC)

.4 Transportation of Dangerous Goods Act, 1992 (TDGA). Transport Canada (TC)

.5 EPA 747-R-95-007-1995, Sampling House Dust for Lead. United States Environmental Protection Agency (EPA)

.6 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994). U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH).

.7 Lead in Construction Regulation - 29 CFR 1926.62-1993. Lead in Construction Regulation - 29 CFR 1926.62-1993. U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances.

.8 Lead on Construction Projects; Ontario Ministry of Labour, Immigration, Training and Skills Development, 2004. Province of Ontario

.9 Occupational Health and Safety Branch, Guideline Lead On Construction Projects, September 2004, and O. Reg. 490/09 respecting Designated Substances - Lead made under the Occupational Health and Safety Act as amended by O. Reg. 148/12 and O. Reg. 149/12. Province of Ontario

1.4 SUBMITTALS

.1 Provide proof satisfactory to Niagara Region that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide: Provincial and local requirements for Notice of Project Form.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:

.1 Provide Niagara Region necessary permits for transportation and disposal of lead based paint waste and proof that it has been received and properly disposed.

.2 Provide proof satisfactory to Niagara Region that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.

.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Niagara Region. Minimum of one supervisor for every ten workers.

.5 Product data:

.1 Provide documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

1.5 QUALITY ASSURANCE

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

.2 Health and Safety

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:

.1 Respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.

.2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.2 Requirements for workers:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.

.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.5 Ensure workers wash hands and face when leaving Work Area. Facilities for washing are located nearby on site.

.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

.8 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to Work Areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Division 01.

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

.1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.

.2 Notify Niagara Region of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Niagara Region.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Niagara Region copy of notifications prior to start of Work.

Part 2 Products

2.1 MATERIALS

.1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass-reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 Slow-drying sealer: non-staining, clear, water-dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

.5 Lead waste containers: type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

Part 3 Execution

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead based paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Niagara Region.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.3 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.4 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.

.5 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.6 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.

.7 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.

.8 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:

.1 CAUTION LEAD HAZARD AREA (25 mm).
NO UNAUTHORIZED ENTRY (19 mm).
WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).

.9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.10 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.11 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment .

.12 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.2 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.3 Separation of Work Areas from Occupied Areas

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply 9 plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.
Cover plywood with polyethylene sheeting and sealed with duct tape.

.4 Maintenance of Enclosures:

.1 Maintain enclosures in clean condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each work day.

.4 Use smoke test method to test effectiveness of barriers as directed by Niagara Region.

3.3 LEAD-BASE PAINT ABATEMENT

.1 Removal of lead based paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted plaster walls or building components by striking a wall with sledgehammer or similar tool.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by

wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean work area including equipment and access room, and equipment used in process. After inspection by Niagara Region, apply continuous coat of slow drying sealer to surfaces. Do not disturb work for 8 hours with no entry, activity, ventilation or disturbance during this period.

.6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Niagara Region will result in work stoppage, at no cost to Owner.

.2 Niagara Region will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs Niagara Regionmay order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

.1 Final lead surface sampling to be conducted as follows:

.1 After Work Area has passed a visual inspection for cleanliness approved by Niagara Region and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed. Niagara Region will perform lead wipe sampling in Work Area.

.1 Final lead wipe sampling results from horizontal and vertical surfaces where lead based paints have been removed must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples must be collected and analyzed in accordance with EPA 747-R-95-007.

.2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.

.5 Clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Niagara Region.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM A1064/A1064M-18a Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

.2 ASTM C73-17 Standard Specification for Calcium Silicate Brick (Sand-Lime Brick)

.2 CSA Group (CSA):

.1 CAN/CSA-A82:14, Fired Masonry Brick Made From Clay or Shale

.2 CSA A165 Series-14, CSA Standards on Concrete Masonry Units (Consists of A165.1 Concrete Block Masonry Units, A165.2 Concrete Brick Masonry Units, and A165.3 Prefaced Concrete Masonry Units)

.3 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry

.4 CAN/CSA-A370:14, Connectors for Masonry

.5 CAN/CSA A371-14, Masonry Construction for Buildings

.6 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement

.7 CSA S304-14, Design of masonry structures

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS)

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:

.1 SCAQMD Rule 1113-A2013, Architectural Coatings

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, product literature and data sheets for unit masonry products, mortar and grout, connectors, anchorage and reinforcing, and accessories. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Samples:

.1 Submit duplicate samples of each unit exposed in final construction for review and acceptance.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate full size samples of each type of masonry unit, mortar, connector, anchorage and reinforcing, and accessory.

.4 Sustainability Standards Certification:

.1 Submit manufacturer's certificates indicating conformity with specified product sustainability characteristics.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in a dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect masonry products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new ones.

.4 Packaging Waste Management: As specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 COLD WEATHER REQUIREMENTS

.1 Supplement requirements of CAN/CSA-A371 as follows:

.1 Maintain temperature of mortar between -5°C and 50°C until used.

1.6 HOT WEATHER REQUIREMENTS

.1 Supplement requirements of CAN/CSA-A371 as follows:

.1 Protect freshly laid masonry from drying too rapidly by using waterproof, non-staining coverings.

Part 2 Products

2.1 MASONRY UNITS

.1 Standard concrete block units: To CSA A165 (specifically CSA A165.1)

.1 Size: Modular.

.2 Special shapes: Provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

.2 Special fire resistant concrete block units: To CSA A165 (specifically CSA A165.1) as modified below:

.1 Classification: H/15/B/M except as modified by fire resistance requirements specified below.

.2 Fire resistant characteristics: Aggregate used in units and equivalent thickness of units to National Building Code of Canada (NBC)2020, for fire-resistance ratings indicated.

.3 Size: Modular.

2.2 REINFORCEMENT AND CONNECTORS

.1 Connectors (Anchors, Ties and Fasteners) and Horizontal Joint Reinforcement (Bars, Rods, Wire Fabric, Metal Embedded in Masonry) in accordance with CSA A370 and CSA A371.

.2 Corrosion protection and material compatibility:

.1 Fabricated connector parts from stainless steel in accordance with CSA A370 Level 3 corrosion protection.

.2 Connector parts made from same material to reduce risk of galvanic corrosion.

.3 Structural integrity and maximum permitted displacement in accordance with CSA A370.

2.3 REINFORCEMENT AND CONNECTORS

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

.2 Wire reinforcement: wire to CAN/CSA-A371 and ASTM A1064/A1064M, truss type.

.3 Connectors: To CAN/CSA-A370

.1 Corrosion resistance: To CAN/CSA-A370

.2 Ties:

.1 Conventional dovetail corrugated strip tie

.2 Conventional adjustable wire tie

.3 Anchors: As indicated on Drawings

.4 Repair anchors: Epoxy adhesive type to suit application.

2.4 MORTAR AND GROUT

.1 Mortar: To CAN/CSA-A179.

.1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.2 Colour: Ground coloured natural aggregates or metallic oxide pigments.

.2 Mortar Type:

.1 Exterior non-loadbearing walls and parapet walls: N based on proportion specifications.

.2 Interior non-loadbearing walls: Type N based on proportion specifications.

.3 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type M based on proportion specifications.

.4 Following applies regardless of mortar types and uses specified above:

.1 Mortar for stonework: Type N based on proportion specifications.

.2 Mortar for grouted reinforced masonry: Type S based on proportion specifications.

.5 Grout: To CAN/CSA-A179, Table 3.

2.5 ACCESSORIES

.1 Weep Holes: Flexible, ultraviolet resistant, cellular, honeycomb design, polypropylene co polymer type.

.1 Temporary protective masking cover on exposed surfaces before shipping.

.2 Cavity Screening: Three dimensional random weave plastic mesh, thickness to match cavity, minimum height three brick masonry courses.

.3 Anchor Bolts: 12 mm diameter x 150 mm long with embedded ends bent 50 mm at 90°, exposed ends threaded with washer and nut.

.4 Embedded Flexible Flashings: Self-adhering sheet 1.0 mm thick consisting of rubberized asphalt compound banded to high density cross laminated polyethylene film, complete with manufacturer's recommended primer.

.5 Loose Steel Lintels: In accordance with OBC, galvanized for exterior, prime painted for interior.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Niagara Region Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.

.1 Bond: Running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings with a minimum amount of cutting.

3.3 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

.2 Building-in:

.1 Install masonry connectors and reinforcement where indicated on drawings.

.2 Build-in items required to be built into masonry.

.3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.4 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Install loose steel lintels centred over openings where indicated, with minimum 200 mm end bearing.

.3 Concrete block lintels:

.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.2 End bearing: Not less than 200 mm as indicated on drawings.

.4 Support of loads:

.1 Use grout to CAN/CSA-A179 where grout is used in lieu of solid units.

.2 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

.5 Provision for movement:

.1 Leave 6 mm space below shelf angles.

.2 Leave 6 mm space between top of non-loadbearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers with provision for vertical movement.

.4 Build expansion and control joints where and as indicated.

.6 Interface with other work:

.1 Cut openings in existing work as indicated.

.2 Make good existing work. Use materials to match existing.

.7 Build-in flashings in masonry in accordance with CAN/CSA-A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated. Seal laps, penetrations and terminations to resist water penetration.

.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:

.1 For self-adhesive flashing, apply primer and firmly press sheet against backing. Lap under air-barrier membrane. Seal penetrations with recommended sealant or mastic. Installation shall be free of wrinkles, fish-mouths and punctures.

.2 Turned up end dams a minimum 50 mm high at ends of all flashings.

.3 For masonry backing, embed flashing 25 mm in joint.

.4 For concrete backing, insert flashing into reglets.

.5 For wood frame backing, staple flashing to walls behind sheathing paper.

.6 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm and seal with adhesive or mastic.

.8 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 610 mm on center.

.9 Place drainage mesh in cavity as indicated as construction progresses.

3.4 REINFORCING AND CONNECTING

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

3.5 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371, and as indicated.

.2 Tie masonry veneer to backing in accordance with : CAN/CSA-A371, CSA S304 and as indicated.

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 At new openings in masonry walls, remove units, clean and re-install rotated to conceal cut and expose finish surface.

.4 Clean bond areas of adjacent masonry to remain, remove loose material and prepare masonry to receive new masonry toothed in.

.5 Install reinforcement as necessary to provide continuity of reinforcing and stability between existing and new masonry work.

.6 Provide repair anchors as necessary to stabilize existing masonry adjacent to and affected by the Work.

3.7 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CAN/CSA-A179, CAN/CSA-A371.

3.8 GROUTING

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

3.9 ANCHORS

.1 Supply and install metal anchors as indicated.

3.10 LATERAL SUPPORT AND ANCHORAGE

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

3.11 SITE TOLERANCES

.1 Tolerances of CAN/CSA-A371 apply.

3.12 SITE QUALITY CONTROL

.1 Inspection and testing will be carried out by General Contractor through project Cash Allowance.

3.13 CLEANING

.1 Progress Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management:

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

.2 Return pallets to masonry manufacturer for re-use.

.3 Return surplus masonry materials to manufacturer for recycling or re-use.

3.14 PROTECTION

.1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect from wind-driven rain until masonry work is completed and protected by flashings or other permanent construction.

.2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.3 Repair damage to adjacent materials caused by masonry products installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Labour, Products, equipment and services necessary for load bearing metal studs Work in accordance with the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry: Rough wood blocking and wall sheathing.

.2 Section 07 26 00 - Vapour Retarders.

.3 Section 07 27 00 - Air Barriers.

.4 Section 09 21 16 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

.5 Section 09 22 16 - Non-structural Metal Stud Framing: Lightweight, non-load bearing metal stud framing.

1.3 DEFINITIONS

.1 Delegated Design Professional: The specialist or supporting design professional contracted to the contractor, fabricator or manufacturer to design and/or review specific building components or sub-components, and provide Shop Drawings and Delegated Design Submittals to meet the requirements of authorities having jurisdiction.

1.4 REFERENCE STANDARDS

.1 Specification D1.3/D1.3M:2018 Structural welding code - sheet steel

.2 ASTM A307-21 Standard specification for carbon steel bolts, studs, and threaded rod 60 000 PSI tensile strength

.3 ASTM F3125/F3125M-21 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, and metric dimensions 830 MPa and 1040 MPa minimum tensile strength

.4 ASTM F3125/F3125M-21 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, and metric dimensions 830 MPa and 1040 MPa minimum tensile strength

.5 ASTM A653/A653M-20 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.6 ASTM A792/A792M-21a Standard specification for steel sheet, 55% aluminum-zinc alloy-coated by the hot-dip process

.7 ASTM C954-18 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

.8 ASTM C955-18e1 Standard specification for cold-formed steel structural framing members

.9 CSA S16:19 Design of steel structures

.10 STD S136-16 North American specification for the design of cold-formed steel structural members

.11 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.12 CSA A370:14 Connectors for masonry

.13 CAN/CSA A371-14 Masonry construction for buildings

.14 STD S304-14 Design of masonry structures

.15 CSA W47.1:19 Certification of companies for fusion welding of steel

.16 STD W55.3-08 Certification of companies for resistance welding of steel and aluminum

.17 STD W59-18 Welded steel construction

.18 MANUAL 51-06 Lightweight steel framing design manual

.19 Maintenance repainting specification manual

.20 SSPC 16-01 Steel structures painting manual. Volume 1: good painting practice

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and installation requirements.

.3 Submit Shop Drawings(s) indicating:

.1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations, and warranties.

.2 Product transportation, storage, handling, and installation requirements.

.3 Member sizes, framing layout, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes, and spacing and anchors.

.4 Welds using CWB symbols, distinguishing between shop and field welds, and showing size, length and type of each weld.

.5 Setting diagrams, templates, instructions and directions for installation of components supplied by this Section to other Subcontractors and necessary for the completion of Work of this Section.

.4 Provide Shop Drawings stamped and signed by the Delegated Design Professional.

1.6 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in the province of Ontario, with experience in work of comparable complexity and scope, as described in this Section, to perform the following services:

.1 Design metal fabrication items as required to resist dead, live, lateral, wind and seismic loads in accordance with the Ontario Building Code.

.2 Structural design.

.3 Review, stamp and sign shop drawings.

.4 Conduct shop and Site inspections.

.5 Prepare inspection reports.

.2 Execute welding by firms certified in accordance with CSA W47.1.

.3 Ensure welding operators are licensed in accordance with CSA W47.1 for types of welding required by Work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Products shall be protected from conditions that may cause physical damage or corrosion.

Part 2 Products

2.1 MATERIALS

.1 Steel: in accordance with CAN/CSA S136, fabricated from ASTM A653/A653M, Grade A to D steel.

.2 Thicknesses of framing members specified is exclusive of galvanized coating.

.3 Zinc galvanized coating: in accordance with A653M, with Z275 designation zinc coating.

.4 Configuration and cutouts: in accordance with CAN/CGSB 7.1, centres of cutouts minimum 300 mm from stud ends.

.5 Welding materials: in accordance with CSA W59 and certified by the Canadian Welding Bureau.

.6 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion-protected to minimum requirements of CSSBI. Screws shall have a minimum coating thickness of 0.008 mm of zinc. Other coatings providing equal or better corrosion protection may be used.

.7 Anchors: concrete expansion anchors or other suitable drilled type fasteners, hot dipped galvanized in accordance with CAN/CSA G164, 600 g/m² zinc coating.

.8 Bolts, nuts, washers: Hot dipped galvanized in accordance with CAN/CSA G164, 600 g/m² zinc coating.

.9 Welding materials: In accordance with CSA W59.

.10 Touch-up primer: Refer to Section 09 91 23, Painting and Finishing Schedule - EXT-MISC and INT-MISC.

2.2 STEEL STUDS DESIGNATIONS

.1 Colour code steel studs in accordance with CSSBI 51, Lightweight Steel Framing Design Manual.

2.3 METAL FRAMING

.1 Minimum steel thicknesses of framing elements: per engineered shop drawings.

.1 Steel studs: In accordance with CAN/CSA S136, fabricated from zinc coated steel, depth as indicated.

.2 Stud tracks: Fabricated from same material and finish as steel studs, depth to suit.

.3 Bridging: Fabricated from same material and finish as studs, 38 mm x 12 mm.

.4 Angle clips: Fabricated from same material and finish as studs, 38 mm x 38 mm x depth of steel stud.

.5 Tension straps and accessories: As recommended by the manufacturer.

Part 3 Execution

3.1 GENERAL

.1 Do Work in accordance with CSSBI 51 guidelines and the recommendations of CSSBI S5: Guide Specifications for Wind Bearing Steel Studs.

.2 Fabrication and erection shall conform to the engineered shop drawings. Modifications required to accommodate as-built conditions (other than minor dimensional changes) shall be submitted to APP for review.

3.2 FASTENERS AND WELDS

.1 3.2.1 Insure that connected parts are in contact. Provide clamping before installing screws as required.

.2 Sheet metal screws shall be not less than a #8 size, and as recommended by the stud framing manufacturer.

.3 Penetration of sheet metal screws beyond joined materials shall be more than three exposed threads.

.4 Sheet metal screw thread types, drilling capability and installation shall conform to the manufacturer's recommendations.

.5 Sheet metal screws covered by sheathing materials shall have low profile heads.

.6 Install concrete expansion anchors in accordance with manufacturer's recommendations. Anchor framing to structure with concrete drilled anchors and sleeves, maximum spacing shall be 400 mm on centre, or as otherwise indicated on engineered shop drawings. Anchor bolt lengths shall not be less than 80 mm long, and 12 mm in diameter. Ensure full embedment in concrete slab.

.7 Companies engaged in welding shall be certified by the Canadian Welding Bureau in accordance with CSA W47.1. Companies shall have welding procedures approved and welders qualified for the base material types and thicknesses that are to be welded.

.8 Welds shall be in accordance with CSA S136, CSA W59 and ANSI/AWS D1.3/D1.3M, whichever is applicable.

.9 For material less than 3 mm thick, the effective throats of welds shall not be less than the thickness of the thinnest connected part.

.10 Touch-up welds and coatings damaged by welding with zinc rich paint. Prior to touching up, prepare the surface in accordance with the paint manufacturer’s recommendations.

3.3 ERECTION

.1 3.3.1 Anchor tracks securely to structure at 800 mm o.c. maximum, unless lesser spacing is indicated on the engineered shop drawings.

.2 Erect steel studs 400 mm on centre, or as otherwise indicated on the engineered shop drawings.

.3 Erect studs plumb, aligned and securely attached with two screws, minimum.

.4 Seat studs into bottom tracks and top track.

.5 Install 50.0 mm minimum telescoping track at top of walls where required to accommodate vertical deflection. Nest top track into deflection channel a minimum of 30.0 mm and a maximum of 40.0 mm. Do not fasten tracks together. Stagger joints.

.6 Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

.7 Brace steel studs with horizontal internal bridging at 1200 mm maximum, or as otherwise indicated on the shop drawings. Fasten bridging to steel clips fastened to steel studs with screws.

.8 Frame openings in stud walls to carry loads adequately by use of additional framing members and bracing as required.

.9 Provide cutouts centred in the webs of members to accommodate services and through the knockout style of bridging.

3.4 ERECTION TOLERANCES

.1 Out of plumbness shall not exceed 1/250th of member length.

.2 Out of straightness (camber and sweep) shall not exceed 1/500th of member length.

.3 Spacing shall not be more than 3.0 mm from design spacing.

.4 Gap between end of stud and track web: Not more than 4.0 mm.

3.5 CUTOUTS

.1 Maximum size of cutouts for services as follows:

.2 Member Depth (mm) Across Member Depth (mm) Along Member Length (mm) Centre to Centre Spacing (mm)

.3

Member Depth (mm)	Across Member Depth (mm)	Along Member Length (mm)	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

.4 Limit the distance from the centerline of the last unreinforced cutout to the end of the member to less than 300 mm.

3.6 INSPECTION

.1 The contractor’s structural engineer shall provide periodic field review during construction and shall submit reports as specified. Field review shall include review of mill test reports, welded and screwed connections, connections to the main structure, member sizes, location and material thickness, coating thickness, erection tolerances and field cutting.

.2 The cost of this field review shall be paid for by the Contractor.

.3 At the election of APP, additional inspection and testing of materials and workmanship may be carried out by a qualified independent inspection agency appointed by APP.

.4 The Contractor shall provide the necessary co-operation and access required to ensure that inspections can proceed.

.5 The inspection provided does not relieve the Contractor of its responsibility for the performance of the Contract. The Contractor is solely responsible for quality control and shall implement its own supervisory and quality control procedures.

.6 The Contractor cannot rely on timely discovery and reporting of defective Work. Materials or workmanship not conforming to the requirements of the Contract may be rejected at any time during the progress of the Work at no cost to APP, even if the Contractor has to destroy and rebuild other Work as a result.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Labour, Products, equipment, and services necessary for rough carpentry Work in accordance with Contract Documents.

1.2 REFERENCE STANDARDS

.1 ANSI A135.4-2020 - Basic Hardboard.

.2 ASTM A123/A123M-17 Standard specification for zinc (hot-dip galvanized) coatings on iron and steel products

.3 ASTM A153/A153M-16a Standard specification for zinc coating (hot-dip) on iron and steel hardware

.4 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.5 ASTM A653/A653M-20 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.6 ASTM D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.

.7 ASTM F1667, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.8 CAN/CGSB 11.3-M87 Hardboard

.9 CAN/CGSB 51.32-M, Sheathing, Membrane, Breather Type.

.10 Canadian plywood handbook

.11 CSA O80 SERIES:21 Wood preservation

.12 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.13 CAN/ULC-S706.1-2020 - Standard for Wood Fibre Insulating Boards for Buildings.

.14 STD O121-17 Douglas fir plywood

.15 STD CSA O141, Softwood Lumber.

.16 STD O151-17 Canadian softwood plywood

.17 CSA O153:19 Poplar plywood

.18 CSA O325:21 Construction sheathing (adopted NIST PS 2-18, with Canadian deviations)

.19 STD O437 SERIES-93 Standards on OSB and waferboard

.20 Standard grading rules for Canadian lumber

.21 STD A208.1-2016 Particleboard

.22 National Lumber Grades Authority (NLGA), Standard Grading Rules for Canadian Lumber

1.3 QUALITY ASSURANCE

.1 Lumber identification: Grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: Grade mark in accordance with applicable CSA standards.

.3 Each fire retardant treated board to bear ULC label indicating Flame Spread Classification (FSC), and smoke developed.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Store plywood panels flat and level.

.3 Keep finish faces inward and cover stacks to protect from bumping and abrasion.

.4 Protect tongue and groove plywood panel edges and corners.

.5 Protect panels from sunlight, water or excessive humidity.

.6 Protect materials from excessive moisture and weather during transit, storage, and erection.

.7 At Site storage:

.1 Wrap material with moisture resistant covers.

.2 Store in dry, ventilated indoor area, and off the ground.

Part 2 Products

2.1 GENERAL

.1 Lumber:

.2 Softwood, G4S, moisture content 19% or less at time of installation, in accordance with the following:

.1 CSA O141 and NLGA Standard Grading Rules for Canadian Lumber.

.2 Board quality, dimension sizes, and post and timber sizes: Standard or better.

.3 Lumber quality:

.1 Carefully select individual pieces with no knots and defects which can interfere with bolt placement, nailing, and connections.

.4 Lumber defects:

.1 Discard wood with defects not suited to serve the intended function.

.2 Reject lumber with excessive warps, twists, bows, crooks, mildew, fungus, mould, improper cutting, and fitting.

.5 Furring, blocking, nailing strips, grounds, bucks, and backing:

.1 G2S, kiln dried with moisture content 19% or less at time of installation, free from sap, shakes, splits, knots, and in accordance with the following:

.2 CSA O141 and NLGA, Standard Grading Rules for Canadian Lumber.

.3 Board quality: Construction or better.

.4 Dimension sizes: Construction light framing or better.

.5 Post and timber sizes: Construction or better.

.6 Curbs, blocking, cants, parapets, fascia, and sleepers in conjunction with roof system:

.1 In accordance with CAN/CSA O80 Series, Jack Pine, Grade No. 2 or better, pressure treated with CCA salt preservative.

.7 Plywood:

.1 In accordance with CSA O121, G1S standard construction, exterior grade, laminated with waterproof adhesive.

.8 Fire-retardant treated plywood:

.1 Impregnated with fire-retardant chemicals in accordance with CAN/CSA O80 Series to meet OBC requirements for flame spread index <25 and smoke development index <50, and tested in accordance with CAN/ULC-S102.

.9 Nails, spikes, and staples:

.1 In accordance with ASTM F1667: Spiral type.

.10 Bolts:

.1 In accordance with ASTM A325, 12.7 mm dia. minimum, with nuts and washers unless noted otherwise.

.11 Proprietary fasteners:

.1 Toggle bolts, expansion shields, lag bolts, screws, and inorganic fibre plugs as recommended by the manufacturer.

.12 Wood screws:

.1 Countersunk head, full thread type.

.13 Hot-dip galvanizing:

.1 In accordance with ASTM A153/A153M, Class A.

.2 Electroplated galvanized fastener is not permitted.

2.2 FIRE RETARDANT PRESSURE TREATMENT OF LUMBER AND PLYWOOD

.1 General:

.1 Treat by pressure impregnation with fire retardant chemicals:

.1 In accordance with CAN/CSA O80 Series M. In accordance with CAN/ULC-S102, flame spread of maximum 25.

.2 Treatment: Dricon Fire Retardant Treated, manufactured by Arch Wood Protection Canada Corp., Lonza Group Ltd. or licensed producer Trent Timber Treating Ltd.

.2 Each piece or bundle of fire retardant treated material or panel:

.1 Bear ULC inspection label or stamp attesting to FRC rating indicating flame spread, smoke developed, and fuel contributed classification.

.3 Bear ULC inspection label or stamp attesting to FRC rating indicating flame spread, smoke developed, and fuel contributed classification.

.4 Indicate exterior type within ULC inspection label or stamp for application exposed to weather or damp or wet locations and tested in accordance with ASTM D2898.

.5 Fire retardant chemicals used to treat lumber to comply with CAN/CSA O80 and be free of halogens, sulphates, and ammonium phosphate.

.6 Carbon steel, galvanized steel, aluminum, copper, and red brass in contact with fire retardant treated wood to exhibit corrosion rates less than 0.0254 mm (1 mil) per year.

.7 Provide colour dye identification in chemical treatment for treated wood concealed in final Work.

2.3 PRESSURE PRESERVATIVE TREATED MATERIALS

.1 Pressure preservative treated lumber:

.1 Lumber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Accreditation Board in accordance with CAN/CSA O80.20M.

.2 Species: Pine or spruce pine.

.3 Grade: No. 2 or better structural posts and lumber, in accordance with NLGA, paragraph 131C. Pieces grade stamped or shipment certified by letter of compliance.

.4 Material with twisted grain or structural defects affecting integrity of lumber is not permitted.

.5 Material with radius edges, minimum 6 mm.

.6 Kiln dry lumber materials to maximum of 8% moisture content.

.2 Pressure preservative treated plywood:

.1 Treated in accordance with CAN/CSA O80.9M, using water-borne preservative to obtain minimum net retention of 4 kg/m³ of wood.

.2 Plywood or laminated materials to be manufactured with exterior grade adhesives.

.3 After treatment, plywood kiln dried to maximum of 8% moisture content.

.3 Surface applied wood preservative:

.1 Green coloured copper naphthenate or 5% pentachlorophenol solution, water repellent preservative or same CCA preservative as used for shop impregnation, in accordance with CAN/CSA O80 Series.

.4 Oil borne treatment:

.1 Use for wood in contact with ground and freshwater (for example, landscaping timbers, retaining walls, piers or docks, pilings, and bases of utility poles or fence posts).

.5 Water borne treatment:

.1 Use for wood in contact with masonry or concrete, within 450 mm of grade, wood decking and fence boards, and some types of wood in contact with roofing, flashing, or waterproofing.

.6 Confirm compatibility of preservative treated wood with roofing, flashing, or waterproofing material before use.

.7 Sheathing paper: If required, provide sheathing paper in accordance with CAN/CGSB 51.32-M.

Part 3 Execution

3.1 INSTALLATION

.1 Fit and install wood furring, strapping, grounds, and blocking.

.2 Adequately size, correctly place, and conceal members for finishes, fitments, and for Work under other Sections. Anchor wood members securely in place.

.3 Install rough bucks, nailing strips, and linings to rough openings as required for backing for frames and other Work.

.4 Bolt wood blocking or nailing strips to steel framing.

.5 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.2 BACKBOARDS

.1 Install backboards, primed and painted white on both sides, with fire retardant paint.

.2 Use minimum 19 mm thick fire retardant treated plywood on 19 mm x 38 mm furring around perimeter and at 300 mm maximum spacing for intermediate furring.

.3 Install backboards as indicated on Contract Drawings.

.4 Erect backboards with long dimension at right angles to supports.

.5 Locate end joints over supporting members.

.6 Install backboards to produce "hairline" joints with allowance for expansion and contraction of plywood sheets.

3.3 ROOF WOODWORK

.1 Wood exposed to weather and water:

.1 Use pressure preservative treated material.

.2 Do not use preservative treated materials on roofs with SBS bituminous membranes and flashings.

.2 Construct wooden roof curbs around openings in roof for vents, ducts, and flues.

.1 Curbs: Minimum 200 mm above roof membrane.

.2 Base for curb: Same thickness as insulation.

.3 Form sloped tops to wood parapet plates and wood upstands, more than 38 mm wide, to roofs to receive metal flashings.

.1 Tops slope: Minimum 1 in 12.

.2 If details are at variance, notify Niagara Region prior to construction and obtain further instruction.

.4 Provide continuous wood backing for flashings.

.5 Provide solid wood or plywood sheathing and backing, to receive membrane and metal flashings, to roofer's requirements in accordance with CRCA Roofing Specifications Manual.

.6 Fasten plywood sheathing securely to walls of parapets with mechanical fasteners. Nails are not permitted.

.7 Construct framing and blocking for membrane control joints as detailed, in accordance with CRCA Roofing Specifications Manual.

.8 Install 89 mm x 89 mm wood cant strips in lengths maximum 2440 mm, where indicated on Contract Drawings or where required.

.9 Anchor plates for fixing cant strips at 1220 mm maximum o.c. and 150 mm maximum from ends of each piece.

.10 Install continuous wood nailers around roof perimeters, curbs, and roof openings larger than 150 mm x 150 mm, and at edges of insulation as detailed. Install cut cant strips and continuous nailers on copings and curbs as detailed.

.11 Install wood backing, dressed, tapered, and recessed slightly below top surface of roof insulation and roof hopper.

3.4 FASTENERS

.1 Frame, anchor, fasten, tie, and brace members for required strength and rigidity.

.2 Use hot-dipped galvanized fasteners for exterior Work, Work below grade, and for pressure treated lumber.

.3 Countersink bolts and bolt heads as required for clearance of other Work.

.4 Size fasteners to penetrate base member by half of fastener length minimum. Minimize splitting of wood members by staggering nails in direction of grain.

.5 For plywood use spiral, annular, or resin coated nails and staples.

3.5 SURFACE-APPLIED WOOD PRESERVATIVE

.1 Treat raw surfaces, drilled holes, and cut ends of pressure treated wood with two coats of wood preservative immediately after cutting.

.2 Apply preservative by dipping, brush or pouring into plugged holes to completely saturate surface.

3.6 FIRE RETARDANT PESSURE TREATMENT

.1 Provide fire retardant pressure treatment of wood against fire in compliance with CAN/CSA O80 for lumber and plywood. Kiln dried after treatment to required moisture content. Pressure treat fire retardant lumber prior to final milling.

.2 Provide ULC or WH-ETL label for treated lumber and plywood as received from pressure treating plant. Do not expose pressure treated material to dampness between time material treated and time finish applied.

.3 Carefully sand surfaces which show surface salt deposits to remove such deposits before finish is applied.

.4 Provide required identification of compliance for materials delivered to Site, on each large item and on bundles of small items.

.5 Minimize reworking of fire retardant treated wood. Re treat surfaces exposed by cutting, trimming, or boring with fire retardant chemical before installation to requirements of labelling authority and authorities having jurisdiction.

3.7 MISCELLANEOUS CARPENTRY WORK

.1 Provide rough carpentry indicated on Contract Drawings and as required to complete the Work.

.2 Cooperate with other trades in installing items supplied by other Sections. Cut openings in woodwork when required, and make good disturbed surfaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Board and plywood panelling.

.2 Shelving.

.3 Fasteners and adhesives.

.4 Wood treatment.

.5 Cabinetry

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry: Grounds and support framing.

.2 Section 09 91 23 - Interior Painting

1.3 REFERENCE STANDARDS

.1 ANSI A135.4-2020 - Basic Hardboard.

.2 ANSI/BHMA A156.9-2015 Cabinet hardware

.3 CSA O80 SERIES:21 Wood preservation

.1 CSA-O80.1-15 - Specification for Treated Wood.

.2 CSA-O80.3-15 - Preservative Formulations.

.4 CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.5 STD O121-17 Douglas fir plywood

.6 CSA O141:05 Softwood lumber

.7 STD O151-17 Canadian softwood plywood

.8 CSA O153:19 Poplar plywood

.9 CHPVA (Canadian Hardwood Plywood and Veneer Association).

.10 STD A208.1-2016 Particleboard

.11 STD A208.2-2016 Medium density fiberboard (MDF) for interior applications

.12 NEMA LD 3-2005 High-pressure decorative laminates (HPDL)

.13 NHLA (National Hardwood Lumber Association)

.14 Standard grading rules for Canadian lumber

.15 HPVA (Hardwood Plywood and Veneer Association)

.1 STD ANSI/HPVA HP-1-2020 American national standard for hardwood and decorative plywood

1.4 DESIGN REQUIREMENTS

.1 Performance Requirements: Ensure millwork is capable of supporting structural loads without deflection.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on fire retardant treatment materials and application instructions.

.3 Shop Drawings:

.1 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

.2 Product transportation, storage, handling, and installation requirements.

.3 Indicate materials, component profiles, fastening methods, jointing details, accessories to a suitable scale for construction dwgs.

.4 Materials, thicknesses, sizes, finishes, hardware, wood species, profiles, connection attachments, shop jointing, field jointing, reinforcing, anchorage, fastener types and sizes, special installation conditions, mechanical and electrical service routes, cutout locations, and sizes. Include erection Drawings, plans, elevations, sections, and details as applicable.

.5 Provide instructions for hardware attachment.

.4 Samples:

.1 Submit two (2) samples of each species and cut of wood specified, 300 x 300 mm in size illustrating wood grain and specified finish.

.2 Submit two (2) samples of wood trim 300 mm long.

.3 Submit two (2) of each colour, pattern, and texture of decorative laminate, in manufacturer's standard tag size.

.4 Submit two (2) of each solid surface, in 100 mm x 75 mm x 10 mm samples.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.7 QUALITY ASSURANCE

.1 Forest Certification: Provide materials produced from wood obtained from forests certified by an FSC-accredited certification body for the following wood products.

.1 Standing and running trim.

.2 Plywood and Board panelling.

.3 Wood shelving.

.2 Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).

.1 Fire Retardant Treated Wood (FRTW): Certified and labelled by ULC.

.3 Execute Work of this Section by member of AWMAC with 5 years' experience in finish carpentry work of comparable complexity and scope.

.4 Fabricate finish carpentry Work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Premium Grade materials, and installation.

.5 Perform Work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, First-Class Workmanship

.6 Remove and replace finish carpentry Work not meeting AWI/AWMAC/WI Architectural Woodwork Standards requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver, store, and handle finish carpentry in accordance with AWMAC Quality Standards.

.3 Deliver materials only when area of operation enclosed, and adjacent work is dry and broom clean.

.4 Maintain indoor temperature and humidity within range recommended for location of the project.

.1 Control temperature and humidity in accordance with AWMAC recommendations, before, during, and after finish carpentry delivery, and during storage and installation.

.5 Protect work from moisture damage.

.6 Provide suitable protective covering material for decorative laminate items. Take special precautions at corners.

.7 Protect materials against dampness during and after delivery.

.8 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.

Part 2 Products

2.1 LUMBER MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC custom premium grade, moisture content as specified.

.2 Machine stress-rated lumber is acceptable.

.3 Hardwood lumber: moisture content 10 % or less in accordance with following standards:

.1 National Hardwood Lumber Association (NHLA).

.2 2.1.1.2.1 In accordance with AWI/AWMAC/WI Premium Grade, moisture content requirements for designated grade.

.4 Solid wood used in conjunction with plywood of same species as adjacent veneer and match adjacent.

2.2 WOOD FACE VENEER

.1 Uniform, clean veneer without open defects or characteristics detrimental to appearance.

.2 Species specified or indicated:

.1 Flat cut to match reviewed samples, minimum 0.8 mm thick.

.2 Selected architectural quality with respect to cutting lengths, uniformity of colour, figure grain, and character.

.3 High finished appearance standard.

.4 Unsuitable veneer includes:

.1 Mineral streaks, discolouration, grain ruptures, loose texture, doze, and shakes.

.2 Contains open joints, face depressions, glue stains, patches, plastic repairs, other manufacturing irregularities, and defects.

.5 Piece veneers parallel clipped, jointed by tapeless splicer, and edge glued.

.6 Panels and doors continuous matched vertically and book matched horizontally.

2.3 SOFTWOOD PLYWOOD

.1 In accordance with CSA O151, 19 mm unless indicated otherwise, G2S.

2.4 HARDWOOD PLYWOOD

.1 In accordance with ANSI/HPVA HP-1.

.1 Exposed faces – transparent finish: Good, Sequence Matched (Architectural Grade) Hard Maple.

.2 Exposed faces – painted finish: Good Grade (G) veneer.

.3 Unexposed faces: Sound Grade (SO) Birch Veneer

.2 Belt sand faces.

2.5 MEDIUM DENSITY FIBREBOARD (MDF)

.1 In accordance with ASTM D1037 and ANSI A208.2, Premium Grade for interior use.

.2 Density: Minimum 700 kg/m³.

.3 Formaldehyde emissions: Maximum 0.30 ppm per 0.424 m2/m3 of room volume.

2.6 WOOD MOULDINGS

.1 Provide interior millwork in accordance with Architectural Woodwork Standards, Section 6 for profiles and configurations required for Contract, and as follows:

.2 Hardwood trim:

.1 In accordance with Architectural Woodwork Standards Premium Grade.

.2 Kiln dried. Species white maple finished lumber (S4S), selected for compatible grain and colour.

.3 Edge grain (vertical).

.4 Suitable for clear finish in profiles as indicated on Contract Drawings and for:

.1 Window and door casings

2.7 PLASTIC LAMINATE MATERIALS

.1 High-pressure decorative laminate (HPDL):

.1 In accordance with ANSI/NEMA LD 3, decorative surface papers impregnated with melamine resins, and pressed over kraft paper core sheets impregnated with phenolic resin.

.2 Sheets bonded together under minimum pressure 6895 kPA (1000 lbs. per sq. in.) and high temperatures approaching 149°C. Finished sheets trimmed and backs sanded to facilitate bonding to substrate.

.3 2.1.11.1.3 Type: Colour through as indicated.

.2 Unless otherwise specified, use:

.1 General purpose type:

.1 Horizontal (HGS) sheet thickness: Minimum 1.2 mm (0.048").

.2 Vertical (VGS) sheet thickness: Minimum 0.7 mm (0.028”).

.2 Cabinet liner type (CLS):

.1 Colour: Non-decorative, white.

.2 Sheet thickness: 0.5 mm (0.020”).

.3 Decorative laminate:

.1 Colour: As selected by Niagara Region from manufacturer’s full range.

.2 Pattern: As selected by Niagara Region from manufacturer’s full range.

.3 Surface finish (texture): Suede.

.4 Manufacturer(s):

.1 Arborite.

.2 Wilsonart.

.3 Panolam.

2.8 SOLID SURFACING

.1 Cast, non-porous, filled polymer, non-coated, laminated, or composite construction, with through-body colours in accordance with ANSI Z124.3 or ANSI Z124.6.

.2 Superficial damage to depth 0.25 mm, repairable by sanding and polishing.

.3 Thickness: 13 mm horizontal and 6 mm vertical, except 35 mm minimum at counter edges.

.4 Colour and finish: As selected by Niagara Region from manufacturer's full range.

.5 Solid surfacing seam adhesives: As recommended by solid surfacing manufacturer, colour matched to solid surfacing.

.6 Manufacturer’s Product(s):

.1 Dupont Corian by Dupont Canada Inc..

.2 Wilsonart Solid Surfacing by Wilsonart Canada, a division of Wilsonart Canada LLC.

2.9 ADHESIVE

.1 Adhesive: Type recommended by laminate manufacturer to suit application.

2.10 FASTENERS

.1 Fasteners: Nails, screws, and anchoring devices, galvanized steel, of size and type to suit application.

.1 Galvanized Coating for Treated Wood: Hot dip galvanized to ASTM A153/A153M.

.2 In accordance with ANSI/ASME B18.6.1 stainless steel othewise.

.2 Draw Bolts and Splines: In accordance with fabricator’s recommendations.

2.11 HARDWARE

.1 Drawer slides:

.1 Full extension slides, complete with front and rear mounting brackets.

.2 Manufacturer’s Product(s):

.1 230M STANDARD by Blum Canada Ltd.

.2 8400 Box/File Drawer Slide - Full Extension by Knape & Vogt Canada Inc.

.2 Pilasters:

.1 Clear anodized aluminum recessed shelf standards with 13 mm divisions.

.2 Manufacturer's Product(s):

.1 255AL Series Aluminum Pilaster Standards by Knape & Vogt Canada Inc.

.2 62162552G Pilaster by Richelieu Hardware.

.3 Clips:

.1 Bright zinc-plated, adjustable height shelf supports.

.2 Manufacturer's Product(s):

.1 256 Pilaster Supports by Knape & Vogt Canada Inc.

.2 2562G Pilaster Shelf Clip by Richelieu Hardware.

.4 Standards and brackets (adjustable):

.1 Stainless steel, single slot design with 51 mm vertical slot adjustability.

.5 Cabinet hinges:

.1 Heavy-duty, concealed "European" type.

.2 Manufacturer's Product(s):

.1 110 degree, clip, self-closing, CLIP top Series, 71T3550 by Blum Canada Ltd.

.2 8711515 Inset Hinge 110° by Richelieu Hardware.

.6 Drawer and cabinet pulls:

.1 Finish: Aluminum.

.2 Size: 8 mm dia. x 90 mm wide.

.3 Manufacturer's Product(s):

.1 Model CBH 220 by Canadian Builders Hardware Mfg. Inc.

.2 37 Wire Pull by Ives Division Leigh Products Inc. a part of Allegion Canada Inc.

.7 Magnetic catches:

.1 Pull strength: 2.27 kg (5 lbs) to 5 kg (11 lbs).

.2 Finish: Aluminum.

.3 Manufacturer's Product(s):

.1 No. 9783AL by Amerock, a part of The Piedmont Hardware Group.

.2 918 Magnetic Catch by Knape & Vogt Canada Inc.

2.12 ACCESSORIES

.1 Lumber for Blocking: Softwood lumber.

.2 Primer: Alkyd primer sealer type.

.3 Wood Filler: Solvent based, tinted to match surface finish colour.

2.13 WOOD TREATMENT

.1 Wood Preservative (Pressure Treatment): CAN/CSA-O80, and in accordance with Table 2 - Use Categories for Specific Products, Uses, and Exposures of CSA-O80.1.

.1 UC2: Interior construction, above-ground and potentially damp applications; use inorganic boron (SBX) preservative.

.2 Wood Preservative (Surface Application): CSA-O80.3, copper naphthenate.

.3 Fire retardant (FRT): CAN/CSA-O80, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 25/50, to CAN/ULC-S102.

2.14 FABRICATION DECORATIVE LAMINATE WORK

.1 Perform Work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.

.2 Identify components for grain matching during site installation.

.3 Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.

.4 Locate counter butt joints minimum 600 mm from sink cut-outs.

.5 Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

.6 Cap exposed edges with chamfered decorative laminate edge banding to match adjacent colour, finish, and pattern.

2.15 FABRICATION SOLID SURFACING WORK

.1 Fabricate units by solid surfacing manufacturer's certified fabricator/installer in accordance with manufacturer’s recommendations.

.2 Fabricate components in shop to greatest extent practical.

.3 Form joints between components using manufacturer’s standard joint adhesive. Joints to be inconspicuous in appearance and without voids.

.4 Fabricate built-up thermally formed profiles as indicated.

.5 Integrate sinks of sizes and in locations indicated.

.6 Rout and finish component edges to smooth, uniform finish.

.7 Surfaces in final assembly: Uniform colour and finish.

2.16 FABRICATION CASEWORK

.1 In accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 10, Premium Grade, and as detailed on Contract Drawings.

.2 Lumber and sheet Products used: In accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 3 and 4.

.3 Shop assemble finish carpentry to accommodate delivery and handling, and ensure passage through building openings.

.4 Coordinate locations of concealed supports and blocking with other parts of Work.

.5 Conceal joints and connections in casework, wherever possible.

.6 Design and construct shelving to support designed live load with deflection not exceeding 1/240 of span. Recess shelf standards, unless noted otherwise. Stagger recessed shelf standards on opposite sides of divider.

.7 Do not exceed maximum 750 mm unsupported span for 19 mm thick shelving. House fixed shelving into gables and divisions.

.8 Fabricate removable plywood access panels, finished to match adjacent surfaces, where necessary for access to concealed wiring or piping.

.9 Fabricate, restrain, and meet seismic requirements.

.10 Concealed edgeband: Maximum 1.6 mm (1/16”), show on face and edge of plywood and particleboard.

.11 Wood casework:

.1 Solid maple wood faces (Exposed Interior and Semi-Exposed Surface) finish: Transparent.

.2 Concealed Surface: In accordance with manufacturer’s standard finish.

.12 Decorative laminate casework:

.1 HPDL faces (Exposed Interior and Semi-Exposed Surface) finish: colour and finish as selected by Niagara Region from manufacturer's full range.

.2 Concealed Surface: In accordance with manufacturer’s standard finish.

.13 Door and drawer front profiles:

.1 Retention fixed panel profiles in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 10.

.14 Construction:

.1 Type B in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 10.

.2 Cabinet and door interface style:

.1 Style 1: Flush overlay.

.15 Adjustable shelf loading and deflection:

.1 Load: Maximum 90.7 kg on 1 shelf.

.2 Deflection: L/144.

.16 Cabinet hardware:

.1 In accordance with ANSI/BHMA standards, Grade 1.

2.17 COUNTERTOP

.1 In accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 11, Premium Grade, and as detailed on Contract Drawings.

.2 Lumber and sheet Products used: In accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 3 and 4.

.3 Fabricate, restrain, and meet seismic requirements.

.4 Surface:

.1 Chemical resistance in accordance with ANSI/NEMA LD 3 and stain resistance in accordance with ASTM D3023, and ASTM C1378.

.2 Abrasion resistance in accordance with ASTM C501.

.5 Concealed edgeband:

.1 Maximum 1.6 mm (1/16”), show on face and edge of plywood and particleboard.

.6 Built up edge with coved splash.

.7 Top of splash: Square.

.8 Deck at splash: Coved.

.9 Front Edge: No Drip.

2.18 SITE FINISHING

.1 Apply wood filler in exposed nail indentations; sand smooth.

.2 On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

.3 Seal surfaces in contact with cementitious materials.

.4 Site finish with materials and methods as specified in Section 09 91 23.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify adequacy of backing and support framing.

.3 Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

.4 Commencement of Work means acceptance of existing conditions.

3.2 INSTALLATION

.1 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

.4 Install materials and components in place, plumb and level, with tight hairline joints and aligned with adjacent materials; provide concealed shims where necessary for proper alignment.

.5 Carefully scribe work abutting other components, with maximum gaps of 1 mm. Do not use additional overlay trim to conceal larger gaps.

.6 Install panelling materials to manufacturer's instructions, with manufacturer's recommended panel adhesive and fasteners, spaced to manufacturer's recommendations.

.7 Countersink fasteners, fill indentations with wood filler or plugs, flush with surface, and sand smooth. For transparent finishes, match filler and plugs to wood material.

.8 Apply plastic laminate finishes where indicated; apply laminate backing sheet on reverse side of plastic laminate finished surfaces.

.9 Solid surfacing:

.1 Install components plumb and level in accordance with reviewed Shop Drawings and manufacturer's recommendations.

.2 Use largest practicable component sizes.

.3 Provide joints where required, at corners, and at changes in surface areas.

.4 Use manufacturer's recommended adhesives and colour to match sealants.

.5 Butt to produce hairline joints.

.6 Use oversize bolt, screw holes, and fabricate components.

.7 Allow thermal expansion and contraction due to temperature extremes in accordance with manufacturer's recommendations.

3.3 HARDWARE

.1 Coordinate wall securement, anchorage, and blocking for finish carpentry items.

.2 Provide hardware for completion of architectural woodwork including:

.1 Adjustable shelf supports.

.2 Cabinet hinges, catches, pulls, drawer accessories, bumpers, drawer slides, closet hanger bars, and similar items.

.3 Install millwork hardware in shop wherever possible.

.4 Install millwork hardware secure, plumb, level, true to line, and in accordance with hardware manufacturer's recommendations.

.5 Cut and fit to millwork for proper installation and operation.

.6 Provide smooth operating units free from binding.

.7 Clean and adjust hardware for proper operation.

.8 Remove and replace damaged, marked, or stained finish carpentry.

.9 Adjust moving and operating parts to function smoothly and correctly.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Wipe surfaces clean with soft, clean cloth; remove dirt and dust from corners.

.3 Remove excess adhesive by method acceptable to adhesive manufacturer.

3.5 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Protect adjacent surfaces from damage during installation of finish carpentry items.

.3 Protect installed finish carpentry items from damage during remainder of construction period.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit one electronic copy of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Certificates:

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 QUALITY ASSURANCE

.1 Mock-Ups:

.1 Submit mock-ups in accordance with Section 01 43 00 - Quality Assurance.

.2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.3 Mock-up will be used to judge quality of work, substrate preparation, and material application.

.4 Locate where directed.

.5 Niagara Region Representative will require minimum 24 hours to review the mock-up.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan in accordance with Section Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

.2 Self-adhesive air/vapour barrier modified bitumen membrane.

.1 Acceptable materials: Soprema Sopraseal Stick 1100, IKO Aqua Barrier AVB, Bakor Blueskin Roof RF200.

2.2 ACCESSORIES

.1 Fasteners: Provide non-corrosive metal screws, nails, plastic clips and other fasteners as recommended by vapour retarder manufacturer required for complete installation of Work.

.2 Joint sealing tape: High density, air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.3 Sealant: Asbestos free non hardening sealant, compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealants.

.4 Staples: minimum 6 mm leg.

.5 Substrate Crack Filler: Closed cell foam backer rod.

.6 Through Wall Membranes: Manufacturer's recommended reinforced self adhesive, compatible with vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.

.7 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Niagara Region Representative.

.2 Inform Niagara region Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from [Niagara Region Representative].

3.2 INSTALLATION

.1 Ensure services are installed and inspected before installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall, ceiling and floor assemblies before installation of gypsum board to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.3 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet and press into sealant bead in accordance with manufacturer's requirements.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier. Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.7 INSTALLATION: UNDERSLAB SHEET VAPOUR BARRIER

.1 Install vapour barrier in accordance with manufacturer's written instructions and ASTM E1643, and generally as follows:

.1 Unroll vapour barrier with the longest dimension parallel to direction of concrete placement.

.2 Lap vapour barrier onto face of grade beams.

.3 Overlap joints in accordance with manufacturer's requirements.

.4 Seal penetrations including pipe and conduit risers in accordance with manufacturer's written instructions.

.5 Make no additional penetrations except as required for placing of reinforcing steel and permanent utilities.

.2 Repair damaged areas by cutting patches of vapour barrier membrane; sized to overlap damaged area, and tape all sides using manufacturer's required tape.

3.8 INSTALLATION: PREMOULDED SHEET VAPOUR BARRIER

.1 Apply membrane in accordance with manufacturer's instructions to provide a permanent, monolithic vapor seal without voids or open seams.

.2 Ensure accessory materials are compatible with membrane and approved by membrane manufacturer.

.3 Place membrane in position by either Dutch lap method with laps sealed with bonding asphalt or by butt joint method with joints sealed with joint tape.

.4 Point exposed edges with pointing mastic to prevent water from traveling under membrane.

.5 Place membrane collar around protrusions through concrete slab, including sewer pipes, water pipes, and utility inlets to create a positive seal between protrusions and membrane. Seal in place with joint tape and point around protrusions with pointing mastic.

.6 Adhere membrane to vertical surfaces with adhesive.

3.9 CLEANING

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

.2 Final Cleaning: remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning upon completion.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: perform in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Air leakage criteria for primary air seal building enclosure materials and assemblies.

.2 Materials and installation methods supplementing primary air seal materials and assemblies.

.3 Air seal materials to connect and seal openings, joints, and junctions between other air seal materials and assemblies.

1.2 RELATED REQUIREMENTS

.1 Section 07 26 00 - Vapour Retarder: Coordinate vapour seal criteria with air barrier requirements.

.2 Section 07 84 00 - Firestopping: Fire stopping materials.

.3 Section 07 92 00 - Joint Sealants: Sealant materials and installation techniques.

.4 Section 08 41 13 - Aluminum Framed Entrances And Storefronts: Aluminum entrances and storefronts, functioning as a primary air seal.

.5 Section 09 91 23 - Interior Painting.

1.3 REFERENCE STANDARDS

.1 STD ASCE/SEI 7-16 Minimum design loads and associated criteria for buildings and other structures

.2 ASTM A653/A653M-20 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.3 ASTM C920-18 Standard specification for elastomeric joint sealants

.4 ASTM C1311-14 Standard specification for solvent release sealants

.5 ASTM E283/E283M-19 Standard test method for determining rate of air leakage through exterior windows, skylights, curtain walls, and doors under specified pressure differences across the specimen

.6 ASTM E330/E330M-14 Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

.7 NABA (National Air Barrier Association) - Air Barrier Quality Assurance Program (QAP).

.8 SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 DEFINITIONS

.1 Air Barrier: A continuous network of materials and joints providing air tightness, with adequate strength and stiffness to not deflect excessively under air pressure differences, to which it will be subjected in service. It can be comprised of a single material or a combination of materials to achieve the performance requirements.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work of this section with all sections referencing this section.

.3 Pre-installation Meetings: Convene one (1) week before starting work of this section.

.4 Sequencing: Sequence work to permit installation of materials in conjunction with related materials and seals.

1.6 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on material performance criteria.

.3 Shop Drawings: Provide Drawings of special joint conditions.

1.7 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements, including preparation, installation requirements and techniques, product storage and handling criteria.

.3 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: closeout Submittals.

1.9 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Perform Work to SWRI sealant and caulking guide requirements for materials installation.

.3 Perform Work in accordance with the NABA Air Barrier Quality Assurance Program.

.4 Maintain one (1) copy of document on site.

.5 Contractor Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience and licensed by the NABA Air Barrier Quality Assurance Program (QAP).

.6 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and be a Licensed or Registered Installer with the NABA Air Barrier Quality Assurance Program (QAP).

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.11 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Provide a three (3) year warranty to include coverage for failure to meet specified requirements.

.3 Warranty: Include coverage of installed sheet materials that fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

Part 2 Products

2.1 PERFORMANCE / DESIGN CRITERIA

.1 Design Requirements: Perform design work to ASCE/SEI 7.

.2 Provide continuity of air seal materials and assemblies in conjunction with materials described in Section 07 92 00.

2.2 SHEET MATERIALS

.1 Materials: as required to achieve specified performance criteria; functionally compatible with adjacent materials and components.

2.3 SEALANTS

.1 Primer: Recommended by sealant manufacturer.

.2 Substrate Cleaner: non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that surfaces and conditions are ready to accept the Work of this section.

3.3 PREPARATION

.1 Remove loose or foreign matter that might impair adhesion of materials.

.2 Clean and prime substrate surfaces to receive adhesive and sealants to manufacturers written instructions.

3.4 INSTALLATION

.1 Install materials to manufacturer's written instructions.

.2 Install sealant materials in accordance with manufacturer's instructions.

.3 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.5 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection and testing.

.2 Provide inspection services for air barrier and material installation to NABA Air Barrier Quality Assurance Program.

.1 Provide one (1) inspection, minimum during course of work.

.2 Provide inspections at 55% stages of completion.

.3 Provide written inspection report to Owner.

3.6 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Do not permit adjacent work to damage work of this section.

3.7 SCHEDULES

.1 Wall Air Seal over Exterior Surface of Gypsum Sheathing: Place sheet seal Type G over sheathing surfaces with Adhesive Type E. Seal with Type Y sealant.

.2 Window Frame Perimeter: Lap sheet seal Type H from wall air seal surface with 75 mm of full contact over firm bearing to window frame with 25 mm of full contact. Edge seal with Type Z sealant.

.3 Wall and Roof Junction: Lap sheet seal Type J from wall seal material with 150 mm of contact over firm bearing to roof air seal membrane with 100 mmof full contact. Seal with Type X sealant.

.4 Roof System Air Seal Over Steel Deck: Gypsum sheathing, taped joints, apply membrane air seal Type K over sheathing surfaces with Adhesive Type D; edge seal membrane with Type Y sealant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Asphalt shingle roofing.

.2 Underlayment.

.3 Eave, valley, and ridge protection.

.4 Associated metal flashings and accessories.

.5 Labour, Products, equipment and services necessary for firestopping Work in accordance with Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 - Rough Carpentry: Roof sheathing and framed openings.

.2 Section 07 26 00 - Vapour Retarders: Continuation of wall vapour retarder.

.3 Section 07 27 00 - Air Barriers: Continuation of wall air barrier system.

.4 Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC): Mechanical work projecting through roof.

1.3 REFERENCE STANDARDS

.1 ASTM B209/B209M-21a Standard specification for aluminum and aluminum-alloy sheet and plate

.2 ASTM B209/B209M-21a Standard specification for aluminum and aluminum-alloy sheet and plate

.3 ASTM B370-12(2019) Standard specification for copper sheet and strip for building construction

.4 ASTM D226/D226M-17 Standard specification for asphalt-saturated organic felt used in roofing and waterproofing

.5 ASTM D2178/D2178M-15a(2021) Standard specification for asphalt glass felt used in roofing and waterproofing

.6 ASTM D2822/D2822M-05(2011)e1 Standard specification for asphalt roof cement, asbestos containing. (Withdrawn 2016)

.7 ASTM D3018/D3018M-22 Standard specification for class A asphalt shingles surfaced with mineral granules

.8 ASTM D3161/D3161M-20 Standard test method for wind resistance of steep slope roofing products (fan-induced method)

.9 ASTM D3462/D3462M-19 Standard specification for asphalt shingles made from glass felt and surfaced with mineral granules

.10 STD A123.5-16 Asphalt shingles made from glass felt and surfaced with mineral granules

.11 CAN/CSA A123.2-03 Asphalt-coated roofing sheets

.12 STD A123.3-05 Asphalt saturated organic roofing felt

.13 STD A123.17-05 Asphalt glass felt used in roofing and waterproofing

.14 STD A123.51-14 Asphalt shingle application on roof slopes 1:6 and steeper

.15 CAN/CGSB 51.32-M77 Sheathing, membrane, breather type

.16 CAN/ULC-S107-19 - Standard Methods of Fire Tests of Roof Coverings.

.17 CGSB 37-GP-56M-80 Membrane, modified, bituminous, prefabricated, and reinforced for roofing

.18 Architectural sheet metal manual

.19 Roofing specifications manual

.20 NRCA (National Roofing Contractors' Association - USA) - Steep Roofing Manual..

.21 Province of Ontario Roofing Contractors Association - Roofing Specifications Manual.

.22 STD UL 580-06 Standard for tests for uplift resistance of roof assemblies

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating material characteristics, limitations, colours, finishes, and performance criteria.

.3 Shop Drawings: Indicate specially configured metal flashings, jointing methods and locations, fastening methods and locations, and installation details.

.4 Samples: Submit two (2) samples of each shingle colour indicating colour range and finish texture/pattern; for colour selection.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide 2% of the roof area of extra shingles of each colour selected.

1.8 QUALITY ASSURANCE

.1 Perform Work in accordance with the following roofing manual. Maintain two (2) copies of document on site.

.1 CRCA Roofing Specifications Manual.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 MOCK-UPS

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide 10 sq m mock-up, including eave protection, underlayment, shingle installation, and associated flashings.

.3 Locate where directed.

.4 Approved mock-up may remain as part of the Work.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not install eave edge protection and shingles when ambient air temperatures are below 10 degrees C.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for CAN/ULC-S107, Class A rating and ASTM D3161, wind uplift for shingle types specified.

2.2 MATERIALS - SHINGLES

.1 Fiberglass-reinforced asphalt shingles: to CSA A123.1/A123.5.

.1 Type: self-seal, standard, pattern rectangular.

.2 Mass: minimum 33 kg/3m².

.3 Colours: as selected by Niagara Region.

2.3 MATERIALS - SHEET

.1 Roofing eave and valley protection and roof underlay membrane: conform to the requirements in CSA-A123.22 and ASTM D5147 made of bitumen with a high softening point and a minimum flow temperature of 87.7°C (190°F) when they are used immediately below any metal panels or flashing, to be self-adhering, and to have a sanded or synthetic, non-bonding top surface. Minimum thickness 1.8 mm.

2.4 ACCESSORIES

.1 Nails: to CSA B111, of galvanized steel, sufficient length to penetrate 19 mm into deck.

.2 Plastic Cement: ASTM D2822/D2822M, asphalt type with mineral fibre components, free of toxic solvents, capable of setting within twenty-four (24) hours at temperatures of 5 to 48 Celsius ınd 50% RH.

.3 Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.

.4 Continuous Ridge Vent: minimum 285 mm wide durable, copolymer plastic ridge vent, providing minimum 357 cm^2/m net free vent area, capable of accepting fiberglass-reinforced asphalt shingle cap over for shingle finish.

Part 3 Execution

3.1 REMOVAL OF EXISTING ROOFING

.1 Remove existing roofing and expose sheathing or shingle lath of roof.

.2 Withdraw existing shingles, set those which break off. Leave surfaces free from dirt and loose material.

.3 Niagara Region to inspect roof sheathing. Take up, cut out, portion of sheathing boards affected by fungal or insect attack as directed on site by Niagara Region.

.4 Replace cut out portions of sheathing or lath with sheathing of equal sectional dimensions, and specified grade. Seat each end of board on rafter/truss, with 25mm bearing, and secure to rafter/truss.

.5 Protect existing remaining components, including rainwater gutters from incidental damage including, damage caused by ladders.

3.2 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

.3 Verify roof openings are correctly framed.

.4 Verify deck surfaces are dry, free of ridges, warps, dirt, open cracks, contaminants, grease, oil, or voids.

3.3 PREPARATION

.1 Fill knot holes and surface cracks with latex filler at areas of bonded eave protection. Cover knot holes with sheet metal.

.2 Broom clean deck surfaces under eave protection and underlayment.

.3 Prepare roofing materials for installation, as required by the manufacturer's written instructions.

3.4 INSTALLATION OF EAVE AND VALLEY PROTECTION

.1 Eave protection: overhang the fascia by a minimum 25.4 mm. Extend up the slope at least 915 mm, or to a line not less than 915 mm inside the inner face of the exterior wall and extend up all abutments at least 150 mm above the surface of the finished roof system surface. Horizontal runs of eave protection to be positively lapped at least 50 mm and end laps (vertical joints) must be at least 150 mm.

.2 Valley protection sheet membranes: The same materials used for eave protection. Ccentred on, and installed parallel to, the valley line, extending from the eave edge past the upper end of the valley metal flashing, at least 50 mm, a minimum 1000 mm wide, and at least wide enough to extend past the outside edges of a metal valley flashing onto each roof field by at least 150 mm. Positively overlap lower runs of valley membrane by a minimum of 150 mm, rolled to ensure even, full adhesion. Overlap and sealed to eave protection.

3.5 INSTALLATION - PROTECTIVE UNDERLAYMENT

.1 Installed using fasteners acceptable to the manufacturer of the underlayment and conform to the underlayment manufacturer's written instructions.

.2 Run underlayment parallel to eaves.

.3 Run below all water-shedding roofing system materials, extend beneath all perimeter flashing, and to cover roofing sheathing beneath penetration flashings.

.4 Carry up vertical surfaces a minimum 150 mm above roof sheathing.

.5 Place one ply of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 150 mm. Stagger end laps of each consecutive layer. Nail in place.

.6 Place a second ply of underlayment over first layer with ends and edges weather lapped minimum 150 mm. Stagger end laps of each consecutive layer. Nail in place.

.7 Install protective underlayment perpendicular to slope of roof and weather lap minimum 100 mm over eave protection.

.8 Weather lap and seal watertight with plastic cement items projecting through or mounted on roof.

3.6 INSTALLATION - METAL FLASHING AND ACCESSORIES

.1 Install drip edge along eaves, overhanging 12 mm, with minimum 50 mm flange extending onto roof decking. Nail to deck at 400 mm on center.

.2 Weather lap joints minimum 150 mm and seal weather tight with plastic cement.

.1 Sealants used in exposed locations to be tooled to positively shed water.

.3 Secure in place with nails at as required to resist expected wind load. Conceal fastenings.

.4 Flash and seal work weather tight, projecting through or mounted on roofing with plastic cement.

3.7 INSTALLATION - FIBERGLASS-REINFORCED ASPHALT SHINGLES

.1 Do fiberglass-reinforced asphalt shingle work in accordance with CAN3-A123.51/CAN3-A123.52, NBC/CRCA Specification, and to shingle manufacturer's instructions except where specified otherwise.

.2 Place shingles in straight coursing pattern with 125 mm weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.

.3 Starter course is required at eaves, gable edges. Install flush with edges of the underlayment and onto valley flashings.

.4 Project first course of shingles 38 mm beyond fascia boards.

.5 Cap hips and ridges with individual shingles, maintaining 125 mm weather exposure. Place to avoid exposed nails.

.6 Install fiberglass-reinforced asphalt shingles on roof slopes 1:3 and steeper in accordance with CAN3-A123.51.

.7 Install fiberglass-reinforced asphalt shingles on roof slopes 1:6 to less than 1:3 in accordance with CAN3-A123.52.

.8 Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counter flashings.

.9 Complete installation to provide weather tight service.

3.8 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection.

3.9 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Do not permit traffic over finished roof surface.

.3 Protect installed products and components from damage during construction.

.4 Repair damage to adjacent materials caused by asphalt shingles installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Tested and listed firestopping systems.

.2 Labour, Products, equipment and services necessary for firestopping Work in accordance with Contract Documents.

.3 Labour, Products, equipment and services necessary for firestopping Work in accordance with Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 07 26 00 - Vapour Retarders: Vapour retarder materials to adjacent insulation.

.2 Section 07 27 00 - Air Barriers: Air barrier materials to adjacent insulation.

.3 Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

.4 Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC): Mechanical work requiring firestopping.

.5 Section 26 - Electrical: Electrical work requiring firestopping.

1.3 REFERENCE STANDARDS

.1 ASTM E84-21a Standard test method for surface burning characteristics of building materials

.2 ASTM E119-20 Standard test methods for fire tests of building construction and materials

.3 ASTM E814-13a(2017) Standard test method for fire tests of penetration firestop systems

.4 ASTM E1966-15(2019) Standard test method for fire-resistive joint systems

.5 ASTM E2174, Standard Practice for On-Site Inspection of Installed Firestop Systems.

.6 ASTM E2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.7 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.8 CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 CAN/ULC-S102.2-18 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.10 CAN/ULC-S115-18 - Standard Method of Fire Tests of Firestop Systems.

.11 FM (Factory Mutual) - FM 4991-2013 - Approval Standard for Firestop Contractors.

.12 Firestop industry manual of practice (FCIA MOP)

.13 IFC, International Fire Stop Council.

.14 NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 edition.

.15 OBC, Ontario Building Code.

.16 OPL (Omega Point Laboratories).

.17 UL 263-2011 - Standard for Fire Tests of Building Construction and Materials (14th Edition).

.18 UL 1479-2015 - Standard for Fire Tests of Through-Penetration Firestops (4th Edition).

.19 UL 1709-2017 - Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel (5th Edition).

.20 UL 2079-2015 - Standard for Tests for Fire Resistance of Building Joint Systems (5th Edition).

.21 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

.22 WHI (Intertek/Warnock Hershey).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other work having a direct bearing on work of this section.

.3 Pre-Installation Meeting: Convene one (1) week before starting work of this section.

.4 Sequencing: Coordinate and sequence firestopping installation with all affected trades.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide manufacturer's written data on product characteristics, performance, and limitation criteria.

.3 Performance criteria, compliance with appropriate reference standard, characteristics, and limitations.

.4 Product transportation, storage, handling, and installation requirements.

.5 Firestopping manufacturer's product data for materials and prefabricated devices including manufacturer's printed installation instructions.

.6 Fire rated systems for each typical application.

.7 Floor plans indicating locations of each proposed fire rated system.

.8 Method of reinforcement anchorage, fastening and installation. Construction details should accurately reflect actual job conditions.

.9 System Design Listings: Submit system design listings including illustrations from a qualified nationally recognized testing and inspection agency applicable to each firestop configuration.

.10 Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) from firestop manufacturer where no specific third party tested, listed and classified firestop system is available for a particular firestop configuration.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's written special preparation and installation requirements and tested and listed firestop systems designs.

.3 Contractor's Certificates:

.1 Provide FCIA Member in Good Standing letter or certificate for the current year, on FCIA letterhead.

.2 Current FM 4991 Approved Contractor Certificate and individual Designated Responsible Individual Certificate.

.4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience and FCIA Manufacturer Member in good standing.

.2 Contractor Qualifications: Company specializing in performing the work of this section and as follows:

.1 FCIA Member in good standing.

.2 Minimum one (1) person employed at the firm who has passed the ULC Firestop Exam.

.3 ULC Qualified Firestop Contractor Program.

.4 FM approved in accordance with FM standard 4991 - Approval of Firestop Contractors.

.5 FCIA Member in good standing.

.6 Licensed by the province or local authority where applicable.

.7 Completed not less than five (5) comparable scale projects.

.3 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer. Obtain firestop systems for complete project, from a single primary firestop systems manufacturer, to the greatest extent possible.

.4 Manufacturer’s technical representative to visit Site during initial installation of firestop systems to train installer in proper selection and installation procedures.

.5 Product selection and installation to be in accordance with ULC or cUL listings and ASTM E814, UL 1479, UL 2079, and CAN/ULC S115 fire test standard to achieve the required fire protection rating.

.6 Provide manufacturer's engineering judgment identification number(s) and shop drawing details when no ULC or cUL system is available for an application. Engineering judgment drawings must follow the requirements set forth by the International Firestop Council and be approved by authorities having jurisdiction.

.7 Third party independent inspection:

.1 Prior to inspection, submit qualifications of third party independent inspector in accordance with ASTM E2174 and ASTM E2393, and certificate indicating inspector is certified by UL, FM Global, or accredited by firestop manufacturer.

1.9 MOCK-UPS

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide mock-up of applied firestopping assemblies.

.3 Apply firestop material to a representative penetrated partition substrate surface.

.4 Obtain Consultant's acceptance of mock-up before start of Work.

.5 Retain and maintain accepted mock-ups during construction in undisturbed condition as a standard for judging completed work.

.6 Locate where directed by Niagara Region.

.7 Approved mock-up may remain as part of the Work.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver firestopping products in original, unopened containers with labels intact and legible, identifying product and manufacturer.

.3 Store and handle firestopping materials to manufacturer's instructions.

1.11 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not apply materials when temperature of substrate material and ambient air is below 15 degrees C.

.2 Maintain this minimum temperature before, during, and for three (3) days after installation of materials.

.3 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 AD Fire Protection Systems.

.2 3M Fire Protection Products.

.3 BALCO, Inc.

.4 HILTI, Inc.

.5 Specified Technologies, Inc

.6 Thermal Ceramics, Inc.

.7 Thermafiber, Inc.

.8 Tremco Canada.

2.2 DESCRIPTION

.1 Manufacturers to comply with through-penetration firestopping systems and joint systems listed in the ULC Fire Resistance Directory – Volume III, or UL Products Certified for Canada (cUL).

.2 Manufacturers to have fire protection specialists on their staff capable of providing technical support at Site, such as Contractor certification and firestopping systems selection.

.3 Single source responsibility: obtain firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

.4 Provide firestopping system composed of components that are compatible with each other, the substrates forming openings and items, if any, penetrating firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

.5 Firestopping system: Provide ULC or cUL listed Products and systems in accordance with CAN/ULC S115, suitable to actual application and installation conditions.

.6 Comply with the requirements of OBC Article 3.1.9.1.

.7 Do not use Products containing asbestos.

.8 Regulatory Requirements:

.1 Conform to applicable code for fire resistance ratings and surface burning characteristics.

.2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials, tested and listed systems or engineering judgments used.

2.3 MATERIALS

.1 Firestopping system ratings: Comply with applicable OBC requirements for locations and hourly ratings of FT designations.

.2 Damming, back-up, supports, and anchorage: Supply Products as required in accordance with the manufacturer's fire rated systems and to the acceptance of authorities having jurisdiction.

.3 Primer: As recommended by firestopping manufacturer.

.4 Impaling clips: Manufacturer's standard Product, galvanized steel.

.5 Water (if applicable): Potable, clean, and free from injurious amounts of deleterious substances.

2.4 ACCESSORIES

.1 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

.2 Forming/Packing Material: Permanent type, suitable for application.

.3 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this section.

.3 Verify tested and listed systems selected are applicable to the conditions encountered.

.4 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FIRESTOPPING LOCATIONS AND RATINGS

.1 Provide ULC or cUL firestopping systems rated to match fire design rating of assemblies into which they are installed.

3.3 PREPARATION

.1 Clean substrate surfaces as recommended in manufacturer's written instructions, of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material and performance of firestop system for fire or smoke resistant situations.

.2 Remove incompatible materials which may affect bond.

.3 Prepare, modify and adjust void sizes, proportions and conditions to conform to fire rated assembly requirements such as assembly opening size and dimensional restrictions.

.4 Mask adjacent surfaces to avoid spillage and over-coating of adjacent surfaces. Remove stains from adjacent surfaces.

3.4 APPLICATION

.1 Install firestopping systems in accordance with manufacturer's instructions and fire rated assembly to establish continuity and integrity of fire separations.

.2 Apply primer and firestopping materials to manufacturer's written instructions.

.3 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to tested and listed system or engineering judgment.

.4 Install temporary forming, damming, and back-up as required. Remove after materials have achieved initial cure and resists displacement.

.5 Use resilient, elastomeric firestopping systems in the following locations:

.1 Openings and sleeves for future use.

.2 Penetration systems subject to vibration or thermal movement.

.3 Penetration systems in acoustical containment enclosures.

.6 Trowel and tool exposed firestopping Product surfaces to uniform, smooth finish.

.7 Repair damaged firestopped surfaces to acceptance by Niagara Region.

.8 Install firestopping filler in horizontal joints with 2 impaling clips per 1200 mm length, maximum.

.9 Identification:

.1 Identify each firestopping penetration assembly with permanent, pressure-sensitive, self-adhesive, preprinted vinyl label.

.2 Permanently secure labels to corrosion resistant backing boards and anchor on surfaces of penetrated construction for each firestop system installation.

.3 Install labels in locations visible to anyone seeking to remove penetrating items or firestop systems.

.4 Label shall list the following:

.1 Assembly and rating in hours.

.2 FH rating or FTH rating.

.3 Firestopping Product(s) used.

.4 Firestopping system used (ULC or cUL system number).

.5 Date of installation.

.6 Name and contact information of installing company.

.7 Warning that opening has been firestopping protected

3.5 FIELD QUALITY CONTROL

.1 All parties to examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Third party independent inspection to be done during filling of joints and penetrations, and after sealing the joints and penetrations.

.3 Third party independent inspector to conduct mandatory random destructive testing in accordance with ASTM E2174, ASTM E2393 and IFC Guidelines. Refill, reseal, and make good the joints and penetrations.

.4 Keep areas of work accessible until inspected by authorities having jurisdiction and third party independent inspector.

.5 Notify the manufacturer's representative prior to concealing or enclosing firestopping materials and service penetration assemblies and arrange for the manufacturer’s walkthrough.

.6 Installation to be done in accordance with manufacturer's written recommendations and drawing details.

.7 Perform patching and repairing of firestopping caused by cutting or penetrating of existing firestopping systems already installed by others.

3.6 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Clean adjacent surfaces of firestopping materials.

3.7 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Protect adjacent surfaces from damage by material installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Preparing substrate surfaces.

.2 Sealant and joint backing.

.3 Structural sealant for glazing assemblies.

.4 Labour, Products, equipment, and services necessary for sealants Work in accordance with Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 07 26 00 - Vapour Retarders: Sealants required in conjunction with vapour retarder.

.2 Section 07 27 00 - Air Barriers: Sealants required in conjunction with air barrier.

.3 Section 07 84 00 - Firestopping: Sealants required in conjunction with firestopping.

.4 Section 08 11 13 - Metal Doors and Frames: Sealants required in conjunction with door frames.

.5 Section 08 80 00 – Glass and Glazing: Sealants required in conjunction with glazing methods.

1.3 REFERENCE STANDARDS

.1 ASTM C834-17 Standard specification for latex sealants

.2 ASTM C919-22 Standard practice for use of sealants in acoustical applications

.3 ASTM C920-18 Standard specification for elastomeric joint sealants

.4 ASTM C1193-16 Standard guide for use of joint sealants

.5 ASTM C1330-18 Standard specification for cylindrical sealant backing for use with cold liquid-applied sealants

.6 ASTM C1481-12(2017) Standard guide for use of joint sealants with exterior insulation and finish systems (EIFS)

.7 ASTM E330/E330M-14 Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

.8 Canadian General Standards Board (CGSB) 1330:

.1 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound

.9 Department of Justice Canada (Jus):

.1 Canadian Environmental Protection Act, 1999 (2018) (CEPA)

.10 General Services Administration (GSA) - Federal Specifications (FS):

.1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement

.11 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS)

.2 Sealant, Waterproofing, and Restoration Institute (SWRI): Sealants: The Professionals' Guide 2013

.12 Transport Canada (TC):

.1 Transportation of Dangerous Goods Act, 1992 (2019 amended.) (TDGA)

.13 ULC Standards/ UL Canada (ULC):

.14 CAN/ULC 115-2018, Standard Method of Fire Tests of Firestop Systems

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Submit manufacturer's product data for each type of primer,backer rod, and sealants and include product characteristics, performance criteria, available colours, compatibility warnings, compliance standards and limitations.

.2 Manufacturer's product to describe:

.3 Submit one electronic copy of WHMIS SDS.

.3 Structural Sealant Joint Design: Provide calculations for structural bite, dead load support, glueline thickness, shear, and other parameters.

.4 Structural Sealant Joint Design: Confirmation that design data provided by Consultant have been reviewed and approved by sealant manufacturer.

.5 Shop Drawings: Indicate sealant joints and dimensions, materials, structural bite, glueline thickness, joint profile, and support framing.

.6 Samples:

.1 Submit two samples of each type of joint sealant material and colour.

.2 Submit two cured samples of exposed sealants of each colour to match adjacent material.

.7 Certificates: When requested by Niagara Region, submit manufacturer's product certificates indicating proposed sealant is appropriate for each application on this Project.

.8 Manufacturer's Instructions:

.1 Submit instructions for each type of product.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Submit maintenance data for incorporation into manual.

1.6 QUALITY ASSURANCE

.1 Perform work to sealant and EIFS manufacturer's requirements for preparation of surfaces and material installation instructions.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Manufacturer: Obtain each type of joint sealant from a single manufacturer.

.4 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.5 Compatibility: Ensure sealants are compatible with adjacent materials and are approved by manufacture for use with adjacent materials.

.6 Mock-Ups:

.1 Construct mock up in accordance with Section 01 43 00 - Quality Assurance.

.2 Before performing sealant work do sample applications of each type of sealant forreview.

.3 Site locations for sample applications shall be designated by Niagara Region.

.4 Construct joint sealant mock-ups in assemblies of other Sections with joint sealants, which are referenced in this Section.

.5 If accepted work up may remain as part of the finish work.

.7 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Health Canada.

1.7 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

.2 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.3 Joint substrates are dry.

.4 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special
conditions governing use.

1.8 WARRANTY

.1 Warranty: Provide a five (5) year warranty for failure to meet specified requirements including coverage for installed sealants and accessories which fail to achieve water tight seal and air tight seal, exhibit loss of adhesion or cohesion, or do not cure.

.2 Manufacturer's Warranty: Provide manufacturer's twenty (20) year material warranty for installed silicone sealant.

.3 Manufacturer's warranty: Provide manufacturer's standard warranty documentation.

.4 Warrant that sealant work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces in accordance with General Conditions, except for threeyears.

.5 Installer's Warranty: Provide an installation warranty, installer agrees to repair or replace joint sealants that do not comply with requirements of this Section for twoyears from Substantial Performance.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, with manufacturer's label.

.3 Storage and Handling Requirements:

.1 Store materials off ground in a ventilated dry indoor locationand in accordance with manufacturer's recommendations.

.2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.3 Do not dispose of unused sealant material into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard

.4 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Niagara Region.

Part 2 Products

2.1 SUSTAINABILITY CHARACTERISTICS

.1 When low toxicity sealants are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.2 VOC emissions limits shall be as follows:

.1 Sealant Primers:

.1 for non-porous surfaces: 250g/L

.2 for porous surfaces: 775g/L

.3 for modified bituminous membranes: 500g/L

.4 for marine deck: 760g/L

.5 for other conditions: 420g/L

.2 Sealants:

.1 architectural: 250g/L

.2 marine deck: 760g/L

.3 non-membrane roof: 300g/L

.4 roadway: 250g/L

.5 single-ply roof membrane: 450g/L

.6 other conditions: 420g/L

2.2 PERFORMANCE REQUIREMENTS

.1 Each sealant system shall meet the following requirements for warranty period

.1 Waterproof, flexible, and compatible with substrate under applicable service conditions.

.2 Provide a weather-tight seal that does not allow moisture penetration

.3 Shall not de-bond, crack, or craze.

.4 Shall not leak

2.3 SEALANT MATERIALS

.1 In air handling units and supply air system, use sealants without strong odours, without toxic chemicals, and are mould-resistantWhen low toxicity sealants are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.2 Provide primers in accordance with manufacturer recommendation

2.4 SEALANT MATERIALS DESIGNATIONS

.1 Type S-1: Acrylic Latex One Part, Shore A Hardness 20,

.2 Type S-2: Silicone Sealant; mould and mildew resistant.

.1 To CAN/CGSB-19.13; type S; grade NS; class 50; use NT, G, and A.

.2 To CAN/CGSB-19.13; type S; grade NS; class 25; use NT, G, and A.

.3 Type S-3: Silicone Sealant; general construction and air-seal sealant.

.1 To ASTM C920: type S; grade NS; class 25; use NT, M, G, A, O.

.4 Type S-4: Silicone Sealant; structural glazing.

.1 To CAN/CGSB-19.13: type S; grade NS; class 25; use NT, A, G, O.

.5 Type S-5: Acoustical Sealant; interior, non-skimming, non-hardening, simple component synthetic rubber sealant, to ASTM C919.

.6 Type S-6: Multi-component polyurethane sealant; chemical curing, exterior wall sealant.

.1 To CAN/CGSB-19.24: type M; grade NS; class 50; use T, NT, M, A, O.

.7 Type S-7: One-component polyurethane sealant; non-sag, for general construction.

.1 To CAN/CGSB-19.24: type S; grade NS; class 25; use NT, M, A, O.

.8 Type S-8: Horizontal joint sealant; two component, self-levelling.

.1 To CAN/CGSB-19.13: type M; grade P; class 25; use T, M, O

.9 Type S-9: One part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to CAN/CGSB-19.24, type S, grade P, class 50, use T, M, A, O, MC-1-25-B-N.

.10 Type S-10: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.

.11 Type S-11 Control Joint Sealant: Two component, polyurea based, load bearing, self levelling sealant.

.12 Type S-12 Control Joint Sealant: Two component, semi-rigid epoxy, load bearing, self levelling sealant.

.13 Type S-13: One-component polyurethane sealant; medium-modulus, non-sag, low-VOC, UV stable, to CAN/CGSB-19.24.

.14 Type S-14: Polysulfide two part:

.1 Self-levelling to CAN/CGSB-19.24, Type 1, Class B.

.2 Non-sag: to CAN/CGSB-19.24, Type 2, Class B

.15 Type S-15: Polysulfide one part:

.1 Self-levelling: to GRADE P, Class 35. Use MC-1-40-B-N.

.2 Non-sag: Grade NS, Class 35use M, A.

2.5 SEALANT SELECTION

.1 Where no specific type of sealant is scheduled, provide one of the sealants indicated in this Section appropriate for its application and consistent with manufacturer's recommendations and the recommendations of SWRI, Sealants: The Professionals' Guide.

.2 Make sealant selections consistent with manufacturer's recommendations.

.3 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.

.4 Use mould & mildew resistant silicone sealant Type S-2 for nonmoving joints in washrooms and kitchens. Do not use on floors.

.5 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type specified.

.6 Use structural glazing silicone Type S-4 for sealing glass, interior and exterior.

.7 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.

.8 Use multi component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

.9 Use multi component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.

.10 Use polyurethane, semi-self levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%

.11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.12 Use control joint sealant S-10 as filler for interior only, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.13 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer floors) and where joints require nosing support.

.14 Use control joint sealant S-12 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.

.15 Use sealant S-13 for sealing exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.

2.6 ACCESSORIES

.1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing:

.1 Rod Type Sealant Backings:

.1 ASTM C1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi cellular material with a surface skin).

.2 Provide any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.

.3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

.4 Non adhering to sealant, to maintain two sided adhesion across joint.

.2 High Density Foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m 3density, or neoprene foam backer,
size as recommended by manufacturer.

.3 Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, non absorbent to water and gas, capable of remaining resilient at temperatures down to 15 deg C. Provide products with low compression set and of size and shape to provide a secondary seal, to control
sealant depth and otherwise contribute to optimum sealant performance.

.4 Bond Breaker Tape:

.1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.

.2 Preformed Sealants:

.1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to
substrates.

.2 Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open cell compression type complying with ASTM D2628and with requirements for size, profile and cross sectional design.

.3 Bond Breaker: Pressure-sensitive plastic tape that will not bond to sealants.

.4 Joint Cleaner: Provide a non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's recommendations

.5 Primer: Provide in accordance with sealant manufacturer's recommendations.

.6 Masking Tape: Non-absorbent type, non-staining, compatible with joint sealant and joint substrates.

2.7 COLOURS

.1 Sealant Colours: Match colour of adjacent materials where visible, as selected by Niagara Region, from manufacturer's standard colour range.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for joint sealants installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate.

.2 Verify joint surfaces are dry and frost free.

.3 Verify substrates are without contaminants capable of interfering with sealant adhesion. Remove contaminants where occurring.

.4 Examine joint sizes and conditions to establish acceptable depth to width ratio for
installation of backup materials and application of sealants.

.5 Verify joint widths are within the limits recommended by joint sealant manufacturer for applications indicated.

.6 Inform Niagara Region of unacceptable conditions immediately upon discovery.

.7 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

.2 Clean bonding joint surfaces of harmful contaminates including dust, rust, oil grease, and other matter which may impair adhesion.

.3 Do not apply sealants to joint substrates treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Prepare surfaces in accordance with manufacturer's directions.

.5 Ensure surface preparation and primer recommendation is compatible with each substrate type.

3.3 PRIMING

.1 Mask adjacent surfaces prior to priming and sealing where necessary to prevent staining.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately applying sealant, except when manufacturer's instructions explicitly state priming is not required.

.3 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc).

3.4 BACKUP MATERIAL

.1 Provide backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

.3 Apply paper masking tape to back of joint to act as bond break where depth of joint does not permit the use of backer rod.

.4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant: Application: Apply sealants to recommendations of ASTM C1193, ASTM C1481,
and in accordance with manufacturer's instructions, and as follows:

.1 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm

.4 Apply sealant in a continuous beads.

.5 Apply sealant using gun with proper size nozzle.

.6 Fill voids and joints solid.

.7 Form sealant surface with a smooth full bead, without from ridges, wrinkles, sags, air pockets, embedded impurities.

.8 Tool exposed surfaces before skinning begins to give slightly concave shape.

.9 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.

.10 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.

.11 Seal at all locations where dissimilar material meet.

.2 Sealant Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until after curing has completed.

3.7 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.1 Clean adjacent surfaces immediately of excess primers and sealants.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

.2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning upon completion.

.3 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal

.1 Do not dispose of unused sealant materials into sewer system, streams, lakes, onto ground, or other location where it might pose a health or environmental hazard.

.2 Divert unused sealants from landfill to a hazardous material collection site.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Dispose of hazardous materials in accordance with the CEPA, TDGA, regional and municipal regulations.

3.8 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Remove masking tape and excess sealant.

.3 Protect sealants until cured, remove temporary glass supports.

3.9 SCHEDULE

.1 Use as per this schedule

.1 Use acrylic sealant Type S-1 only on the interior and only where little or no movement can occur.

.2 Use mould and mildew-resistant silicone sealant Type S-2 for non-moving joints in
washrooms and kitchens. Do not use on floors.

.3 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints,
interior and exterior, where no other specific sealant type is specified.

.4 Use structural glazing silicone Type S-4 for sealing structural glass and sealing butt-to glazing joints, interior and exterior.

.5 Use acoustical sealant Type S-5 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.

.6 Use multicomponent sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

.7 Use multicomponent sealant type S-6, at perimeters of exterior openings where frames meet exterior facade of building (e.g., brick, block, precast masonry).

.8 Use multicomponent sealant Type S-8 for horizontal joint sealant of plaza, floors and
decks, exterior areas only, subject to pedestrian and vehicular traffic.

.9 Use sealant Type S-8 for exterior joints in horizontal wearing surfaces.

.10 Use polyurethane, semi-self-levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.

.11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.12 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer room floors) and where joints require nosing support.

.13 Use control joint sealant S-12 as filler for interior, horizontal saw cut, or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.

.14 Use sealant S-13 for exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.

.15 Use sealant S-16 in pavement wherever fuel oils may be present

.16 In addition, provide joint sealants at the following conditions:

.17 Seal perimeters of hollow metal door frames on both sides.

.18 Seal control joints in gypsum board , except where prefabricated control joints are specified.

.19 Seal junctures between interior partitions with exterior walls.

.20 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained , as indicated on Drawings.

.21 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.

.22 Perimeter of bath fixtures (e.g., sinks, tubs, urinals, water closets, basins, vanities).

.23 Expansion and control joints in exterior surfaces of poured-in-place concrete walls.

.24 Expansion and control joints in exterior surfaces of precast architectural wall panels.

.25 Movement, control and expansion joints in exterior surfaces of unit masonry walls.

.26 Coping joints and coping-to facade joints.

.27 Cornice and wash (or horizontal surface joints).

.28 Seal interior perimeters of exterior openings as detailed on Drawings.

.29 Control and expansion joints on the interior of exterior cast-in place concrete walls.

.30 Expansion and control joints on the interior of exterior precast, architectural wall panels.

.31 Joints of underside of precast beams or planks.

.32 Movement, control and expansion joints on the interior of exterior surfaces of unit masonry walls.

.33 Interior control and expansion joints in floor surfaces.

.34 Perimeters of interior frames , as detailed.

.35 Movement, control and expansion joints in exterior surfaces of unit masonry walls.

.36 Joints at tops of non-load bearing masonry walls at the underside of poured concrete.

.37 Exposed interior control joints in gypsum board.

.38 Seal at all locations where dissimilar material meet.

.39 Refer to Section 07 84 00 - Fire Stopping for additional requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Hollow metal steel frames.

.2 Pressed steel doors.

.3 Labour, Products, equipment, and services necessary for metal doors and frames Work in accordance with the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 00 – Cleaning and Waste Management

.3 Section 07 92 00 - Joint Sealants.

.4 Section 04 05 10 - Mortar and Masonry Grout: Masonry grout fill of metal frames.

.5 Section 08 71 00 - Door Hardware - General: Hardware, silencers.

.6 Section 23 37 13 - Diffusers, Registers and Grilles.

.7 Division 26: Wiring for electronic hardware.

.8 Section 09 91 00 - Painting: Field painting of doors.

.9 Division 22 - Plumbing: Louvres.

1.3 REFERENCE STANDARDS

.1 ANSI/BHMA A156.16, Auxiliary Hardware.

.2 ANSI/NAAMM HMMA-841, Tolerances and Clearances for Commercial Hollow Metal Doors and Frames.

.3 ANSI/NAAMM HMMA-867, Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M-20 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.5 ASTM A653/A653M-20 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.6 ASTM A924/A924M, Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.

.7 ASTM B29-19 Standard specification for refined lead

.8 ASTM B749-20 Standard specification for lead and lead alloy strip, sheet, and plate products

.9 ASTM C553-13(2019) Standard specification for mineral fiber blanket thermal insulation for commercial and industrial applications

.10 ASTM C578-19 Standard specification for rigid, cellular polystyrene thermal insulation

.11 ASTM C591-21 Standard specification for unfaced preformed rigid cellular polyisocyanurate thermal insulation

.12 ASTM C592, Standard Specification for Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.13 ASTM C665-17 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing

.14 ASTM C1289-21 Standard specification for faced rigid cellular polyisocyanurate thermal insulation board

.15 ASTM D4726, Standard Specification for Rigid PVC Exterior Profile Extrusions Used for Assembled Windows and Doors.

.16 ASTM E90-09(2016) Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements

.17 ASTM E413-16 Classification for rating sound insulation

.18 CAN/ULC-S104-15 - Standard Method for Fire Tests of Door Assemblies.

.19 CAN/ULC-S105-16 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

.20 CAN/ULC-S701.1-2022 - Standard for Thermal Insulation, Polystyrene Boards.

.21 CAN/ULC-S702.1-14 (R2019) - Standard for Mineral Fibre Thermal Insulation for Buildings.

.22 CAN/ULC-S704.1-2017 - Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.23 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.24 CSA W59, Welded Steel Construction (Metal Arc Welding).

.25 STD G40.20/G40.21-13 General requirements for rolled or welded structural quality steel/structural quality steel

.26 STD W59-18 Welded steel construction

.27 FM (Factory Mutual).

.28 CSDMA (Canadian Steel Door Manufacturers Association).

.1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2009.

.2 Recommended Selection and Usage Guide for Commercial Steel Doors and Frame Products, 2009.

.29 NFPA 80 - Standard for Fire Doors and Other Opening Protectives, 2022 Edition.

.30 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies, 2022 Edition.

.31 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

.32 UL - Fire Resistance Directory.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with frame opening construction, door, and hardware installation.

.3 Sequencing: Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.

.3 Shop Drawings:

.1 Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

.2 Indicate door elevations, internal reinforcement, closure method, and cut-outs for finishes.

.3 Dimensioned door and frame type and wall thickness, construction elevations, and sections.

.4 Door openings and details.

.5 Location of mortises, reinforcement, anchorages, joining, welding, sleeving, exposed fasteners, openings, and arrangement for hardware.

.6 Provide manufacturer’s recommended installation instructions and procedures.

.7 Submit schedule identifying each unit with door marks and numbers relating to numbering on Contract Drawings and in door schedule. Indicate doors and frames to be fire-rated.

.8 Coordinate with the Section 08 71 00 Door Hardware submittals and submit for review and the same time so that they may be review together.

.4 Samples:

.1 Submit two (2) samples of frame, 500 mm in size illustrating factory finished frame colours and surface texture.

.2 Submit two (2) samples of door face metal, 500 mm in size illustrating pre-finished door colours and surface texture.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

.4 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Sustainable Design Closeout Documentation: 01 78 53.

1.8 QUALITY ASSURANCE

.1 1.5.1 Materials, fabrication, and installation to be in accordance with requirements of Canadian Steel Door and Frame Manufacturing Association (CSDMA) or National Association of Architectural Metal Manufacturers (NAAMM) and Hollow Metal Manufacturers Association (HMMA).

.2 Label and listed as fire-rated doors and frames by an organization accredited by the Standards Council of Canada in conformance with CAN4-S104-M and CAN4-S105-M for ratings specified or indicated. Fire labels to be factory-applied by manufacturer. Field application of fire labels is not permitted.

.3 Obtain approval from authorities having jurisdiction for materials, fabrication, and installation of fire-rated oversized door and frame assemblies.

.4 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

.3 Store in vertical position, spaced with blocking to permit air circulation between components.

.4 Store materials on planks or dunnage, out of water and covered to protect from damage.

.5 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

Part 2 Products

2.1 MANUFACTURERS

.1 All Steel Doors 2000 Ltd.

.2 Ambico Limited.

.3 Apex Industries Inc.

.4 Artek Door (1985) Ltd.

.5 Baron Metal Industries Inc., Subsidiary of ASSA ABLOY Door Group.

.6 Cedo Door, Subsidiary of ASSA ABLOY Door Group.

.7 Daybar Industries Inc.

.8 Fleming Door Products, Subsidiary of ASSA ABLOY Door Group.

.9 M.J. Daley Manufacturing Co.

.10 Metal Door Ltd.

.11 Trillium Steel Doors Ltd.

.12 Vision Hollow Metal Ltd.

2.2 DESCRIPTION

.1 Design Requirements:

.1 Fire Rated Door and Frame Construction: Labelled and listed to CAN/ULC-S104 / NFPA 252.

.2 Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as indicated.

.3 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

2.3 MATERIALS

.1 Sheet Steel: Galvanized steel to ASTM A653/A653M, commercial grade (CS), Type B.

.1 Minimum coating designation, ZF75 (A25) for internal use and ZF180 (A60) for exterior use, commercially known as paintable Galvanneal.

.2 Interior Doors: Coating designation ZF75.

.2 Reinforcement Channel: CSA-G40.20/G40.21, Type 44W, ZF75 coating designation to ASTM A653/A653M.

.3 Nominal Base Steel Thicknes

.1 Frames:

.1 Heavy Duty (HD): 1.9939 mm (14 gauge).

.2 Doors:

.1 Laminated Core Construction:

.1 Face sheets heavy duty (HD): 1.613 mm (16 gauge).

.2 Interior vertical stiffeners: 1.01 mm (20 gauge).

.2 Welded Stiffener Construction:

.1 Face sheets heavy duty (HD): 1.613 mm (16 gauge).

.2 Exterior vertical stiffeners: 0.853 mm (22 gauge).

.3 Accessories:

.1 Lock/Strike reinforcements:1.613 mm (16 gauge).

.2 Hinge reinforcements: 2.753 mm (12 gauge).

.3 All other reinforcement: 1.613 mm (16 gauge).

.4 Top and bottom channels: 1.310 mm (18 gauge).

.5 Glazing stops: 1.310 mm (18 gauge).

.6 Guard boxes: 1.01 mm (20 gauge).

.7 Jamb spreaders:1.310 mm (18 gauge).

2.4 DOOR CORE MATERIALS

.1 Heavy duty: Stiffened hollow steel core with mineral fibre semi-rigid blanket and batt insulation in accordance with ASTM C592 or ASTM C553, Type 1. Minimum 24 kg/m³ density.

.2 Insulated heavy duty: Stiffened hollow steel core with polyurethane insulation in accordance with ASTM C1029. Thermal performance max. U-Factor 0.29, minimum R-Value 3.4 in accordance with ASTM C1363 in thermally broken frame. Maximum 3 hour fire rating.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250˚C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

.4 Thermal Insulation material must:

.1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.

.2 Be manufactured using a process that uses chemical compounds with the minimum zone depletion potential (ODP) available.

2.5 ADHESIVES

.1 Cores and Steel Components: Heat resistant, structural reinforced epoxy, resin based adhesive, meeting manufacturer's requirements and tested in accordance with UL/ULC certification requirements.

.2 Lock Seam: Reinforced epoxy resin, high viscosity, fire resistant sealant/adhesive meeting manufacturer's requirements, and tested in accordance with UL/ULC certification requirements.

2.6 PRIMERS

.1 Primer: Rust inhibitive touch-up only.

2.7 ACCESSORIES

.1 Door Silencers: Single stud rubber/neoprene.

.2 Screws: Tamperproof stainless steel screws with countersunk flat head.

.3 Top Caps:

.1 Non fire lablled exterior doors to have top caps of rigid polyvinylchloride (PVC) extrusion.

.2 Fire labelled exterior doors to have factory-installed flush steel top caps.

.4 Frame Thermal Breaks: Rigid polyvinylchloride (PVC) extrusion.

.5 Frame anchors:

.1 Frames in masonry: Minimum 1.6 mm, adjustable T-strap jamb anchors.

.2 Frames in steel stud partitions: Minimum 0.9 mm steel anchors of suitable design securely welded inside each jamb.

.3 Frames in existing masonry, concrete or precast walls: Minimum 1.31 mm to suit design.

.4 Labelled frames: In accordance with CAN4-S104-M and CAN4-S105-M requirements.

.6 Floor anchors: Minimum 3.5 mm adjustable floor clip angles with 2 holes for anchorage to floor.

.7 Labels for fire-rated doors and door frames: Aluminum plate, riveted to door and door frame. Do not paint fire labels.

.8 Weatherstripping: Specified in Section 08 71 00.

.9 Louvres:

.1 Material and Finish: Extruded aluminum; wipe coat of zinc.

.1 Colour: As selected .

.2 Louver Blade: Inverted slat Y blade, sight proof.

.3 Louver Free Area: 45%.

2.8 FABRICATION - DOORS

.1 Fabricate doors and frames in accordance with reviewed Shop Drawings.

.2 Longitudinal Edges: Continuously welded, filled and sanded with no visible edge seams.

.3 Ream and remove burrs from drilled and punched holes. Grind welded corners and joints to flat plane and fill with metallic filler and sand to uniform smooth finish. Apply one coat of primer.

.4 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier.

.5 Reinforce for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware.

.6 Top and Bottom Channels: Inverted, recessed, welded steel channels, and PVC top caps on exterior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

2.9 FABRICATION - FRAMES

.1 Fabricate frames of welded construction. Cut mitres and joints accurately and weld continuously on inside of frame profile.

.2 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier. Provide mortar guard boxes.

.3 Reinforce frames wider than 1 200 mm with roll formed steel channels fitted tightly into frame head, flush with top.

.4 Furnish exterior door frames with continuously welded integral steel weather drip at head of frame.

.5 Prepare frames for silencers. Provide three (3) single silencers for single doors and mullions of double doors on strike side. Provide two (2) single silencers on frame head at double doors without mullions.

.6 Attach fire rated label to each fire rated door unit.

.7 Anchorage:

.1 Anchor units to floor and wall. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb. Minimum number of anchors for each jamb as follows:

.1 Frames up to 2285 mm: 3 anchors.

.2 Frames from 2285 mm to 2440 mm: 4 anchors.

.3 Frames over 2440 mm: One anchor for each 600 mm or fraction thereof in height.

.2 Where frames are set in masonry or concrete, supply adjustable anchors to trade installing frame.

.3 2.3.3.3 Fabricate frames for installation in gypsum board partitions with steel anchors of suitable design. Minimum number of anchors for each jamb as follows:

.1 Frames up to 2285 mm: 4 anchors.

.2 Frames from 2285 mm to 2440 mm: 5 anchors.

.3 Frames over 2440 mm: 5 anchors, plus one anchor for each 600 mm or fraction thereof in height.

.4 Frames in previously placed concrete, masonry, precast or structural steel: Anchors located at maximum 150 mm from top and bottom of each jamb, and intermediate anchors at maximum 660 mm on center.

.8 Fabricate frames to suit masonry wall coursing with 50 mm head member.

.9 Thermally broken door frames:

.1 For conditions where extreme temperature differences occur, use thermally broken commercial knocked-down or welded steel frames to decrease thermal conductivity.

.2 Manufactured from 1.6 mm (16 gauge) paintable galvanneal steel.

.3 Where thermally broken welded frame is specified, ensure welds do not cause thermal transfers between interior and exterior surfaces of frame sections.

.4 Fabricate interior and exterior sections of thermally broken frames with continuous PVC thermal break separation.

.5 Do not assemble thermally broken sections by means of screws, grommets or other fasteners.

.6 Closed sections (mullions and centre rails) of thermally broken frames to be factory insulated with 24 kg/m3 (1.5 pcf) loose batt type fibreglass material.

2.10 FINISHES

.1 Factory Finish: Thermosetting epoxy; colour as selected by Niagara Region from manufacturer's full range.

.2 Coat inside of frame profile with bituminous coating to a thickness of 1.5 mm.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that opening sizes and tolerances are acceptable; check floor area within path of door swing for flatness.

.3 Verify doors and frames are correct size, swing, rating and opening number.

.4 Remove temporary shipping spreaders.

3.2 INSTALLATION

.1 Install doors and frames to CSDMA.

.2 Install fire-rated doors and frames in accordance with NFPA 80, and local authority having jurisdiction.

.3 Coordinate with gypsum board and masonry wall construction for anchor placement.

.4 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.

.5 Set frames plumb, square, level and at correct elevation.

.6 Secure anchorages and connections to adjacent construction.

.7 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 1 200 mm in width.

.8 Remove wood spreaders after frames have been built-in.

.9 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

.10 Caulk perimeter of frames between frame and adjacent material.

.11 Maintain continuity of air barrier and vapour retarder.

.12 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.

.13 Provide even margins between doors and jambs and doors and finished floor as follows.

.1 Hinge side: 1.0 mm.

.2 Latch side and head: 1.5 mm.

.3 Finished floor: 13 mm.

.14 Adjust operable parts for correct clearances and function.

.15 Install louvers, glazing and door silencers.

.16 Finish paint as specified in Section 09 91 00.

.17 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES

.1 Section 01 73 00: Tolerances.

.2 Maximum Diagonal Distortion: 1.5 mm measured with straight edges, crossed corner to corner.

.3 During setting of frame, check, and correct as necessary for opening width, opening height, square, alignment, twist, and plumb, in accordance with CSDMA, Recommended Dimensional Standards for Commercial Steel Doors and Frames or ANSI/NAAMM HMMA-841.

.4 Allow for structural deflection and prevent structural loads from being transmitted to hollow metal frames.

3.4 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 COMMISSIONING

.1 Contractor to instruct maintenance personnel in operation and maintenance of doors and hardware.

.2 Confirm operation and function for all doors and hardware.

.3 Commissioning will be witnessed by Owner and Certificate will be signed by Contractor and Owner.

3.6 SCHEDULE

.1 As noted on the drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Access door and frame units.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete: Openings in concrete.

.2 Section 04 26 00 - Single Wythe Masonry: Openings in masonry.

.3 Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions.

.4 Section 09 51 13 - Acoustic Panel Ceilings: Openings in ceilings.

.5 Section 09 91 00 - Painting: Field paint finish.

.6 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Access doors in ductwork.

.7 Division 28 – Electronic Safety and Security: Electrical components requiring access .

1.3 REFERENCE STANDARDS

.1 UL - Fire Resistance Directory.

.2 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other work having a direct bearing on work of this section.

.1 Coordinate the work with other work requiring access doors.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

.3 Shop Drawings: Indicate exact position of all access door units.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements, rough-in dimensions , finishes, and functions.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Record Documentation: Record actual locations of all access units.

1.8 QUALITY ASSURANCE

.1 Perform Work in accordance with ULC Assembly Assembly Design for the access doors.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for fire rated access doors.

.2 Provide certificate of compliance from authority having jurisdiction indicating approval of fire rated doors.

2.2 ACCESS DOORS

.1 Sizes: Except as indicated otherwise, to be minimum sizes as follows:

.1 For body entry: 600 x 600 mm.

.2 For hand entry: 300 x 300 mm.

.3 Or as otherwise noted in the drawings.

.2 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180°.

.3 Materials:

.1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Niagara Region.

.2 Other areas: Prime coated steel.

.4 Lay-in tile ceilings: use unobtrusive identification locators.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that rough openings for door and frame are correctly sized and located.

3.2 INSTALLATION

.1 Install units to manufacturer's written instructions.

.2 Install frames plumb and level in opening. Secure rigidly in place.

.3 Position unit to provide convenient access to concealed work requiring access.

3.3 LOCATION

.1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Aluminum doors and frames.

.2 Perimeter sealant.

1.2 RELATED REQUIREMENTS

.1 Section 05 12 00 - Structural Steel: Steel fabricated

.2 Section 05 50 00 - Metal Fabrications: Steel fabricated

.3 Section 07 26 00 - Vapour Retarders: Perimeter vapour seal between glazing system and adjacent construction.

.4 Section 07 27 00 - Air Barriers: Perimeter air seal between glazing system and adjacent construction.

.5 Section 07 84 00 - Firestopping: Fire stop at system junction with structure.

.6 Section 07 92 00 - Joint Sealants: System perimeter sealant and back-up materials.

.7 Section 08 71 00 - Door Hardware - General: Mortised hardware reinforcement requirements affecting framing members.

.8 Section 08 71 13 - Automatic Door Operators.

.9 Section 08 80 00 – Glass and Glazing.

.10 Section 08 44 13 - Glazed Aluminum Curtain Walls.

.11 Section 09 91 00 - Painting: Field painting of interior surfaces.

.12 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Wall fin convectors and support saddles attached to framing members.

1.3 DEFINITIONS

.1 Delegated Design Professional: The specialist or supporting design professional contracted to the contractor, fabricator or manufacturer to design and/or review specific building components or sub-components, and provide Shop Drawings and Delegated Design Submittals to meet the requirements of authorities having jurisdiction.

1.4 REFERENCE STANDARDS

.1 DAF-45OL Designation system for aluminum finishes

.2 AAMA CWDG1-96 Aluminum curtain wall design guide manual

.3 AAMA CWG1-89 Installation of aluminum curtain walls

.4 AAMA CW10-15 Care and handling of architectural aluminum from shop to site

.5 AAMA 501-15 Methods of test for exterior walls

.6 AAMA 501.1-17 Standard test method for water penetration of windows, curtain walls and doors using dynamic pressure

.7 AAMA 611-14 Voluntary standards for anodized architectural aluminum

.8 AAMA 2603-21 Voluntary specification, performance requirements and test procedures for pigmented organic coatings on aluminum extrusions and panels (with coil coating appendix)

.9 AAMA 2605-20 Voluntary specification, performance requirements and test procedures for superior performing organic coatings on aluminum extrusions and panels (with coil coating appendix)

.10 AAMA RPC-00 Rain penetration control - applying current knowledge

.11 AAMA SFM01-14 Aluminum store front and entrance manual

.12 ASTM A36/A36M-19 Standard specification for carbon structural steel

.13 ASTM A123/A123M-17 Standard specification for zinc (hot-dip galvanized) coatings on iron and steel products

.14 ASTM A653/A653M-20 Standard specification for steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process

.15 ASTM B209/B209M-21a Standard specification for aluminum and aluminum-alloy sheet and plate

.16 ASTM B221M-21 Standard specification for aluminum and aluminum-alloy extruded bars, rods, wire, profiles, and tubes (metric)

.17 ASTM B221-21 Standard specification for aluminum and aluminum-alloy extruded bars, rods, wire, profiles, and tubes

.18 ASTM E283/E283M-19 Standard test method for determining rate of air leakage through exterior windows, skylights, curtain walls, and doors under specified pressure differences across the specimen

.19 ASTM E330/E330M-14 Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

.20 ASTM E331-00(2016) Standard test method for water penetration of exterior windows, skylights, doors, and curtain walls by uniform static air pressure difference

.21 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

.22 Maintenance repainting specification manual

.23 SSPC 16-01 Steel structures painting manual. Volume 1: good painting practice

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the Work with installation of vapour retarder and air barrier components or materials.

.3 Pre-Installation Meeting: Convene one (1) week before starting work of this section.

1.6 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and door hardware.

.3 Shop Drawings:

.1 Indicate system dimensions, plans, sections, details, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

.2 Indicate: Products and glazing types. Finishes. Anchorage inserts, system installation tolerances. Section and hardware reinforcement, anchorage, assembly fixings. Detailing, locations, and allowances for movement, expansion, contraction. Path of cavity drainage and air pressure equalization.

.3 Provide Shop Drawings stamped and signed by the delegated design professional.

1.7 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Design Data: Provide framing member structural and physical characteristics, calculations and dimensional limitations.

.3 Delegated Design Submittals:

.1 Submit documentation indicating compliance to performance/design criteria, signed and sealed by the delegated design professional responsible for their preparation.

.1 Design Data: Include material data, calculations and details.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

.3 Cleaning and maintenance data of aluminum finishes.

.4 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.

.5 Shop and site inspection reports.

1.9 QUALITY ASSURANCE

.1 Perform Work in accordance with AAMA CW-DG-1.

.2 Manufacturer: Company specializing in manufacturing aluminum glazing systems with minimum three (3) years documented experience.

.3 Delegated Design Professional Qualifications: Professional Structural Engineer experienced in design of this Work and licensed in the province where the project is located.

.1 Design aluminum entrances.

.2 Review, stamp, and sign fabrication and erection Shop Drawings.

.3 Conduct shop and site inspections and prepare inspection reports.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Handle Products of this section in accordance with AAMA CW-10.

.3 Protect finished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.11 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not install sealants when ambient temperature is less than 5 degrees C during and forty-eight (48) hours after installation.

1.12 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Correct defective Work within a five (5) year period after Substantial Completion.

.3 Warranty: Include coverage for complete system for failure to meet specified requirements.

.4 Provide five (5) year manufacturer warranty for glazed units.

Part 2 Products

2.1 MANUFACTURERS

.1 Aluminum entrances (Non-thermally broken for interior use, single glazed systems):

.1 Aluminum FlushGlaze 800 Series Frames by Alumicor Limited. (44 mm x 114 mm).

.2 Trifab VG 450 by Kawneer Co. Canada Ltd. (44 mm X 114 mm).

.3 Series 450 SF by U.S. Aluminum (44 mm x 114 mm).

.2 Doors (Non-thermally broken for interior use, single glazed systems):

.1 Canadiana Series Door 400A by Alumicor Limited. (stiles: 53 mm, top rail: 98 mm, bottom rail: 178 mm, depth: 44 mm).

.2 Institutional 350 by Kawneer Co. Canada Ltd. (stiles: 89 mm, top rail: 89 mm, bottom rail: 165 mm, depth: 44 mm).

.3 800 Durafront Door by U.S. Aluminum. (stiles: 89 mm, top rail: 85 mm, bottom rail: 165 mm, depth: 44 mm).

.3 Aluminum entrances (thermally broken double glazed systems for exterior use):

.1 FlushGlaze BF 3400 Series Insulframe by Alumicor Limited. (51 mm x 114 mm).

.2 Trifab VG 451T by Kawneer Co. Canada Ltd. (51 x 114 mm).

.3 Series IT 451 by U.S. Aluminum (51 mm x 114 mm).

.4 Doors (thermally broken double glazed systems for exterior use):

.1 Insuldoor Entrance Doors Series 400A by Alumicor Limited. Stiles: 53 mm, top rail: 54 mm, bottom rail: 98 mm, [mid-rail: 203 mm,] depth: 51 mm.

.2 360 Insulclad Thermal Entrances Series Door by Kawneer Co. Canada, Ltd. (stiles: 89 mm, top rail: 89 mm, bottom rail: 165 mm, [mid-rail: 203 mm,] depth: 51 mm).

.3 Series 400-T Thermal Door by U.S. Aluminum. Stiles: 102 mm, top rail: 121 mm, bottom rail: 178 mm, mid-rail: 130 mm, depth: 57 mm.

2.2 DESCRIPTION

.1 System Description:

.1 Aluminum entrances and storefront system includes tubular aluminum sections with supplementary internal support framing, shop fabricated, factory finished, vision glass, glass infill, related flashings, anchorage and attachment devices.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Delegated Design: Design structural support framing components, connections, and anchors by a licensed design professional using performance and design criteria as indicated.

.2 System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall:

.1 As calculated in accordance with applicable code.

.3 Design aluminum entrances system in accordance with following Climatic Design Data for Niagara Falls contained in Ontario Building Code (OBC):

.1 Design Temperature: January 1%, July 2 1/2%.

.2 Wind (hourly wind pressures): 1 in 100 year occurrence.

.3 Earthquake: Seismic data as listed.

.4 Design aluminum entrance system to accommodate following without detrimental effect:

.1 Cyclic 40°C daily, thermal swing of components.

.2 Cyclic, dynamic loading and release of loads such as wind loads.

.5 For mullion, corner and special change of wall plane conditions, limit glazing sealant design movement to 20% maximum for elastomeric sealants or 5% for acrylic or butyl sealants. Special conditions may require special statements in the paragraph below; edit accordingly.

.6 Deflection: Limit mullion deflection to flexure limit of glass or 1/200 span, to a maximum of 10 mm regardless of span; with full recovery of glazing materials.

.7 System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

.8 Air Infiltration: Limit air leakage through assembly to 0.0003 cu m/s/sq m of wall area, measured at a reference differential pressure across assembly of 75 Pa as measured in accordance with ASTM E283.

.9 Design glass in accordance with CAN/CGSB 12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.

.10 Design and detail air barrier, vapour retarder, insulation and rainscreen Products and assemblies into continuous and integrated aluminum entrance envelope. Optimize aluminum entrance design to align envelope layers and minimize thermal bridges

.11 System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network. Prevent water from entering interior when tested in accordance with ASTM E331.

.12 Design anchorage assemblies to accommodate construction and installation tolerances.

2.4 MATERIALS

.1 Aluminum extrusions (such as framing members, pressure plates, caps and similar items.): ASTM B221M and, ANSI H35.1/H35.1M AA6063, T6 temper alloy.

.1 Thermal breaks in frame members: Vertically aligned with glazing.

.2 Aluminum sheet: In accordance with ASTM B209M, and ANSI H35.1/H35.1M AA6063, T6 temper alloy, 1.0 mm thick minimum aluminum sheet.

.3 Glazing: to Section 08 81 00.

.4 Glazing and rebate primers, sealants, sealers, and cleaners: Compatible with each other. Type as recommended by glass manufacturer.

.5 Glazing sealant: Type as recommended by the aluminum entrance manufacturer.

.6 Joint backing: Closed cell foam polyethylene rod, outsized minimum 30-50% larger than joint width and compatible with joint sealant. Product as recommended by sealant manufacturer.

.7 Airseal sealant: In accordance with ASTM C920; One part silicone neutral cure low modulus sealant. Verify compatibility with insulating glass unit manufacturer's secondary sealant.

.8 Aluminum entrance sealant: In accordance with CAN/CGSB 19.24-M; Multi-component, chemical curing, polyurethane sealant, Dymeric by Tremco Ltd. Colour as selected by Niagara Region from manufacturer's full range.

.9 Flashing, closure, and trim: AA1100, H14 temper aluminum alloy, 1.0 mm thick sheet aluminum.

.10 Screws, bolts and other fasteners: In accordance with ASTM F738M; Stainless steel Type 304.

.11 Steel reinforcements and anchors: In accordance with CSA G40.20/G40.21; Grade 300W hot-dip galvanized in accordance with ASTM A143/A143M. Touch-up paint primer, refer to Section 09 91 00 Painting – Painting and Finishing Schedule – EXT-MISC and INT-MISC.

.12 Bituminous paint: Brush or spray grade, non-fibrated asbestos free, liquid asphalt type emulsion in accordance with ASTM D1187/D1187M, Type I or II.

2.5 COMPONENTS

.1 Fabricate doors of heavy duty, welded construction.

.2 Glazing: as specified in Section 08 81 00 Glazing.

.3 Glazing stop: Square, snap-on type, designed for neoprene glazing system.

.4 Hardware: as specified in Section 08 710 00 Door Hardware.

2.6 SEALANT MATERIALS

.1 Sealant and Backing Materials:

.1 Sealant: as specified in Section 07 92 00.

2.7 FABRICATION

.1 Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enable installation and dynamic movement of perimeter seal.

.2 Fabricate sections true to detail, free from defects impairing appearance, strength and durability. Fabricate extrusions with sharp, well defined corners.

.3 Fabricate frame members with thermal break for double glazed systems, vertically aligned with glazing.

.4 Fabricate, fit, and secure framing joints and corners accurately, with flush surfaces, and hairline joints. Seal frame at joints weatherproof.

.5 Fabricate doors and frames complete with internal reinforcements, mortise cut-outs, and recesses to accommodate finish hardware. Reinforce cut-outs to assure adequate strength.

.6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates supplied under Section 08 71 00.

.7 Conceal anchors, reinforcement and attachments from view. Fabricate reinforcement in accordance with design requirements and as required for door hardware anchorage.

.8 Do not expose manufacturer's identification labels on aluminum entrance or aluminum door assemblies.

.9 Accurately fit and secure joints and corners. Make joints weatherproof.

.10 Prepare components to receive anchor devices. Fabricate anchors.

.11 Arrange fasteners and attachments to conceal from view.

.12 Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

.13 Reinforce framing members for imposed loads.

2.8 FINISHES

.1 Clear Anodic Coating: AAMA 611, Class II, AA-M10C22A31.

.1 Location: Interior and exterior exposed aluminum surfaces.

.2 Concealed Steel Items:

.1 Galvanized to appropriate grade for type and size of steel material indicated, coating thickness ASTM A123/A123M.

.2 Primed with iron oxide paint.

.3 Apply one (1) coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

.4 Shop and Touch-Up Primer for Steel Components: SSPC-Paint 25, zinc oxide alkyd primer.

.5 Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, Type II - Organic zinc-rich primer.

.6 Extent of Finish:

.1 Apply factory coating to all surfaces exposed at completed assemblies.

.2 Apply finish to surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

.3 Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify dimensions, tolerances, and method of attachment with other work.

.3 Verify wall openings and adjoining air and vapour seal materials are ready to receive work of this Section.

3.2 INSTALLATION

.1 Install wall system and doors to manufacturer instructions.

.2 Install wall system in accordance with AAMA CWG-1.

.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 Coordinate attachment and seal of perimeter air and vapour barrier materials.

.8 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

.9 Install flashings.

.10 Set thresholds in bed of mastic and secure.

.11 Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

.12 Install glass and infill panels in accordance with Section 08 80 00, to interior and exterior glazing method required to achieve performance criteria.

.13 Install perimeter sealant to method required to achieve performance criteria.

3.3 ERECTION TOLERANCES

.1 Section 01 73 00: Tolerances.

.2 Maximum Variation from Plumb: 1.5 mm/m non-cumulative or 1.5 mm per 3 m, whichever is less.

.3 Maximum Misalignment of Two Adjoining Members Abutting in Plane: 0.8 mm.

.4 Vertical and horizontal positions: ±3 mm.

.5 Racking of face: 6 mm, nil in elevation.

.6 Maximum perimeter sealant joint between aluminum entrance and adjacent construction: 13 mm.

3.4 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Inspection will monitor quality of installation and glazing.

3.5 ADJUSTING

.1 Adjust operating hardware for smooth operation.

3.6 CLEANING

.1 Section 01 74 00: Cleaning and Waste Management.

.2 Remove protective material from pre-finished aluminum surfaces.

.3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.4 Remove excess sealant by method acceptable to sealant manufacturer.

3.7 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Protect finished Work from damage.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Hardware for doors.

.2 Thresholds.

.3 Weatherstripping, seals, and door gaskets.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 08 12 13 - Hollow Metal doors and frames

.3 Section 01 74 00 - Cleaning and waste management

.4 Section 01 78 00 Closeout submittals

.5 Section 08 31 13 - Access Doors and Frames.

.6 Section 08 71 13 - Automatic Door Operators: Hardware for same except cylinders.

.7 Section 08 44 13 - Glazed Aluminum Curtain Walls: Hardware for integral doors and frames except lock cylinders.

.8 Section 08 44 26.16 - Suspended Glass Assembly: Hardware for integral doors and frames except lock cylinders.

.9 Section 10 14 00 - Signage.

.10 Division 26 - Electrical wiring for magnetic strikes, electric releases, electric locks

.11 Division 28 – Electronic Safety and Security: Power supply to electric hardware devices security equipment.

1.3 REFERENCE STANDARDS

.1 CAN/ULC-S104-15 - Standard Method for Fire Tests of Door Assemblies.

.2 CAN/ULC-S132-16 (R2020) - Standard for Emergency Exit and Emergency Fire Exit Hardware.

.3 CSDMA (Canadian Steel Door Manufacturers Association).

.4 DHI (Door and Hardware Institute Canada) - AHC and EHC certification programs.

.5 STD A115.16-1994 Installation guide for doors and hardware

.6 STD WDHS-3-1996 Recommended hardware locations for wood flush doors

.7 BHMA (Builders Hardware Manufacturers Association) - A156 Series Standards

.8 NFPA 80 - Standard for Fire Doors and Other Opening Protectives, 2022 Edition.

.9 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies, 2022 Edition.

.10 STD UL 10B-08 Standard for fire tests of door assemblies

.11 STD UL 305-12 Standard for panic hardware

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other work having a direct bearing on work of this section.

.1 Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.

.2 Coordinate Owner's keying requirements during the course of the Work.

.3 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings:

.1 Indicate locations and mounting heights of each type of hardware, schedules, catalogue cuts, electrical characteristics and connection requirements.

.2 Submit manufacturer's parts lists and templates.

.3 Samples:

.1 Submit one (1) sample of each element illustrating style, colour, and finish.

.2 Samples will be incorporated into the Work.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

.3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

.4 Record Documentation:

.1 Record actual locations of installed cylinders and their master key code.

.2 Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

.5 Sustainable Design Closeout Documentation: 01 78 53.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance and extra material requirements.

.2 Extra Stock Materials:

.1 Provide ten (10) extra key lock cylinders for each master keyed group.

.3 Tools:

.1 Provide special wrenches and tools applicable to each different or special hardware component.

.2 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.9 QUALITY ASSURANCE

.1 Perform Work to the following requirements:

.1 BHMA A156 series.

.2 CSDMA.

.3 NFPA 80.

.4 NFPA 252.

.5 UL 10B .

.6 UL 305.

.7 CAN/ULC-S132.

.8 CAN/ULC-S104.

.9 Maintain one (1) copy of each document on site.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by the manufacturer.

.4 Hardware Supplier Personnel: Employ a qualified person to assist in the work of this section.

.5 Hardware Supplier Personnel: Employ a qualified person to assist in the electronics and controls work of this section.

.6 Upon completion of finish hardware installation, hardware supplier shall inspect work and shall certify in writing that all items and their installation are in accordance with requirements of Contract Documents and are functioning properly.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

.3 Store finishing hardware in locked, clean and dry area.

1.11 WARRANTY

.1 Provide seven years (7) year manufacturer warranty for Locks and Latches.

.2 Provide three years (3) year manufacturer warranty for Butt and Hinges.

.3 Provide ten (10) year manufacturer warranty for Exit Devices.

.4 Provide twenty five (25) year manufacturer warranty for Door Closers.

.5 Provide two (2) year manufacturer warranty for Door Operators.

.6 Provide two (2) year manufacturer warranty for Power supplies.

.7 Provide five (5) year manufacturer warranty for Architectural Door Trims.

.8 Provide five (5) year manufacturer warranty for Door bottoms, Thesholds, and Weatherstripping.

.9 Provide one (1) year manufacturer warranty for Astragals.

.10 Provide a written Contractor’s warranty for work of this Section for failure due to defective installation workmanship for one (1) year, dated from submittal completion certificate.

1.12 MAINTENANCE SERVICE

.1 Provide maintenance service for one year during warranty period to maintain all barrier free entrance automatic operators as follows:

.1 Qualified service personal approved by manufacturer of operators.

.2 Site inspection every three months will all necessary adjustment made during this visit. Separate warranty service calls, if required, will only qualify as an inspection if time of call is close to the three month intervals.

.3 Make detailed reports of each visit and copy to Owner and Engineer.

.4 Cost of this service will be included as part of this Section and is not covered by any allowance amount.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for Products requiring electrical connection. Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

.2 Use one manufacturer's products only for similar items.

.3 All hardware to ANSI/BHMA Grade 1.

2.2 MANUFACTURERS

.1

Manufacturer's Parts and Products				
Hardware Types	**DORMA + KABA GROUP**	**ALLEGION GROUP**	**ASSA ABLOY GROUP**	**Finish**
Standard weight butt hinge	PBBCB51 - 4 1/2" x 4" x NRP	IVES3CB1 - 4 1/2" x 4" x NRP	McKinneyTA314 - 4 1/2" x 4" x NRP	630
Continuous geared hinge	ABH	IVES	McKinney / Pemko	628
Exit device for aluminum door	Dorma 9000 Series (Narrow Style)	Von Duprin 35A Series	SargentAD80 Series	630
Exit device for doors (except aluminum door)	Dorma - 9000 Series	Von Duprin - 98 Series	Sargent - 80 Series	630
Electric strike for exit device	Rutherford Controls 0563	Von Duprin 6300	HES 9500	630
Electric strike for lock	Rutherford Controls F2164	Von Duprin 6400	HES 1006	630
Power supply for electric strike	Rutherford Controls10 Series	SchlagePS900 Series	SecuritronBPS	
Cylindrical storeroom lockset	DormaC800 SERIES ("LR Lever) Prepare with 20200V1(S) core	SchlageND SERIES (Rhodes Lever with Vandlguard Feature)	ArrowQL SERIESwith 20200H1(S) core	626

		Prepare with 2020073(S) core		
Mortise deadbolt, classroom function		SchlageL400 Series	8200 Series	630
Surface door closer (with metal cover)	Dorma - 8900 Series	LCN - 4041XP Series	Sargent - 351 Series	689
Kickplate	CBH903 x SIZE x 3M TAPE	Standard MetalK10A - SIZE x 3M Tape	RockwoodK1050 x SIZE x SA	630

.2

Manufacturer's Parts and Products				
Hardware Types	**DORMA + KABA GROUP**	**ALLEGION GROUP**	**ASSA ABLOY GROUP**	**Finish**
Floor stop	CBH -CBH 110 or 100	IVES - FS13 or FS17	Rockwood - 438 or 439	626
Wall stop	CBH - CBH 140	IVES - WS406CVX	Rockwood - 406	626
Concealed overhead stop	ABH - 1000SL Series	Glynn Johnson - 100 Series	Rixson - 1ADJ Series	630
Surface door closer (with metal cover)	Dorma - 8900 Series	LCN - 4041XP Series	Sargent - 351 Series	689
Standard push bottom for door operator	Rutherford Controls 950H6	LCN 8310-852T	BEA 10PBR1	630/ Blue Filled

.3

Manufacturer's Parts and Products				
Hardware Types	**DORMA + KABA GROUP**	**ALLEGION GROUP**	**ASSA ABLOY GROUP**	**Finish**
Weatherstripping	W-14	312_R	134NA	AL
Door Sweep	W-13S	315_N	200NSS	AL
Threshold	CT-9	170A	424	AL

.4 Schedule at the end of the section

2.3 FASTENINGS

.1 Provide fastening devices required for satisfactory installation and operation of hardware.

.2 Attach items to masonry or concrete with expandable shields, lag screws, bolts or other fastening devices as required.

.3 Fasteners to be stainless steel, with Phillips or Robertson heads, unless indicated otherwise in hardware schedule.

.4 Where pull is specified on one side of door and push plate on other side, provide fastening devices to secure pull through door from reverse side. Install push plate to cover fasteners.

2.4 KEYING

.1 Door Locks: Master keyed or keyed in groups as directed.

.2 Include control keying with removable core cylinders.

.3 Supply cylinders with cam/tail pieces suitable for specified lock function. Supply compression rings, trim collars, and blocking rings to suit.

2.5 FINISHES

.1 Metal finishes: Free from defects, clean, unstained, and of uniform colour for each type of finish required.

.2 Finishes and categories: In accordance with ANSI/BHMA A156.18.

.1 619: Satin nickel plated, clear coated

.2 626: Satin chromium plated over nickel; base material brass/bronze; Category "A" brushed chrome.

.3 628: Satin aluminum, clear anodized; base material aluminum; Category "A".

.4 630: Satin stainless steel, base material STS 300 Series; Category "A".

.5 689: Aluminum painted; base material any; Category "E" silver sprayed.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that doors and frames are ready to receive work and dimensions are as indicated on Shop Drawings.

.3 Verify that electric power is available to power operated devices and is of the correct characteristics.

.4 Replace defective hardware, including incorrectly selected hardware, remedial, and installation costs.

3.2 INSTALLATION

.1 Install hardware to manufacturer's written instructions.

.2 Use templates provided by hardware item manufacturer.

.3 Mounting heights for hardware from finished floor to centre line of hardware item:

.1 Locksets: 1000 mm.

.2 Push/Pulls: 1100 mm.

.3 Dead Locks: 1000 mm.

.4 Top hinge: 250 mm from head of door to top of hinge.

.5 Bottom hinge: 265 mm from finished floor to bottom of hinge.

.6 Intermediate hinge: Centred between top and bottom hinge.

.7 Panic device crossbar: 1000 mm.

.8 Guard bars: 1100 mm.

.9 Door pulls: 1100 mm to bottom of pulls.

.10 Blank strike: 1450 mm.

.11 Blank fronts: 1450 mm.

.12 Flush bolts: 1500 mm maximum, regardless of door height.

.13 Key switches: 1500 mm maximum to centre of switch.

.14 Flush bolts on entrance and exit doors (including replacement doors): 1500 mm.

.15 Exit Devices: 1000 mm.

.16 Door Operator push buttons: low 250 mm and high 1000 mm.

3.3 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 23: Testing and inspecting services

.2 Architectural Hardware Consultant will inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's written instructions and as specified.

.3 Ensure hardware supplied is correctly installed and correct for Work as constructed.

3.4 ADJUSTING

.1 Adjust hardware for smooth operation.

3.5 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Do not permit adjacent work to damage hardware or finish.

3.6 SCHEDULES

.1 <u>Main Entrance Single Aluminum Door with Panic Hardware and Automatic Entrance.</u>

.1 1 Continuous Geared Hinge.

.2 1 Narrow Stile Rim Exit Device with Cylinder Dogging.

.3 3 Cylinder (Mortise or Rim to Suit).

.4 2 Full Length Offset Door Pull Engraved Push or Pull.

.5 1 Electric Strike.

.6 1 Key Switch.

.7 1 Automatic Door Opener.

.8 4 Round Push Buttons with Barrier Free Logo, mounted high and low and each side of door. Complete with Stainless Steel Escutcheons.

.9 1 Concealed Overhead Stop.

.10 1 Weatherstrip set, full height and width of jambs and head.

.11 1 Door Sweep.

.12 1 Threshold, width to suit.

.2 <u>Main Entrance Interior Vestibule (Automatic Entrance) Single Aluminum Door.</u>

.1 1 Continuous Geared Hinge.

.2 2 Full Length Offset Door Pull Engraved Push or Pull.

.3 1 Automatic Door Opener.

.4 4 Round Push Buttons with Barrier Free Logo, mounted high and low and each side of door. Complete with Stainless Steel Escutcheons.

.5 1 Concealed Overhead Stop.

.6 1 Weatherstrip set, full height and width of jambs and head.

.7 1 Door Sweep.

.3 Emergency Exit Single Door. Hollow Metal.

.1 1 Continuous Geared Hinge.

.2 1 Narrow Stile Rim Exit Device with Cylinder Dogging.

.3 3 Cylinder (Mortise or Rim to Suit).

.4 2 Full Length Offset Door Pull Engraved Push or Pull.

.5 1 Surface Closer with Metal Cover and Mounting Plate.

.6 1 Concealed Overhead Stop.

.7 1 Weatherstrip set, full height and width of jambs and head.

.8 1 Door Sweep.

.9 1 Threshold, width to suit.

.4 Public Washroom - Multi-Stall

.1 3 (1 1/2 pairs) Standard Weight Concealed Ball Bearing Hinge, Stainless Steel, with non-removable pins.

.2 1 Deadbolt (key from either side operates deadbolt, thumbturn inside retracts deadbolt but will not project it).

.3 1 228.6 mm Straight Door Pull

.4 1 127 mm x 508 mm Push Plate

.5 1 Surface Closer with Metal Cover

.6 1 Concealed Overhead Holder

.7 1 Kickplate – 254 mm x 38.1 mm Less Door Width

.8 1 Concealed Overhead Stop.

.5 Washroom - Barrier Free Single User

.1 3 (1 1/2 pairs) Standard Weight Concealed Ball Bearing Hinge, Stainless Steel, with non-removable pins.

.2 1 Mortise Set with Occupancy Indicator

.3 1 Electric Strike.

.4 1 Deadbolt Monitor Switch

.5 1 Auto Door Opener.

.6 4 Round Push Buttons with Barrier Free Logo, mounted high and low and each side of door. Complete with Stainless Steel Escutcheons.

.7 1 Kickplate – 254 mm x 38.1 mm Less Door Width

.8 1 Concealed Overhead Stop.

.6 Washroom - Non-Barrier Free Single User

.1 3 (1 1/2 pairs) Standard Weight Concealed Ball Bearing Hinge, Stainless Steel, with non-removable pins.

.2 1 Mortise Set with Occupancy Indicator

.3 1 Concealed Overhead Stop

.4 1 Kickplate – 254 mm x 38.1 mm Less Door Width

.5 1 Concealed Overhead Stop.

.7 Electrical or Communications Room Single Door. Fire Rated.

.1 3 (1 1/2 pairs) Standard Weight Concealed Ball Bearing Hinge, Stainless Steel, with non-removable pins.

.2 1 Mortise Set with Storeroom Operation

.3 1 Surface Closer with Metal Cover and Mounting Plate.

.4 1 Kickplate – 254 mm x 38.1 mm Less Door Width

.5 1 Concealed Overhead Stop.

.6 1 Weatherstrip set, full height and width of jambs and head. To suit fire rating

.7 1 Threshold, width to suit and fire rating.

.8 Office Single Door

.1 3 (1 1/2 pairs) Standard Weight Concealed Ball Bearing Hinge, Stainless Steel, with non-removable pins.

.2 1 Cylindrical Office Function Set.

.3 1 Surface Closer with Metal Cover and Mounting Plate.

.4 1 Kickplate – 254 mm x 38.1 mm Less Door Width.

.5 1 Floor Stop.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Electric operated door equipment.

.2 Control devices.

.3 Handrails.

.4 Labour, Products, equipment and services necessary for automatic door equipment Work in accordance with the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 08 41 13 - Aluminum Framed Entrances and Storefronts: Aluminum doors and frames.

.2 Section 08 71 00 - Door Hardware

.3 Section 28 46 00 - Fire Alarm: Electrical connection to activate door closers.

.4 Section 26 05 19 - Building Wire and Cable:

.1 Wiring from door operator to control switch.

.2 Wiring from control switch to power unit.

.3 Wiring from power unit to disconnect.

1.3 REFERENCE STANDARDS

.1 BHMA A156.10-2017 - Power Operated Pedestrian Doors.

.2 BHMA A156.19-2013 - Power Assist And Low Energy Power Operated Doors.

.3 CSA-C22.1-18 - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations (24th Edition).

.4 CSA-C22.2 No. 100-14 (R2019) - Motors and Generators.

.5 CSA-C22.2 No. 247-14 (R2019) - Operators and Systems of Doors, Gates, Draperies and Louvres.

.6 NEMA MG 1-2016 - Motors and Generators.

.7 NFPA 70 - National Electrical Code (NEC), 2017 Edition.

.8 UL 325-2017 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems (7th Edition).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Coordination: Coordinate with other work having a direct bearing on work of this section.

.3 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on system components, sizes, features, and finishes.

.3 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 Performance criteria, compliance with appropriate reference standard, characteristics, limitations and trouble-shooting protocol.

.4 Product transportation, storage, handling and installation requirements.

.5 Complete electrical wiring diagrams including electrical schematics and sequence of operation.

.6 Complete engineering design data to confirm design criteria specified is met, upon request from Niagara Region.

.4 Samples: Submit two (2) samples of exposed to view hardware and attachment hardware.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements indicating special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Maintenance Contracts: Provide service and maintenance of operating equipment for one year from Date of Substantial Completion.

.3 Operation and Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

.4 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

.5 Record Documentation: Record actual locations of concealed equipment, services, and conduit.

.6 Sustainable Design Closeout Documentation: 01 78 53.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance extra material requirements.

.2 Tools: Provide wrenches and tools required for maintenance of equipment.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.10 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Provide five (5) year manufacturer warranty for operating unit.

Part 2 Products

2.1 MANUFACTURERS

.1 Exterior Heavy Duty Operator:

.1 Basis of design: LCN; Product: 4600 series Automatic Door Operators .

.1 Other acceptable manufacturers offering functionally and aesthetically equivalent products:

.1 Besam of Canada: Surface mounted: 450 series.

.2 Horton Automatics: Surface mounted: 4,000 series.

.3 Gyro Tech Inc.: Surface mounted: GT500.

.4 Hunter Automatic Ltd.: Autoswing HA-8 surface mounted.

.2 Interior Light Heavy Duty Operator:

.1 Basis of design: LCN; Product: 4600 series Automatic Door Operators .

.1 Other acceptable manufacturers offering functionally and aesthetically equivalent products:

.1 Besam of Canada: Electra 150.

.2 Horton Automatics: 7000 series.

.3 Gyro Tech Inc.: GT710.

.4 Hunter Automatic Ltd.: Autoswing HA-8 surface mounted.

.3 Other acceptable manufacturers offering functionally and aesthetically equivalent products.

.1 Besam ; Product: 450 series.

.2 Horton Automatics; Product: 4,000 series.

.3 Gyro Tech Inc; Product: GT500.

.4 Hunter Automatic Ltd; Product: Autoswing HA-8 .

2.2 DESCRIPTION

.1 System Description:

.1 Automatic Door Equipment: Electrically operated with push plates and buttons control device.

.2 Door operating equipment complete with electro mechanical motor gear box. Provide 3 position (off-on) switch. System to operate between -34ºC and 71ºC.

.3 Door: Single swing, hinged operation.

.4 Provide for manual open, close, and break-open operation of door leaves in the event of power failure.

.5 Equipment designed to operate swing doors up to weight of 102 kg.

.6 Opening Speed: Field adjusted to back check as required in Table 1 of ANSI/BHMA A156.19. Opening speed to fully open 4 seconds or longer.

.7 Hold Open: Door field adjusted to remain fully open for minimum 5 seconds, maximum 30 seconds.

.8 Closing Speed: Doors field adjusted to close 90° to 10° in 3 seconds or longer as required in Table 1 of ANSI/BHMA A156.19. Doors to close from 10o to fully closed in minimum 1.5 seconds. Force required to prevent door from opening or closing maximum 7 kg applied 25 mm from latch edge of door at any point in opening or closing cycle. During power failure, doors to open with manual pressure maximum 11 kg at point 25 mm from latch edge of door. Doors equipped with signs visible from either side, instructing user as to operation and function of door.

.9 System Operation: Where 1 of push buttons on either side of door actuated door to open slowly to back check (80°) in 3 to 6 seconds and to full open position in 4 to 7 seconds. Door to remain open for period set to suit requirements (period of 5 to 30 seconds). After time delay door to close by spring in door operator from 90° to 10° in 3 to 6 seconds from 10° to fully closed in 1-1/2 to 2 seconds.

.10 Provide header complete with full housing, finish to match door frame finish.

.11 Operator activated by 114 mm diameter stainless steel push button switches surface mounted on wall on either sides of doors as indicated. Switches located at 250 mm and 1000 mm from floor. Switches to bear engraved universal handicap logo visible to all types of traffic.

.2 Regulatory Requirements:

.1 Conform to applicable code for automatic release of control drive unit to permit manual opening of doors.

.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.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that surfaces, openings and recesses are ready to receive work and dimensions are as indicated on Shop Drawings.

.3 Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

.1 Provide automatic door operators, controls and accessories for doors indicated.

.2 Doors to operate manually as though equipped with manual door closers, without damage to automatic door components, in event of power failure or in event of power termination.

.3 Install equipment to manufacturer's written instructions.

.4 Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

.5 Provide for dimensional distortion of components during operation.

.6 Install pneumatic lines and door power units in a manner to prevent condensation or freezing.

.7 Coordinate installation of components with related and adjacent work; level and plumb.

.8 Power supply to each door operator and wiring provided by Division 26, Electrical. Make connections at operators and at control panel and supply and install each electrical work

between operators and activating controls. Comply with requirements of Division 26, Electrical. All wiring concealed and run in conduit where exposed. Location of exposed wiring subject to Niagara Region's approval.

3.3 ADJUSTING

.1 Adjust door equipment for correct function and smooth operation.

3.4 CLEANING

.1 Section 01 74 00: Cleaning and Waste Management.

.2 Remove temporary protection, clean exposed surfaces.

.3 Upon completion of Work of this Section, remove from Site all debris, equipment and excess material resulting from Work of this Section.

3.5 DEMONSTRATION AND INSTRUCTIONS

.1 Section 01 79 00: Demonstrating installed work.

.2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Glass and glazing for glazed walls, and doors.

.2 Design, labour, Products, equipment and services necessary for glass and glazing Work in accordance with the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 74 19 – Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 07 92 00 - Joint Sealants: Sealant and back-up materials.

.6 Section 08 31 13 - Access Doors and Frames

.7 Section 08 41 13 - Aluminum-Framed Entrances and Storefronts

1.3 REFERENCE STANDARDS

.1 ASTM C920-18 Standard specification for elastomeric joint sealants

.2 ASTM C1036-21 Standard specification for flat glass

.3 ASTM C1048-18 Standard specification for heat-strengthened and fully tempered flat glass

.4 ASTM C1172-19 Standard specification for laminated architectural flat glass

.5 ASTM E84-21a Standard test method for surface burning characteristics of building materials

.6 ASTM E119-20 Standard test methods for fire tests of building construction and materials

.7 ASTM E283/E283M-19 Standard test method for determining rate of air leakage through exterior windows, skylights, curtain walls, and doors under specified pressure differences across the specimen

.8 ASTM E330/E330M-14 Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

.9 ASTM E2190-19 Standard specification for insulating glass unit performance and evaluation

.10 (a) ASTM C794, Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

.11 (c) ASTM C1087, Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.

.12 (e) ASTM D1187/D1187M, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

.13 CAN/CGSB 12.1-2017 Safety glazing

.14 CAN/CGSB 12.2-M91 Flat, clear sheet glass

.15 CAN/CGSB 12.3-M91 Flat, clear float glass

.16 CAN/CGSB 12.4-M91 Heat absorbing glass

.17 CAN/CGSB-12.5, Mirrors, Silvered.

.18 CAN/CGSB 12.8-2017 Insulating glass units

.19 CAN/CGSB 12.9-M, Spandrel Glass.

.20 CAN/CGSB 12.10-M76 Glass, light and heat reflecting

.21 CAN/CGSB 12.11-M90 Wired safety glass

.22 CAN/CGSB 12.13-M, Patterned Glass.

.23 CAN/CGSB 12.20-M, Structural Design of Glass for Buildings.

.24 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.25 CAN/ULC-S104-15 - Standard Method for Fire Tests of Door Assemblies.

.26 16 CFR 1201 - Safety standard for architectural glazing materials

.27 Glazing manual - 50th anniversary edition

.28 IGMA (Insulating Glass Manufacturers Alliance).

.29 NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 edition.

.30 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies, 2022 Edition.

.31 NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies, 2022 Edition.

.32 STD UL 263-11 Fire tests of building construction and materials

.33 IGMAC, Insulating Glass Manufacturer's Association of Canada.

.34 LSGA, Laminators Safety Glass Association, Standards Manual.

.35 NFPA 80, Fire Doors.

.36 OBC, Ontario's Building Code.

.37 UL 752, Standard for Bullet Resisting Equipment.

.38 ULC, Underwriters Laboratories of Canada.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.

.2 Pre-Installation Meeting: Convene one (1) week before starting work of this section.

1.5 DESIGN REQUIREMENTS

.1 Conform to OBC design requirements and design glass in accordance with CAN/CGSB 12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, train dynamic pressure of 2.0 kPa uniform distributed load, handling, transportation and erection loads. In case of discrepancies, the most stringent requirements to govern.

.2 Framing and connection details: Design framing and connections, where not indicated on Contract Drawings, in accordance with CSA S16 and CSA S136.1.

.3 Framing-system glass bite: Coordinate with other Sections and size glass units as required to ensure that the minimum glass bite on all 4 sides is 15 mm for all glazing Types.

.4 Industry standards: Design, fabricate and install the Work in accordance with the guidelines and recommendations of the following industry manuals. In case of discrepancies, the most stringent requirements govern:

.5 GANA, Glazing Manual.

.6 GANA, Sealant Manual.

.7 GANA, Laminated Glazing Reference Manual.

.8 GANA, Engineering Standards Manual.

.9 LSGA, Standards Manual.

.10 Deflection: Size glass thickness to limit glass deflection to 1/200 with full recovery of glazing materials.

1.6 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Glass Sheets: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

.2 Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colours.

.3 Samples:

.1 Submit two (2) samples 500 mm in size, exampling glass units.

.2 Submit 500 mm long bead of glazing sealant, colour as selected.

1.7 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Certificates: Certify that Products meet or exceed specified requirements.

.3 Manufacturer's Certificate: Certify that sealed insulated glass, meets or exceeds specified requirements.

.4 Shop drawings: Submit shop drawings in accordance with the Conditions of the Contract for fabrication and erection of glazing elements indicating materials, thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.8 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.9 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide one (1) of each glass type size.

1.10 QUALITY ASSURANCE

.1 Perform Work in accordance with GANA Glazing Manual for glazing installation methods. Maintain one (1) copy of document on site.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by the manufacturer.

.3 Quality Assurance Submittal(s):

.1 Submit manufacturer's certification compatibility of glass and glazing materials.

.2 Submit IGMAC Certification Number(s) for Products provided for this Contract.

.4 Retain Professional Engineer, licensed in the Province of Ontario, with experience in glazing work of comparable complexity and scope, to perform the following services as part of the Work of this Section:

.1 Design glass and glazing Work.

.2 Review, stamp and sign fabrication and erection Shop Drawings.

.3 Conduct shop and site inspections and prepare inspection reports.

1.11 MOCK-UPS

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide mock-up of systems including glass and air barrier and vapor retarder seal.

.3 Locate where directed.

.4 Approved mock-up may remain as part of the Work.

1.12 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not install glazing when ambient temperature is less than 10 degrees C.

.2 Maintain minimum ambient temperature before, during and twenty-four (24) hours after installation of glazing compounds.

.2 Coordinate the Work of this Section with the installation of framing to ensure a continuous, uninterrupted sequence and to prevent the undue exposure of unprotected frames to the weather or contamination.

.3 Do not install any glazing until all nearby welding is completed.

1.13 WARRANTY

.1 Section 01 78 00: Warranties.

.2 Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

.3 Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.

Part 2 Products

2.1 MANUFACTURERS

.1 AFGD Glass Inc.

.2 AGC Glass Company.

.3 General Electric Company.

.4 Guardian Industries Corp.

.5 Laird Plastics.

.6 Nippon Electric Glass Company Ltd.

.7 Oldcastle Glass Inc.

.8 Pilkington Glass of Canada Ltd.

.9 PPG Canada Inc.

.10 Prelco Inc.

.11 Saint-Gobain Vetrotech.

.12 TGP

.13 Visteon Corporation.

2.2 MATERIALS

.1 General

.1 Glass shall be glazing quality, clear float glass or low iron, thickness 6 mm unless otherwise specified.

.2 Glass thicknesses shall be to the minimum indicated or of greater thickness to ensure compliance with the design requirements of this Section and reviewed Shop Drawings.

.3 Provide the glazing types specified in this Section.

.2 Tempered Glass:

.1 Impact safety rated in accordance with CAN/CGSB 12.1-M, Type 2, Class B, Category II, minimum thickness 6 mm.

.2 Clear float glass.

.3 Perform tempering using horizontal tong free method.

.3 Fire-rated glass labelled up to 90 min for fire-rated doors:

.1 Fire rated in accordance with CAN4-S106-M.

.2 5 mm minimum thickness clear glass ceramic.

.3 Impact safety rated accordance with CAN/CGSB 12.1-M, Type 2, Class B, Category II.

2.3 SEALED INSULATING GLASS UNITS

.1 Insulated Glass Units (Type SG-A): 1, double pane, interpane space filled with argon gas; with metal edge seal; total unit thickness of 25 mm.

.1 Inner Pane: 6 mm impact rated tempered safety glass.

.2 Outer Pane: 6 mm impact rated tempered safety glass. Low 'E' coating on surface 2.

.3 Performance

.1 Colour as selected by Niagara Region from manufacturer's full line.

.2 Solar heat gain coefficient: 0.40 maximum.

.3 Visible light transmission: 68% minimum.

.4 Winter U-valve: 1.64 W/(sq.m K) maximum

.5 Summer U-valve: 1.76 W/(sq.m K) maximum.

.2 Edge Seal: Metal edge seal; stainless steel, bent and spot welded corners.

2.4 GLAZING ACCESSORIES

.1 Glazing and rebate primers, sealants, sealers, and cleaners: Compatible with each other. Type as recommended by glazing manufacturer.

.2 Glazing sealant: Silicone sealant as recommended by glazing manufacturer.

.3 Heel & toe bead: Silicone sealant as recommended by glazing manufacturer.

.4 Glazing gasket: extruded composite glazing seal in grey colour, size and type as recommended by glazing manufacturer.

.5 Glazing tape: Polyshim II glazing tape EPDM shim.

.6 Glazing splines: Silicone, extruded shape to suit glazing channel retaining slot, colour as selected.

.7 Setting Block (Structural Glazing): Silicone setting blocks with Shore, Type A durometer hardness of 85, plus or minus 5 to ASTM D2240, sized to suit glazing method, glass unit weight and area.

.8 Edge blocks: EPDM, 60-70 Shore A Durometer hardness, sized with 3 mm clearance from glass edge and spanning glass thickness(es). Capable of withstanding weight of glass unit, self adhesive on face.

.9 Glass presence markers: Easily removable, non-residue depositing.

.10 Isolation Coating: Bituminous Paint:

.1 Brush or spray grade, non-fibrated, asbestos free, liquid asphalt type emulsion in accordance with ASTM D1187/D1187M, Type I or II.

.1 Karnak 100 AF Non-Fibered Emulsion Dampproofing by Karnak Corporation.

.2 Sealmastic by W.R. Meadows of Canada.

.3 No. 810-07 Non-Fibered Asphalt Coating by Henry Company Canada Inc.

.11 Screws, bolts and fasteners: In accordance with ASTM F738M; Type 304 stainless steel.

.12 Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units destined for removal for smoke control.

2.5 FABRICATION

.1 Verify glazing dimensions on Site.

.2 Clearly label each glass lite with maker's name and glass type. Ensure labels are easily removable, non-residue depositing type. Do not remove labels until after Work is accepted by Consultant.

.3 Fabricate glazing not less than 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims, and setting blocks as necessary.

.4 Work shall have smooth finished surfaces free from distortion and defects detrimental to appearance and performance.

.5 Carefully make and fit details. Take special care with exposed finished Work to produce a neat and correct appearance to the Consultant's acceptance.

.6 Grind and polish a 1.5 mm arris to all vertical edges of glazing.

2.6 SHOP INSTALLATION

.1 Provide glazing in accordance with IGMA recommendations. Provide continuous contact between glazing tapes and gasket to the glazing.

.2 Provide neat, straight sight lines. Trim excess glazing material flush with top of stops and fixed leg of frames.

.3 Remove protective coatings, glazing stops, clean rebate and glass contact surfaces with solvent, wipe dry.

.4 Apply primer/sealer to contact surfaces, prior to glazing.

.5 Apply glazing tape as per manufacturer’s instructions including recommended corner sealant.

.6 Use setting blocks at 1/4 points and spacers to centre glass unit in frame.

.7 Install glazing in accordance with reviewed shop drawings and manufacturer's written instructions. Install glazing with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.

.8 Apply a continuous heel bead of sealant around perimeter of inboard lite of the sealed unit and the metal framing.

.9 Re-install glazing stops ensuring continuous contact and rattle-free installation. Do not distort glass. Trim tape protruding more than 2 mm above stop.

.10 Install glazing gasket in accordance with manufacturer’s recommendations.

.11 Do not cut or abrade tempered, heat treated, or coated glass.

.12 Install glass presence markers in two cross stripes extending from diagonal corners. Maintain markers until final clean-up.

.13 Remove, dispose of, and replace broken, cut, abraded glass, and defective glass including but not limited to production dimples, tiger-stripping, chips, cracks, etc.

.14 Exterior glass: Glaze units in accordance with reviewed shop drawings and in accordance with manufacturer’s written instructions.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that openings for glazing are correctly sized and within tolerance.

.3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

.4 Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

.4 Install sealant in accordance with manufacturer's written instructions.

3.3 INSTALLATION - GLAZING

.1 Refer to the Contract Drawings and schedules for glazing requirements and locations.

.2 Install glazing to the Work unless specified to be carried out under other Sections. Work of this Section includes all glazing not specified under other Sections.

.3 Remove glazing stops, clean rebate and glass contact surfaces with solvent, wipe dry.

.4 Apply primer to contact surfaces prior to glazing.

.5 Use setting blocks at 1/4 points and spacers to centre glass unit in frame.

.6 Perform work in accordance with GANA, Glazing Manual, IGMAC and Laminators Safety Glass Association Standards Manual for glazing installation methods.

.7 Size glass to code requirements and verify openings for glazing correctly sized and within tolerance and install glazing in accordance with manufacturer's written instructions.

.8 Install glazing with full contact and adhesion at perimeter.

.9 Maintain edge clearance recommended by glass manufacturer.

.10 Reinstall glazing stops ensuring continuous contact and rattle-free installation. Do not distort glass. Trim tape protruding more than 2 mm above stop.

.11 Install glass presence markers in 2 cross stripes extending from diagonal corners. Maintain markers until final clean-up.

.12 Remove, dispose of and replace broken, cut and abraded glass.

.13 Install 2 sided frameless structural butt joint glass assemblies using tempered safety glass with slightly wet grinded kerf and polished butt-joint edges for aesthetics.

.14 Ensure precise levelling of sill member achieved and provision made at head to accommodate deflection of structure.

.15 For glazing at head and sill use wet, dry, or wet/dry glazing systems. Position glazing so vertical edges spaced slightly apart and seal with clear, colourless or coloured silicone sealant.

.16 At framing or rebate locations, provide clear colourless or coloured silicone sealant in clear colourless or colour selected by Niagara Region.

.17 Ensure sealant flush with and does not protrude above glazing stop or rebate.

.18 Fire rated glazing to be installed as required by the fire rating listing and NFPA 80.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove glazing materials from finish surfaces.

.3 Periodically clean installed glass during construction to avoid permanent etching and staining.

.4 Remove labels, protective material and glass presence markers from prefinished surfaces after Work is complete.

.5 Avoid storing materials adjacent to glass

.6 Protect glass from other trades

.7 At completion of Work, replace any damaged or broken glass provided under this Section with similar glass.

.8 Clean glass and adjacent surfaces.

3.5 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Protect glass from other trades

.3 After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Gypsum board.

.2 Cementitious backer board.

.3 Acoustic insulation.

.4 Light gauge metal stud wall framing.

.5 Metal channel ceiling framing.

.6 Design, labour, Products, equipment and services necessary for gypsum and cement board Work in accordance with the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 05 41 00 - Structural Metal Lightweight Framing: Load bearing studs for exterior applications.

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 06 20 00 - Finish Carpentry.

.4 Section 07 84 00 - Firestopping.

.5 Section 07 92 00 - Joint Sealants.

.6 Section 08 31 13 - Access Doors and Frames: Metal access panels and frames.

.7 Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCE STANDARDS

.1 STD A108/A118/A136.1:2021 American National specifications for the installation of ceramic tile

.2 ASTM C475/C475M-17 Standard specification for joint compound and joint tape for finishing gypsum board

.3 ASTM C514-04(2020) Standard specification for nails for the application of gypsum board

.4 ASTM C557-03(2017) Standard specification for adhesives for fastening gypsum wallboard to wood framing

.5 ASTM C645-18 Standard specification for nonstructural steel framing members

.6 ASTM C665-17 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing

.7 ASTM C754-20 Standard specification for installation of steel framing members to receive screw-attached gypsum panel products

.8 ASTM C840-20 Standard specification for application and finishing of gypsum board

.9 ASTM C1002-20 Standard specification for steel self-piercing tapping screws for application of gypsum panel products or metal plaster bases to wood studs or steel studs

.10 ASTM C1047-19 Standard specification for accessories for gypsum wallboard and gypsum veneer base

.11 ASTM C1278/C1278M-17 Standard specification for fiber-reinforced gypsum panel

.12 ASTM C1288-17 Standard specification for fiber-cement interior substrate sheets

.13 ASTM C1325-21 Standard specification for fiber-mat reinforced cementitious backer units

.14 ASTM C1396/C1396M-17 Standard specification for gypsum board

.15 ASTM E90-09(2016) Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements

.16 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.17 CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.18 CAN/ULC-S702-14 - Standard for Mineral Fibre Thermal Insulation for Buildings.

.19 Gypsum Association GA-214-2017 - Recommended Levels of Gypsum Board Finish.

.20 Gypsum Association GA-216-2016 - Application and Finishing of Gypsum Panel Products.

.21 Gypsum Association GA-600-2015 - Gypsum Fire Resistance Design Manual.

.22 Gypsum Association GA-801-2017 - Handling and Storage of Gypsum Panel Products.

.23 UL - Fire Resistance Directory.

.24 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Provide data on metal framing, gypsum board, backer board, joint tape, and accessories.

.2 Provide data decorative finish.

.3 Provide MSDS on all products within the shaft wall assembly.

.3 Shop Drawings, Indicate:

.1 Special details associated with firestopping seal for openings and fireproofing.

.2 Performance criteria, compliance with appropriate reference standard, characteristics and limitations.

.3 Adjacent construction, elevations, sections and details, dimensions, thickness, finishes and relationship to adjacent construction.

.4 Shop Drawings indicating details for anchorage and bracing for seismic restraint, stamped and signed by Engineer licensed to practice in the Province that the work is being installed in.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

1.6 DESIGN REQUIREMENTS

.1 Design ceiling suspension system in accordance with manufacturer's printed directions and ASTM C754.

.2 Design suspended ceiling system for adequate support of electrical fixtures to meet requirements of the OESC and OBC.

.3 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.4 Design suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures and with adequate support to allow rotation/relocation of light fixtures.

.5 Design ceiling system to withstand positive and negative wind loads, uplift of piston effect of up to 1.25 kPa and train wind load of 158 km/h (44 m/s).

.6 Design subframing as necessary to accommodate and to circumvent conflicts and interferences where ducts or other equipment prevent the regular spacing of hangers.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

.1 Perform Work in accordance with ASTM C840. Maintain one (1) copy of document on site.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.3 Handling Gypsum Board: Comply with GA-801.

1.9 SITE CONDITIONS

.1 Do not begin Work of this Section until:

.1 Wet Work including concrete, masonry, plaster, stucco and terrazzo finishes are complete.

.2 Mechanical and electrical Work above the gypsum board ceilings is complete.

.3 Relative humidity is below 80%.

.4 Ventilation is adequate to remove excess moisture.

.5 Substrate and ambient temperature for gypsum board:

.1 Prior to installation: Maintain between 10°C to 20°C for 48 hours.

.2 During installation: Maintain between 10°C to 20°C.

.3 After Installation: Maintain between 10°C to 20°C for 48 hours after completion with joint treatment.

Part 2 Products

2.1 FRAMING MATERIALS

.1 Studs and Tracks: Specified in Section 09 22 16.

.2 In accordance with ASTM A653/A653M, Z275; cold rolled, galvanized steel sheet:

.1 2.1.1.2.1 Steel studs and track runners: In accordance with ASTM C645; formed from galvanized steel sheet, 1.12 mm thick, galvanized steel studs and runners, 32 mm wide x 89 mm depth and as indicated on Contract Drawings.

.2 Main carrying channels: In accordance with ASTM C645; formed from galvanized steel sheet, 38 mm x 19 mm cold rolled channels.

.3 Furring channels: In accordance with ASTM C645; formed from galvanized steel sheet cold rolled, width 64 mm, depth 13 mm.

.3 Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

2.2 GYPSUM BOARD MATERIALS

.1 Board manufacturers:

.1 CertainTeed Gypsum Inc.

.2 CGC Inc.

.3 Georgia Pacific Canada.

.2 Standard gypsum board: In accordance with ASTM C1396/C1396M; 15.9 mm thick and of maximum practical lengths to minimize end joints, unless indicated otherwise.

.3 Fire rated gypsum board: In accordance with ASTM C1396/C1396M Type X or C as indicated on Drawings. Of maximum practical lengths to minimize end joints, unless indicated otherwise.

.4 Interior ceiling board: Sag resistant, in accordance with ASTM C1396/C1396M; of maximum practical lengths to minimize end joints, unless indicated otherwise.

.5 Exterior soffit board: Weather and sag resistant, in accordance with ASTM C1396/C1396M; of maximum practical lengths to minimize end joints, unless indicated otherwise.

.6 Moisture and mould resistant gypsum board: In accordance with ASTM C1396/C1396M, ASTM C1177/C1177M, ASTM D3273 score of 10; 15.9 mm thick and of maximum practical lengths to minimize end joints, unless indicated otherwise.

.7 Tile backer gypsum board: In accordance with ASTM C1178/C1178M and ASTM C1658/C1658M; as indicated on Contract Drawings.

.1 Diamondback Tile Backer or Diamondback Type X Tile Backer by CertainTeed Gypsum Inc.

.2 Sheetrock Mould Tough Fibreglass Interior Panel or Sheetrock Mould Tough Fibreglass Type X Interior Panel] by CGC Inc.

.3 DensShield Tile Backer or DensShield Tile Backer Type X by Georgia Pacific Canada.

2.3 ACCESSORIES

.1 Acoustic Insulation: CAN/ULC-S702 Type 1; preformed glass fibre, friction fit type, unfaced.

.1 QuietZone by Owens Corning Inc.

.2 AFB by Roxul Inc.

.2 Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board. In accordance with CAN/CGSB 19.21-M.

.3 Corner Beads: ASTM C1047, metal corner bead.

.4 Edge Trim: ASTM C1047; of galvanized steel sheet.

.5 Joint Materials: ASTM C475/C475M.

.1 Reinforcing tape, adhesive, and water.

.2 Joint compound: In accordance with ASTM C475/C475M; asbestos-free, dust-controlled supplied by manufacturer of gypsum board used.

.6 Screw fasteners: In accordance with ASTM C1002 Type S; corrosion resistant.

.7 Hanger wires: 4.1 mm minimum diameter, pencil rod, steel wire, galvanized.

.8 Tie wire: 1.6 mm thick minimum diameter, soft annealed, galvanized steel wire.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that site conditions are ready to receive work and opening dimensions are as instructed by the manufacturer.

3.2 METAL STUD INSTALLATION

.1 Install studs to ASTM C475/C475M, manufacturer's written instructions, and assembly listings.

.2 Install wall framing requiring seismic restraint to meet requirements of Ontario Building code.

.3 Metal Stud Spacing: 406 mm unless noted otherwise on centre.

.4 Refer to Drawings for indication of partitions extending stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

.5 Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.

.6 Blocking: Bolt or screw steel channels to studs. Install blocking for support of fittings, fixtures, accessories and miscellaneous specialties.

3.3 WALL FURRING INSTALLATION

.1 Erect furring for direct attachment to masonry and concrete walls.

.2 Erect metal stud framing tight to masonry and concrete walls, attached by adjustable furring brackets in accordance with manufacturer's written instructions.

.3 Erect metal stud framing spaced 50 mm from masonry and concrete walls, attached by adjustable furring brackets in accordance with manufacturer's written instructions.

3.4 FURRING FOR FIRE RATINGS

.1 Install furring as required for fire resistance ratings indicated and to GA-600 requirements.

3.5 CEILING FRAMING INSTALLATION

.1 Install to ASTM C754 and manufacturer's written instructions.

.2 Install metal suspension system requiring seismic restraint to meet requirements of Ontario Building code.

.3 Install hanger wires plumb and securely anchored to the building structural framing, independent of walls, pipes, ducts and metal deck; install additional framing and hangers to bridge interference items.

.4 Install hanger wires at 1220 mm maximum centres along carrying channels, not less than 25 mm and not more than 150 mm from channel ends.

.5 Install additional hangers at lighting fixture and air distribution ductwork locations. Do not attach hanger wires to mechanical or electrical equipment. Do not support mechanical and electrical fixtures and fittings on ceiling without the ceiling manufacturer's written acceptance.

.6 Install main carrying channels transverse to structural framing members. Lap main carrying channels 200 mm minimum at splices and wire each end with 2 loops and prevent clustering or lining-up of splices.

.7 Install furring channels at 400 mm o.c., not less than 25 mm and not more than 150 mm from perimeter walls, at openings, at interruptions in ceiling continuity and at change in plane. Install furring channels to a tolerance of 3 mm maximum in 3600 mm.

.8 Install additional main carrying and furring channels to frame and to reinforce openings such as recessed lighting fixtures, access hatches, ceiling grilles, outlet boxes, ventilating outlets and similar items.

.9 Coordinate location of hangers with other work.

.10 Install ceiling framing independent of walls, columns, and above ceiling work.

.11 Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.

.12 Laterally brace entire suspension system.

3.6 ACOUSTIC ACCESSORIES INSTALLATION

.1 Install resilient channels at maximum spacing noted on assembly listing on centre. Locate joints over framing members.

.2 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

.3 Install acoustic sealant within partitions in accordance with manufacturer's written instructions.

.4 Install acoustic sealant at gypsum board perimeter at:

.1 Metal Framing: Two (2) beads.

.2 Base Layer.

.3 Face Layer.

.4 Caulk all penetrations of partitions by conduit, pipe, duct work, rough-in boxes, and other components.

3.7 GYPSUM BOARD INSTALLATION

.1 Install gypsum board to ASTM C840 and manufacturer's written instructions.

.2 Erect single layer standard gypsum board vertically or horizontally, whichever result in fewer end joints, with ends and edges occurring over firm bearing.

.3 Erect single layer fire rated gypsum board with orientation according to listing for fire rate assembly, with edges and ends occurring over firm bearing.

.4 Use screws when fastening gypsum board to metal furring or framing.

.5 Use screws when fastening gypsum board to wood furring or framing. .

.6 Double Layer Applications: Use gypsum backing board for first layer, placed in orientation required to framing or furring members. Use fire rated gypsum backing board for fire rated partitions and ceilings.

.7 Double Layer Applications: Secure second layer to first with fasteners and adhesive and sufficient support to hold in place. Apply adhesive to manufacturer's written instructions.

.8 Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.

.9 Treat cut edges and holes in moisture resistant gypsum board with sealant.

.10 Place control joints consistent with lines of building spaces as directed.

.11 Place corner beads at external corners as indicated. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.

.12 Install backing board over substrate to manufacturer's written instructions.

.13 Apply gypsum board to curved walls in accordance with GA-216.

.14 Gypsum Board Finish: finish gypsum board walls and ceiling to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: No tapping, finishing or accessories required for temporary hoarding only.

.2 Level 1 for concealed areas only: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.3 Level 2 for areas to receive the final finish tile covering: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.4 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges. For use in permanent assemblies that will receive painted finishes.

3.8 JOINT TREATMENT

.1 Finish to ASTM C840 to level noted. Install reinforcing tape and multiple coats of joint compound over gypsum board joints, metal trim and accessories and screw fasteners in accordance with the gypsum board manufacturer's instructions.

.2 Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

.3 Feather coats on to adjoining surfaces so that camber is maximum 0.8 mm.

.4 Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

.5 Fill and finish joints and corners of backing board.

.6 Install finished gypsum board Work smooth, seamless, plumb, true, flush and with square, plumb and neat corners.

3.9 TOLERANCES

.1 Section 01 73 00: Tolerances.

.2 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 3 mm in 3 m in any direction.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 41 01 - Structural Metal Stud & Joist Framing.

.2 Section 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C645- 14e1, Standard Specification for Nonstructural Steel Framing Members.

.2 ASTM A653/A653M- 07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.

.3 ASTM C754- 15, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Underwriter's Laboratories (UL)

.1 UL-2768- 2011, Architectural Surface Coatings.

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.1 MPI #26, Primer, Galvanized Metal, Cementitious.

.4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168- A2005, Adhesives and Sealants Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 30 - Health and Safety Requirements

.3 Samples:

.1 Submit duplicate 300 mm long samples of non-structural metal framing.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to Site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal framing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated, roll formed from 0.91 mm thickness hot dipped zinc-coated (galvanized) steel sheet in accordance with ASTM A653, Z180, for screw attachment of gypsum board.

.1 Knock-out service holes at 460 mm centres.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, and as follows:

.1 Double Runner Deflection Track: Outside runner using 75 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.

.2 Deep Leg Deflection Track: Top runner having 75 mm down standing legs; maintaining 13 mm minimum deflection space.

.3 Base Runner: Bottom track with 33 mm upstanding legs.

.3 Furring Channels: Commercial steel sheet in accordance with ASTM A653, Z180, hot dipped zinc-coated (galvanized), as follows:

.1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.75 mm thickness x 22 mm deep

.2 Resilient Furring Channels: 0.46 mm thickness x 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).

.4 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.

.5 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

.6 For load bearding steel stud and joint framing see Section 05 41 01 - Structural Metal Stud & Joist Framing.

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 non-structural metal framing application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Niagara Region Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval to proceed from.

3.2 ERECTION

.1 Erect partitions in accordance with framing requirements of ASTM C754

.2 Align partition tracks at floor and ceiling and secure at 610 mm on centre maximum.

.3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.4 Unless noted otherwise place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.

.1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.5 Erect metal studding to tolerance of 1:1000.

.6 Attach studs to bottom and ceiling track using screws.

.7 Co-ordinate simultaneous erection of studs with installation of service lines. Align web openings when erecting studs.

.8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.9 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.

.1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.10 Install heavy gauge single jamb studs at openings.

.11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.

.1 Secure track to studs at each end, in accordance with manufacturer's instructions.

.2 Install intermediate studs above and below openings in same manner and spacing as wall studs.

.12 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.13 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.14 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.15 Extend partitions to ceiling height except where noted otherwise on drawings.

.16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

.1 Use 50 mm leg ceiling tracks. Use double track slip joint.

.17 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.18 Install insulating strip under studs and tracks around perimeter of sound control partitions.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Labour, Products, equipment, and services necessary for tiling Work in accordance with Contract Documents.

.2 Porcelain tiles.

.3 Tile accessories.

.4 Mortar and Grout.

.5 Floor levelling.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal procedures

.2 Section 01 43 39 - Mock Ups

.3 Section 01 61 00 - Common product requirements

.4 Section 01 74 00 - Cleaning and Waste management

.5 Section 01 78 00 - Closeout submittals

.6 Section 07 92 00 - Joint Sealants

.7 Section 09 23 00 - Gypsum Plastering: Scratch and brown coats for tile finish.

.8 Section 09 21 16 - Gypsum Board Assemblies: Gypsum board wall substrate.

.9 Section 10 28 13 - Toilet Accessories

1.3 REFERENCE STANDARDS

.1 STD A108/A118/A136.1:2021 American National specifications for the installation of ceramic tile

.2 STD A137.1:2021 American National standard specifications for ceramic tile

.3 ASTM C144-18 Standard specification for aggregate for masonry mortar

.4 ASTM C171-20 Standard specification for sheet materials for curing concrete

.5 ASTM C207-18 Standard specification for hydrated lime for masonry purposes

.6 ASTM C241/C241M-21 Standard test method for abrasion resistance of stone subjected to foot traffic

.7 ASTM C373-18 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

.8 ASTM C503/C503M-15 Standard specification for marble dimension stone

.9 ASTM C568/C568M-15 Standard specification for limestone dimension stone

.10 ASTM C615/C615M-18e1 Standard specification for granite dimension stone

.11 ASTM C627-18 Standard test method for evaluating ceramic floor tile installation systems using the Robinson-type floor tester

.12 ASTM C629/C629M-15 Standard specification for slate dimension stone

.13 ASTM C847-18 Standard specification for metal lath

.14 ASTM C1353/C1353M-20e1 Standard test method for abrasion resistance of dimension stone subjected to foot traffic using a rotary platform abraser

.15 ASTM C1527/C1527M-11(2018) Standard specification for travertine dimension stone

.16 CAN/CGSB 51.34-M86 Vapor barrier, polyethylene sheet for use in building construction

.17 CAN/CGSB 25.20-95 Surface sealer for floors

.18 STD A3000-18 Cementitious materials compendium

.19 STD A123.3-05 Asphalt saturated organic roofing felt

.20 TTMAC, Terrazzo, Tile and Marble Association of Canada, Specification Guide 09 30 00 Tile Installation Manual.

.21 TTMAC, Terrazzo, Tile and Marble Association of Canada, Hard Surface Maintenance Guide.

.22 DIN 51130:2014 Testing of floor coverings. Determination of anti-slip property. Workrooms and fields of activities with slip danger, walking method. Ramp test

.23 ISO 10545 Series - Ceramic Tiles, Standards for Testing.

.24 ISO 13006:2018 Ceramic tiles - Definitions, classification, characteristics and marking

.25 Handbook for ceramic, glass, and stone tile installation

.26 2019-2021 Specifications guide 09 30 00 tile installation manual

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate requirements for floor recesses, accounting for mortar bed, bond coat and tile thickness where finished tile surfaces are installed flush with adjacent floor finishes.

.2 Pre-installation Meetings: Convene one (1) week before starting work of this section.

.1 Attendance required by tile installer and Constructor to discuss site conditions.

1.5 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Submit manufacturer's product data for each type of product specified.

.3 Shop Drawing(s):

.1 Catalogue cut sheets and technical data.

.2 Manufacturer’s installation and instruction guidelines.

.3 Design data and test report.

.4 Requirements for transportation, storage, and handling of Products.

.5 Tile layout, patterns, colour arrangement, and control joint locations.

.6 Perimeter conditions, junctions with dissimilar materials.

.7 Setting details.

.8 Ventilation Plan

.4 Samples for Initial Selection: Submit the following samples for initial selection:

.1 Tile: Submit samples of actual tiles or sections of tiles showing manufacturer's full range of colours, textures, and patterns available for each type and composition of tile indicated. Include samples of accessories involving colour selection.

.2 Grout: Manufacturer's standard colours using actual sections of grout showing full range of colours available for each type of grout indicated.

.5 Samples for Verification: Submit the following samples for final verification, including full range of colour and texture variations expected.

.1 Tiles: Submit one (1) pieces of each tile selected.

.2 Trims: Submit full size units of each type of trim and accessory in each colour required for installation; minimum 150 mm lengths.

1.6 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Manufacturer's Certificate: Certify that Products meet or exceed the requirements of ANSI A137.1.

.3 Installation Data:

.1 Manufacturer's recommended and special installation requirements.

.2 Written instructions for using adhesives and grouts.

.4 Quality Assurance Submittal(s):

.1 Submit installer’s proof of membership in good standing with TTMAC.

.2 Submit certification for each type of floor tile that DCOF is minimum 0.42 tested in accordance with ANSI A137.1.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Submit two (2) copies of TTMAC Maintenance Guide and additional information as follows.

.1 Manufacturer’s maintenance data sheets for floor sealers and other non-tile maintenance materials and accessories.

.2 Warning of maintenance practices or materials that may damage or disfigure finished Work.

.3 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.

.4 Submit field quality control inspection reports.

.5 Extra stock materials list in accordance with Article .

.6 Warranty information.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance and extra material requirements.

.2 Extra Stock Materials: Provide 3 sq m of each size, colour, and surface finish of tile specified.

.1 Store in original containers, clearly marked to identify the following:

.1 Manufacturer, stone quarry and distributor’s name.

.2 Material series name and stocking number.

.3 Material description, including colour and pattern.

.3 Maintenance material to be of same production run as installed material.

1.9 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Conform to TTMAC Tile Installation Manual.

.3 Maintain one (1) copy of document on site.

.4 Quality Assurance Program: Provide specifications and material compatibility submissions to TTMAC as required for Verispec Program; include costs for Verispec Program as part of submitted Bid.

.5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.6 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience and having completed tile installations similar in material, design and extent to this Project and be a member in good standing with TTMAC at time of bidding.

.7 Provide certificate of quality compliance from tile manufacturer.

.8 Provide certificate of quality compliance from tile installer upon satisfactory completion of installation.

1.10 MOCK-UPS

.1 Section 01 43 00: Provide mock-up of tile.

.2 Dry lay sample installation for each form of construction and finish required.

.3 Provide 2 m mock-up for washroom, with waterproofing.

.4 Locate where directed by Consultant.

.5 Accepted mock-ups will form the standard of acceptance for the remainder of the Work.

.6 Approved mock-up may remain as part of the Work.

1.11 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver and store packaged materials in original containers with seals unbroken and labels intact.

.3 Store materials to prevent damage or contamination to materials by water, freezing, foreign matter, and other causes; store cementitious materials in a dry area, and raised off floor and ground surfaces.

.4 Have materials delivered to job site prior to installation.

.5 Keep boxes dry and protect from vandalism and away from heavy traffic area.

.6 Store boxes in upright position.

1.12 SITE CONDITIONS

.1 Ambient Conditions:

.1 Apply tile after completion of Work by other sections, to dry, clean, firm, level and plumb surfaces, free from oil or wax or any other material detrimental to tile adhesion.

.2 Do not install Work of this Section outside of the following environmental ranges without Region's and Product manufacturer's written acceptance:

.1 Ambient air and surface temperature: 12°C to 38°C.

.2 Precipitation for exterior tiling work: No Work to be done in rain or snow.

.3 Install epoxy mortar and grout between 18°C and 35°C in accordance with manufacturer’s recommendations.

.3 Maintain temperature range for minimum forty-eight (48) hours before and during installation and until materials are fully set and cured to manufacturer’s recommendations.

.4 Curing time: Maintain temperature range for 48 hours before, during, and after installation.

.5 Install temporary protection and facilities to maintain Product manufacturer's specified environmental requirements for 7 Days before, during, and 7 Days after installation.

.6 Maintain adequate ventilation where Work generates toxic gases or where there is a risk of raising relative humidity to levels detrimental to building finishes and assemblies.

Part 2 Products

2.1 MANUFACTURERS

.1 Porcelain Tile(s) FLOOR tiles acceptable manufacturers:

.1 Porcelanosa

.2 Soho

.3 Stone Tile

.4 Ciot

.5 Emerson

.6 RODA

.7 TileSolutions

.2 Porcelain Tile(s) FLOOR tiles acceptable manufacturers:

.1 Porcelanosa

.2 Soho

.3 Stone Tile

.3 Trim Shapes acceptable manufacturers:

.1 Schluter

.2 Profilitec

.3 EMAC

.4 Mortar and Grout acceptable manufacturers:

.1 Mapei Corporation

.2 Laticrete International Inc.

.3 Ardex Americas

.4 Flextile Ltd

.5 Marcal Products

2.2 DESCRIPTION

.1 System Description:

.1 Porcelain tile, installed on walls and floors, including base and using thinset mortar bed application method.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Tile products manufactured and tested to ANSI A137.1.

.2 Slip Resistance: Minimum dynamic coefficient of friction (DCOF) 0.42 dry/wet in accordance with ANSI A137.1 when tested to BOT 3000 Digital Tribometer..

.3 Floor Traffic Load Bearing Performance: ASTM C627, with the following load rating:

.1 Extra Heavy, passing cycles 1 through 14.

.4 Frost Resistance: Maximum water absorption rating of 0.5% or less when measured to ASTM C373 for ceramic materials. Submit proof of freeze-thaw stability for tile materials having water absorption higher than 0.5%.

.5 Surface Flatness Tolerances:

.1 Large Format Floor Tile (400 x 600 mm and larger): Floor flatness measured to a minimum of FF50; equivalent to 3 mm with maximum 2 gaps under 3 m straightedge measurement.

.2 Wall Tiles: Wall levelling similar to floors tiles having similar sizes listed above.

2.4 PORCELAIN TILE MATERIALS

.1 See Schedules at eh end of the section

2.5 TRIMS AND EDGING

.1 Trims: Shapes and profiles to match colour and finish of adjoining field tile; coordinate with size and coursing of adjoining flat tile where applicable.

.1 Base: Coved, to match flooring for surface finish and colour:

.1 Length of units: wall length

.2 Height: wall height.

.3 Top Edge: Bull nosed.

.4 Internal corners coved.

.5 External corner bullnosed.

.2 Wainscot caps.

.3 Tapered transitions.

.4 Stair Nosings: Slip resistant, textured nosings.

.2 Flexible Trims: Aluminum flexible trim Type Schluter JOLLY Wall Radius Aluminum Matte White 8mm or approved alternative. To use in tiled walls cutouts with existing openings.

.3 Reducer Strips: Purpose made metal extrusion; anodized aluminium type; maximum slope of 1:2.

2.6 MORTAR AND GROUT MATERIALS

.1 Self-Levelling Underlayment: Latex-modified, portland cement-based, as recommended by tile-setting manufacturer.

.1 Product: self-leveler Plus, manufactured by Mapei.

.2 Wall Tile Mortar: ANSI A108/A118/A136.

.1 Dry-Set Portland Cement (interior thin set): Fast-setting, non-sagging water retentive Portland cement mortar.

.1 Product: Ultralite S2, manufactured by Mapei.

.3 Floor Tile Mortar: ANSI A108/A118/A136.

.1 Dry-Set Portland Cement (interior thin set): Fast setting water retentive Portland cement mortar, rated for floor traffic load bearing performance as indicated.

.1 Product: Ultraflex LFT, manufactured by Mapei.

.4 Tile Grout: ANSI A108/A118/A136.

.1 Portland Cement Grout - Unsanded: Factory blended latex-portland cement grout, specifically formulated for joints maximum 3 mm wide.

.1 Colour: white.

.2 Product: Ultracolor Plus, manufactured by Mapei.

2.7 ADHESIVE MATERIALS

.1 Carpet adhesive

.1 Product: Ultrabond ECO 811, manufactured by Mapei

.2 Porcelain Tile adhesive (horizontal and vertical surfaces)

.1 Product: Ultrabond ECO GPT, manufactured by Mapei

.3 Vinyl Tile adhesive (horizontal and vertical surfaces)

.1 Product: Ultrabond ECO 560, manufactured by Mapei

2.8 ACCESSORIES

.1 Crack Isolation: ANSI A108/A118/A136, liquid applied, lightweight fabric reinforced membrane system, thickness as recommended by manufacturer to accommodate in-plane substrate movement.

.1 Product: Mapelastic CI, manufactured by Mapei.

.2 Joint Sealant: As specified in Section 07 92 00.

.3 Sealer: Meeting or exceeding requirements of CAN/CGSB 25.20, Type 1, as recommended by tile manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Examine surfaces and verify that surfaces are ready to receive tile installation.

.1 Substrates are dry; clean; free from oil, waxy films, and curing compounds; and within starting flatness tolerances as specified in Section 03 35 00, and are ready for application of levelling materials.

.2 Grounds, anchors, recessed frames, electrical and mechanical units of Work in or behind tile have been installed.

.3 Joints and cracks in tile substrates are coordinated with tile joint locations.

.3 Verify tile subject to colour variations has been factory blended and packaged. If not factory blended, blend tiles at site before installing.

3.2 PREPARATION

.1 Protect surrounding work from damage or disfiguration.

.2 Vacuum clean surfaces and damp clean.

.3 Seal substrate surface cracks with filler. Level existing substrate surfaces to flatness tolerances specified.

.4 Install backing board over metal studs to board manufacturer's written instructions. Tape joints and corners.

.5 Shot blast existing concrete surface floors, except where new, wood float or broom finished concrete.

.6 Clean and dry surfaces thoroughly. Remove oil, wax, grease, dust, dirt, paint, tar, primers, form release agents, curing compound, and other foreign material from substrate surfaces which may prevent or reduce adhesion.

.1 Where necessary, grind or shot blast surfaces to remove curing compounds and other deleterious matters detrimental to positive bond.

.7 Neutralize trace of strong acids or alkali from substrate.

.8 Where indicated or required, provide sloped-to-drain mortar bed prior to application of tile and waterproofing system. On concrete and masonry walls where tiles and bases are required, apply levelling coat prior to application of thinset mortar.

.9 Other than slabs where waterproofing system is required on existing concrete slabs where existing flooring finishes are demolished and where new tile Work is required, apply levelling coat as required to ensure level substrate prior to mortar application.

.10 Thoroughly clean back of tiles immediately prior to installation.

3.3 INSTALLATION

.1 Install tile to manufacturer's written instructions.

.2 Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

.3 Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions:

.4 Cut and fit tile tight to penetrations through tile. Form corners neatly. Align floor and wall joints.

.5 Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or grout.

.6 Adjust tile layout to minimize tile cutting. Maintain minimum tile width of one-third unit size unless indicated otherwise on Drawings.

.7 Form internal angles square and external angles bullnosed.

.8 Sound tile after setting. Replace hollow sounding units.

.9 Keep control joints free of adhesive or grout. Apply sealant to joints.

.10 Allow tile to set for a minimum of forty-eight (48) hours prior to grouting.

.11 Install grout to TTMAC Tile Installation Manual and manufacturer’s written instructions.

.12 Apply sealant to junction of tile and dissimilar materials and planes.

.13 Install prefabricated edge strips and movement joints at locations indicated or where exposed edge of floor tile meets different flooring materials and exposed substrates.

.14 Protect exposed edges of floor tile with properly sized transition strips; at uneven transitions between 6 mm and 13 mm, use sloped reducer strips.

3.4 INSTALLATION - ACCESSORIES

.1 Membranes:

.1 Install membrane to ANSI A108/A118/A136 and manufacturer's written instructions; lap and seal watertight edges and ends.

.2 Movement Joints: Install control joints where indicated on Drawings, to TTMAC Detail 301MJ-2012/2013; keep control and expansion joints free of setting and grouting materials.

3.5 LIPPAGE TOLERANCES

.1 Field Verification of Finished Installation: To TTMAC Tile Installation Manual lippage limits as follows:

.2

TILE TYPE	TILE SIZE	JOINT WIDTH	ALLOWABLE LIPPAGE
Pressed Floor/Porcelain	All	1.5 mm to less than 6 mm	.78 mm

3.6 FIELD QUALITY CONTROL

.1 Inspection and Testing:

.1 Section 01 45 00: Field inspection.

.2 Provide inspection of the following:

.1 Tiles are set flush and level with adjacent tiles, meeting lippage requirements.

.2 Identify broken, cracked, damaged or hollow sounding tiles.

.3 Accessories are correctly installed.

.4 Grouting and sealant are correctly installed.

.5 Installation is complete to TTMAC.

3.7 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Clean tile and grout surfaces with manufacturer's recommended cleaning methods.

.3 Clean and polish floor and wall tile after grout has cured in accordance with TTMAC recommendations in Hard Surface Maintenance Guide. Do not use acid for cleaning.

.4 Repoint joints after cleaning as required to eliminate imperfections, repeat cleaning as required. Avoid scratching tile surfaces.

3.8 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Protect finished areas from traffic until setting materials have sufficiently cured to TTMAC requirements.

.3 Protect finished floor areas from foot and wheel traffic from floors for a minimum of forty eight (48) hours after completion of grouting.

.4 Prevent direct impact, vibration, and heavy hammering on adjacent and opposite walls for minimum twenty four (24) hours after final installation.

3.9 SCHEDULES

.1

PORCELAIN FLOOR TILES	Manufacturer	Type	Size	Notes
PFT1	1-Porcelanosa	Berna Caliza	600x600mm	
	2-SOHO	Prima colored Warm White	"	
	3-Stone Tile	Architecture - Dark Ivory	"	
PFT2	1-Porcelanosa	Ascot Arce	300x1200mm	Wood texturized
	2-CIOT	Melange	"	
	3-Emerson	Wood Butter Pecan	"	
PFT4	1-Porcelanosa	Toscana caliza	600x600mm	
	2-SOHO	Prima Colored True White	"	
	3-Stone Tile	Architecture White	"	

.2

VINYL FLOOR TILES	Manufacturer	Type	Size	Notes
VFT6	1-Kraus	4111 Shoal Bay II - Rosen	178mmx1220mm	wood texturized
	2-Dura	Fusion 5.5	180mmx1524mm	"
	3-Coretec	Pro Plus XL 7"	180mmx1850mm	"

.3

PORCELAIN WALL TILES	Manufacturer	Type	Size	Notes
PWT4	1-Porcelanosa	Toscana Caliza	600x600mm	to match RAL 9010
	2-SOHO	Prima Colored	"	
	3-Stone Tile	Architecture	"	

.4 Floor tile installation: in accordance with TTMAC detail 311F-A, Tile Bonded to Concrete Slab -Thin-Set Method.

.5 Wall Tile installation concrete block substrate: in accordance with TTMAC detail 303W, Tile Installed Over Masonry or Concrete Walls -Thin-Set Method.

.6 Wall Tile installation backer board substrate: in accordance with TTMAC detail 305W-Tile Installed on Coated Glass Mat Backer Board - Thin-Set Method/Walls.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Suspended metal grid ceiling system and perimeter trim.

.2 Acoustic panels.

.3 Design, labour, Products, equipment, and services required for acoustical ceilings Work in accordance with Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal procedures

.2 Section 01 43 39 – Mockup Requirements.

.3 Section 01 45 00 - Quality Control.

.4 Section 01 74 19 - Waste Management and Disposal.

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 06 10 53 – Miscellaneous Rough Carpentry

.7 Section 09 22 26 – Suspension systems

.8 Section 08 31 13 - Access Doors and Frames: Access panels.

.9 Section 09 21 16 - Gypsum Board Assemblies

.10 Division 21 - Fire Suppression: Sprinkler heads in ceiling system.

.11 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Air diffusion devices in ceiling system.

.12 Section 26 51 13 - Interior Luminaires: Light fixtures in ceiling system.

.13 Division 27 - Communications: Speakers in ceiling system.

.14 Section 28 46 00 - Fire Alarm: Fire alarm components in ceiling system.

1.3 REFERENCE STANDARDS

.1 ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM C635/C635M-17 Standard specification for manufacture, performance, and testing of metal suspension systems for acoustical tile and lay-in panel ceilings

.3 ASTM C636/C636M-19 Standard practice for installation of metal ceiling suspension systems for acoustical tile and lay-in panels

.4 ASTM C665-17 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing

.5 ASTM E580/E580M-20 Standard practice for installation of ceiling suspension systems for acoustical tile and lay-in panels in areas subject to earthquake ground motions

.6 ASTM E1264-19 Standard classification for acoustical ceiling products

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.4 DEFINITIONS

.1 Delegated Design Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce Shop Drawings to meet requirements of authorities having jurisdiction; and registered or licensed in the Province of Ontario, Canada.

1.5 DESIGN REQUIREMENTS

.1 Design suspension system to support safely and without distortion, superimposed loads of:

.1 Lighting fixtures.

.2 Air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles.

.3 Drapery tracks and drapes.

.4 Power grid system, where indicated.

.2 Acoustical ceiling suspension system to support weight of mechanical and electrical items, such as air handling boots and lighting fixtures and with adequate support to allow rotation or relocation of light fixtures.

.3 Hanger anchor and entire acoustical ceiling suspension system static loading not to exceed 25% of their ultimate capacity, including lighting fixture dead loads.

.4 Design suspension system to support lighting fixtures according to Ontario Hydro regulations and submit certification in accordance with Rule 30-302 (1).

.5 Prepare panels for sprinkler head penetrations and suspension members of curtain tracks.

.6 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with Requirements of the Ontario Building Code.

.7 Design bracing above the ceiling as necessary to ensure the ceiling design as shown in the Drawings, including the floating ceiling areas, conform to all loading requirements.

.8 Coordinate installation and cooperate with Mechanical and Electrical Subcontractors, to accommodate mechanical and electrical items, or any other Work required to be incorporated in or coordinated with the ceiling system. Subframing as required to avoid conflicts and interferences where ducts or other equipment may prevent regular spacing of hangers.

.9 Unless otherwise indicated, ceiling suspension Products shall be manufactured to minimum requirements of ASTM C635/C635M, for Heavy Duty, modified as required to suit grid design shown.

.10 Complete ceiling assemblies including panel and suspension system shall be fire rated and labelled in accordance with ULC Design number noted on Drawings.

1.6 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on metal grid system components and acoustic units.

.3 Shop Drawings:

.1 Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

.2 Provide Shop Drawings indicating details for anchorage and bracing for seismic restraint, stamped and signed by a Professional Engineer registered or licensed in Ontario.

.4 Samples:

.1 Submit two (2) samples, 150mm x 100 mm in size, illustrating material and finish of acoustic units.

.2 Submit two (2) samples each, 500 mm long, of suspension system main runner, cross runner and perimeter molding.

.5 Certificates

.1 Submit certificate attesting installed acoustical ceiling systems meet fire-resistance
ratings required for this Project.

.2 Submit independent test data and certificate confirming system meets or exceeds
specified STC rating.

.3 Submit independent test data and design tables for each type of insert to be employed on this Project for hanger supports.

.4 Obtain certificate from Professional Engineer responsible for design which includes
seismic assessment and field review of this part of the Work, validating that work substantially complies with the requirements of the OBC and that requisite field reviews have been completed

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Sustainable Design Closeout Documentation: Section 01 78 53.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Operation and maintenance data.

.2 Extra Stock Materials: Provide 5% of total acoustic unit area of extra tiles to Niagara Region.

1.9 QUALITY ASSURANCE

.1 Conform to AWCCBC requirements.

.2 Grid Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Acoustic Unit Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.10 MOCK-UP

.1 Construct mock-ups in accordance with Section 01 43 39 – Mock Up Requirements.

.2 Construct mock-up 10 m^2 minimum of each type acoustical tile ceiling including: one inside corner, one outside corner.

.3 Construct mock-up where directed.

.4 If approved mock-up may remain as part of the finished work.

1.11 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain uniform temperature of minimum 15 degrees C, and maximum humidity of 40% prior to, during, and after acoustic unit installation.

.2 Permit wet work to dry before commencement of installation.

.3 Store materials in work area 48 hours prior to installation.

1.12 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Replace defective or damaged materials with new.

.4 Store extra materials required for maintenance, where directed by Niagara Region.

1.13 COORDINATION

.1 Do not begin erection of ceiling suspension system until work above ceiling has been inspected by Niagara Region.

1.14 PRE-INSTALLATION MEETING

.1 Convene pre-installation meeting one week prior to beginning work of this Section, with Niagara Region to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with work of other sections.

.4 Review manufacturer’s installation instructions and warranty requirements.

.5 Review accepted shop drawings for installation requirements.

1.15 MAINTENANCE MATERIALS

.1 Extra Stock Materials:

.1 Supply in addition to quantities required for work, extra materials and Products to
be stored by Construction Contractor as follows:

.1 Provide 3% extra stock of each type of ceiling tile.

.2 Deliver extra stock to Construction Contractor as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed.

Part 2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to applicable code for combustibility requirements for materials.

2.2 MANUFACTURERS - ACOUSTIC UNIT MATERIALS

.1 ##
REVISE THE PRODUCT, AND BELOW IN MATERIALS
##

.2 Amstrong; Product: 610mm x 1220 mm CALLA Health Zone AirAssure white for public areas and Washrooms

.3 Other acceptable manufacturers offering functionally and aesthetically equivalent products.

.1 By CGC Inc.

.2 By CertainTeed Saint-Gobain Corporation

2.3 MATERIALS

.1 Acoustic Tile: ASTM E1264, conforming to the following:

.1 Size: 610mm x 1220mm.

.2 Thickness: 24 mm or 22 mm.

.3 Composition: Mineral.

.4 Type IV

.5 Form 2

.6 Pattern E

.7 Light Reflectance: 0.85 minimum.

.8 NRC: 0.8 minimum

.9 CAC: 40 minimum

.10 Fire Hazard Classification: Class A to ATEM E84 and CAN/ULC S102.

.1 Flame Spread Index: 25 maximum.

.2 Smoke Development Index: 50 maximum.

.11 Edge: Square.

.12 Surface Colour: White.

.13 Surface Finish: acoustically transparent membrane and polyethylene flim.

.2 Exposed Grid System

.1 Basic Steel Material and Finish: Commercial quality cold rolled steel 0.455 mm (26
ga) minimum thickness, galvanized to zinc coating designation Z120 (G30) for standard office use, Z180 (G60) for humid interior conditions and Z275 (G90) for exterior or semi-exposed conditions.

.2 Ensure exposed surfaces of metal products are factory finished in non-yellowing, low sheen satin white enamel to Designer’s acceptance to match whiteness in panels. Provide paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in the ceiling assemblies. Provide slip-on trim mouldings or metal mouldings with baked enamel finish, as standard with grid manufacturer, to trim around light fixtures.

.3 Grid System model: Donn DX/DXL by CGC Inc. ”Prelude XL”, by Armstrong World
Industries, or approved alternative by CGC Inc. or CertainTeed Corporation in factory finished satin white on hot dipped galvanized cold rolled steel.

.4 Complete with splices, clips and perimeter moulding of manufacturer's standard and aluminum types to suit the applicable conditions unless special conditions and

access areas are shown or specified. In high humidity areas provide galvanized suspension system.

.5 Main Tees: double web design, rectangular bulb at top of web, 38 mm web height,
in longest lengths possible. Expansion cut-outs in main tees controlling buckling caused by heat expansion.

.6 Main Tee Splices: Designed to lock lengths of main tees together so joined lengths of tee function structurally as single unit with tee faces at joint perfectly aligned and
presenting tight seam.

.7 Cross Tees: 1220 mm long, 25 mm web height structural cross-section, design same
as main tees, designed to connect at main tees forming positive lock without play,
loss or gain in grid dimensions with offset over-ride of face flange over main tee flange to provide flush joint. Provide 38 mm web height of cross tee for fire rated assemblies.

.8 Seismic Struts (Where required): Manufacturer's standard compression struts designed to accommodate lateral forces.

.9 Seismic Clips (Where Required): Manufacturer's standard seismic clips designed and
spaced to secure acoustical tiles in-place.

.10 Exposed metal edge mouldings and trim:

.1 Perimeter Trim: Moulding Around Ceiling Perimeters at wall connection: Materials and finish to match tees. Provide hold-down function as necessary
in coordinatation with Design Requirements to suit loading conditions.

.3 Hangers

.1 Minimum 2.642 mm (12 ga) overall thickness galvanized steel wire to zinc coating
designation Z275 (G90), meeting "Heavy-duty" classification of ASTM C635/C635M. Inserts for Concrete Slabs: Certified type for setting in concrete or self drilling expansion inserts for placing afterwards. Tie wire anchors. Power actuated fasteners will not be permitted.

.4 Fasteners

.1 Galvanized and of size suited to loading conditions.

.5 Metal Closures and Trim

.1 Bonderized and with factory-applied white baked enamel finish. Provide anchors as standard with manufacturer.

.6 Supplementary Steel Supports

.1 Steel conforming to Section 05 50 00.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that layout of hangers will not interfere with other work.

.3 Do not install acoustical panel ceiling systems until work above ceiling has been inspected by Niagara Region.

3.2 INSTALLATION - SUSPENSION SYSTEM

.1 Install suspension system to ASTM C636/C636M, and as supplemented in this section.

.2 Install ceiling suspension systems forming a part of a fire resistance rated assembly in accordance with ULC requirements as listed in this Section.

.3 Install ceiling suspension systems requiring seismic restraint to ASTM E580/E580M.

.4 Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

.5 Coordinate the following for the services running above acoustical ceilings:

.1 Locations, openings, supports, and penetrations through acoustical ceilings.

.2 Field conditions, clearances, and measurements.

.3 Testing and commissioning.

.6 Install acoustical ceiling suspension system to tolerance of 1:1200 of span and maximum 0.4 mm between adjacent metal members. Tolerances to be non cumulative. Refer to mechanical and electrical Contract Drawings for fixture layout.

.7 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 610 mm around perimeter of fixture.

.8 Locate system on room axis according to reflected plan.

.9 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

.10 Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

.11 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.

.12 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected related carrying channels to span the extra distance.

.13 Provide additional hangers at lighting fixture and air distribution ductwork locations. Do not attach hanger wires to mechanical or electrical equipment. Do not support mechanical and electrical fixtures and fittings on acoustical ceiling without ceiling manufacturer's written acceptance.

.14 Do not bend or twist hangers as means of levelling. Form double loops tightly and lock to prevent vertical movement or rotation within loop.

.15 Install perimeter moulding at intersection of acoustical ceiling and vertical surfaces. Butt joints neatly, square, and true in alignment.

.16 Unless noted otherwise centre acoustical ceiling suspension system on room axis. Install equal border pieces. Install hangers onto ends of main tee runners at no more than 150 mm from ends of runners, adjacent, and perpendicular to walls.

.17 Ensure that lighting fixtures within each suspension system module is capable of being reinstalled at a future date at right angles to the installed direction without the use of additional hangers.

.18 Install main runners in maximum available lengths. Lay out joints in suspension members to avoid perimeters of recessed fixtures. Lock grid members to form rigid assembly.

Install additional tee suspension system framing around recessed fixtures, diffusers, grilles, and other items as required for a complete assembly.

.19 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.

.20 Do not eccentrically load system or produce rotation of runners.

.21 Perimeter Molding:

.1 Install edge molding at intersection of ceiling and vertical surfaces .

.2 Use longest practical lengths.

.3 Mitre corners.

.4 Provide concealed molding at junctions with other interruptions.

.22 Form expansion joints as detailed. Form to accommodate plus or minus 25 mm movement. Maintain visual closure.

.23 Install light fixture boxes constructed of acoustic panel above light fixtures to ULC assembly requirements and light fixture ventilation requirements.

3.3 INSTALLATION - ACOUSTIC UNITS

.1 Install acoustic units to manufacturer's written instructions.

.2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

.3 Install units after above ceiling work is complete.

.4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.5 Cutting Acoustic Units:

.1 Cut to fit irregular grid and perimeter edge trim.

.2 Cut bevel edges to field cut units.

.3 Double cut and field paint exposed edges of tegular units.

.4 Carefully cut and trim acoustical panels to accommodate other components.

.5 Fit acoustical panels carefully into place. Remove and replace acoustical panels which have broken edges, or are damaged, marked, discoloured, soiled, or stained.

.6 Accurately scribe and cut acoustical panels to fit irregular spaces, recessed items, and adjacent Work. Butt joints tight and terminate edges with moulding.

.6 Where round obstructions occur, provide preformed closures to match perimeter molding.

.7 Lay acoustic insulation for a distance of 1 200 mm either side of acoustic partitions as indicated.

.8 Install hold-down clips to retain panels tight to grid system within 6 m of an exterior door.

.9 Install acoustical panels directly below valves and controls to be easily removable. Mark such units inconspicuously.

.10 Install hold-down clips to retain panels tight to grid system in exterior locations.

3.4 ERECTION TOLERANCES

.1 Section 01 73 00: Tolerances.

.2 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.

.3 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 CLEANING AND PROTECTION

.1 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning. Touch up scratches, abrasions, voids and other defects in painted surfaces.

.2 Protection

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by acoustical suspension installation.

3.6 COMMISSIONING

.1 Train user staff in the care, cleaning and replacement of acoustical ceiling tile.

.2 Acceptance of maintenance material turned over to owner.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Resilient sheet flooring.

.2 Resilient tile flooring.

.3 Resilient base.

.4 Resilient stair treads, risers, skirting, and nosings.

.5 Labour, Products, equipment and services necessary for resilient flooring Work in accordance with Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

.2 Division 26 – Electrical: Electrical floor cover plate with recess for resilient flooring.

1.3 REFERENCE STANDARDS

.1 ASTM E648, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

.2 ASTM E84-21a Standard test method for surface burning characteristics of building materials

.3 ASTM F150, Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.

.4 ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.5 ASTM F1066-04(2018) Standard specification for vinyl composition floor tile

.6 ASTM F1303-04(2021) Standard specification for sheet vinyl floor covering with backing

.7 ASTM F1344-21a Standard specification for rubber floor tile

.8 ASTM F1516, Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended)

.9 ASTM F1700-20 Standard specification for solid vinyl floor tile

.10 ASTM F1859-21a Standard specification for rubber sheet floor covering without backing

.11 ASTM F1860-21a Standard specification for rubber sheet floor covering with backing

.12 ASTM F1861-21 Standard specification for resilient wall base

.13 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

.14 ASTM F1913-19 Standard specification for vinyl sheet floor covering without backing

.15 ASTM F2034-18 Standard specification for sheet linoleum floor covering

.16 ASTM F2169-15(2020) Standard specification for resilient stair treads

.17 CAN/ULC-S102.2-18 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, and patterns and colours available.

.3 Provide performance criteria, compliance with appropriate reference standards, characteristics, and limitations.

.4 Provide product transportation, storage, handling and installation requirements.

.5 Provide manufacturer's recommended maintenance procedures and instructions.

.6 Layout of tiles, trims, transitions, terminations, borders, patterns, seaming plan, thresholds, base, formed cove base, and grounding strips.

.7 Samples:

.1 Submit two (2) samples, manufacturer's sample cupons in size illustrating colour and pattern for each floor material for each colour specified.

1.5 INFORMATIONAL SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention and other special conditions.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Section 01 78 23: Maintenance and extra material requirements.

.2 Provide 3 m^2 of each colour, pattern and type flooring material required for project for maintenance use.

.3 Extra materials to be in one piece and from same production run as installed materials.

.4 Clearly identify each roll of sheet flooring and each container of adhesive.

1.8 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.3 Preparation, installation and materials to be in accordance with National Floor Covering Association (NFCA) requirements.

.4 Install Work of this Section straight and level to maximum variation of 1:1000.

.5 Provide like Products from same production run. Install Products in sequence from sequentially numbered dye lots.

.6 Testing of concrete floors:

.1 Test floors that have been cured for minimum 28 Days, and after preparation for Product installation is complete, and after patching and levelling compounds are fully cured as per manufacturer’s printed instructions.

.2 Conduct testing on floors free of sealer, curing compounds, oil, grease and other agents detrimental to the test and the Product performance, and in conformance with test kit manufacturer's written instructions.

.3 Locate test sites representatively cover installation areas. Do not proceed with Work when the test results do not conform to the specified requirements.

.4 Moisture vapour emission:

.1 Maximum 1.36 kg (3 lbs) of moisture per 92.9 sq.m (1,000 sq.ft.) per 24 hour. Test floors to ASTM F1869 using anhydrous calcium chloride method. Provide 3 test sites for floor area up to 92.9 sq.m (1,000 sq.ft.), add 1 test site for each additional 1,000 sq.ft. or fraction thereof.

.5 Alkalinity:

.1 Test substrates in accordance with ASTM F710 using distilled water and pH paper. Ensure measured pH is within the pH range acceptable to flooring manufacturer for the flooring Product and adhesives to be installed. Provide 2 tests for every moisture vapour emission test.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Protect roll materials from damage by storing on end.

.3 Deliver Products to area of Work minimum 48 hours prior to installation. Remove Products from containers to allow them to become fully acclimatized.

.4 Store and handle materials in accordance with manufacturer's requirements.

.5 Prevent Products from freezing.

.6 Label containers to clearly identify contents by Product description, manufacturer, lot number, size, colour, and pattern.

1.10 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain ambient temperature and substrate temperature at flooring installation area above 20°C for 48 hours before, during, and 48 hours after installation.

.2 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.3 Store materials for three (3) days prior to installation in area of installation to achieve temperature stability.

.4 Maintain ambient temperature required by adhesive manufacturer three (3) days prior to, during, and twenty-four (24) hours after installation of materials.

Part 2 Products

2.1 MATERIALS - TILE FLOORING

.1 Product(s) and manufacturer(s):

.1 Kraus, product 4111 SHOAL BAY II.

.2 DURA, product Fusion 5.5.

.3 CoreTec, product Pro Plus XL 7.

.2 Vinyl Composition Tile: ASTM F1066.

.1 Size: 305 mm x 305 mm.

.2 Thickness: 3 mm.

.3 In accordance with ASTM F1066, Class: 2, Through pattern tile , Pattern: Mottled, Wearing surface: Smooth. Asbestos-free.

.4 In colours selected by Niagara Region from manufacturer's full range. Up to three (3) colours to be selected.

.3 Feature Strips: Of same material as tile.

2.2 MATERIALS - STAIR COVERING

.1 Fibre reinforced polymer stair tread with nosing. 0.125 mm thick, heavy-duty, one piece, flame retardant, moulded fibreglass gritted surface stair tread with nosing for entire length of stair.

.2 Depth: Full depth of stairs.

.3 Colour: Black with yellow.

.4 Stair Treads: ASTM F2169.

.1 Full width and depth of stair tread in one piece; return down edge of tread.

.2 Design: Serrated nosing.

.5 Product(s) and manufacturer(s):

.1 Stair Tread Covers by Fibergrate Composite Structures.

.2 Fiberglass Stair Tread Covers by Fiberman.

.3 Fiberglass Step Covers by Sure-Foot Industries Corp.

.4 Duratread by Strongwell.

.6 Metal edge strip: Extruded aluminum, smooth mill finish with lip to extend under flooring, tapered edge, of profile and width indicated, of height required to protect exposed edge of flooring, and of maximum lengths to minimize running joints.

.7 Floor mouldings, transitions, and terminations: In accordance with ULC S102.2, Class I, manufactured from highest quality raw materials, smooth and free from imperfections, one piece vinyl adapters, thresholds, edge guards, cove sticks, caps, reducers, each from manufacturer's standard colour range.

.1 Product(s) and manufacturer(s):

.1 Floor finishing accessories by Tarkett.

.2 Mercer mouldings and transitions by Burke Flooring, a division of Mannington Mills, Inc.

.3 Floor finishing accessories by Roppe Corporation.

.8 Stair Risers:

.1 Maintain height and length in one piece.

.2 Sheet Material: to match tread covers.

.3 By manufacturer of tread covers.

.9 Stair Skirting:

.1 Width: Maintain width sufficient to provide 50 mm above stair nose, measured perpendicular to stair slope.

.2 Sheet Material: to match stair tread covers.

.3 Pattern: Smooth.

2.3 MATERIALS - BASE

.1 Manufacturers:

.1 Amtico by Mannington Mills, Inc.

.2 Mercer by Burke Flooring, a division of Mannington Mills, Inc.

.3 TightLock by Tarkett.

.4 Pinnacle Rubber Base by Roppe Corporation.

.2 Resilient base: In accordance with ASTM F1861 and ULC S102.2, Class I, rubber cove and straight base.

.1 Height 150 mm high x 3.0 mm thick, in longest lengths possible.

.3 Base Accessories: Premoulded end stops and external corners, of same material, size, and colour as base.

2.4 ACCESSORIES

.1 Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

.2 Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

.3 Sealer and Wax: Types recommended by flooring manufacturer.

.1 Non-toxic, odourless, waterproof, solvent-free, and of types recommended by flooring manufacturer for specific material on applicable substrate, above, at, or below grade. Choose primers and sealers based on actual Site conditions, including substrate test results.

.4 Formed flashing cove accessories: Inside corners, outside corners, cove caps, termination bars for openings, and other accessories required to form cove base.

.5 Welding rod: Compatible with resilient tile flooring and recommended by the flooring manufacturer. Colour as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify concrete floors are dry to a maximum moisture content of 7%, and exhibit negative alkalinity, carbonization, or dusting.

.3 Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

.4 Commencement of Work means acceptance of existing conditions.

3.2 PREPARATION

.1 Prepare floor substrates in accordance with ASTM F710 and manufacturer's recommendations including, but not limited to, vacuuming, grinding, sanding, shotblasting, and cleaning.

.2 Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface. Trowel and

float subfloor filler to leave smooth, flat hard surface. Prohibit traffic until filler is cured and dry as per manufacturer's printed instructions.

.3 Clean and remove deleterious materials from surfaces to receive Work in accordance with adhesive manufacturer's recommendations.

.4 Prohibit traffic until filler is cured.

.5 Vacuum clean substrate.

.6 Apply sealer and primer in accordance with adhesive manufacturer's written instructions.

3.3 INSTALLATION - GENERAL

.1 Remove adhesive seepage at seams or surface while adhesive is still wet in accordance with manufacturer's recommendation.

.2 Cut tile and fit neatly around fixed objects and gaps.

.3 Install feature strips and floor markings where indicated on Drawings. Fit joints tightly.

.4 Continue flooring through areas to receive demountable type partitions without interrupting floor pattern.

.5 Terminate flooring at centreline of door in its closed position where adjacent floor finish or colour is dissimilar. Where flooring continues through doorway, continue established pattern with no interruption unless otherwise indicated.

.6 Provide floor mouldings, metal edge strips, transitions, terminations and other accessories. Install at unprotected or exposed edges where flooring terminates, where there are two finishes of different thicknesses, and where indicated on Contract Drawings and Room Finish Schedule.

3.4 INSTALLATION - TILE FLOORING

.1 Apply adhesive uniformly in accordance with manufacturer's instructions using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.2 Install tile flooring to manufacturer's written instructions.

.3 Mix tile from container to ensure shade variations are consistent when tile is placed.

.4 Spread only enough adhesive to permit installation of materials before initial set.

.5 Set flooring in place, press with heavy roller to attain full adhesion.

.1 As installation progresses, and after installation, roll flooring in 2 directions with minimum 45 kg roller to ensure full adhesion.

.6 Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

.7 Install tile to pattern selected by Niagara Region pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

.8 Terminate flooring at centreline of door openings where adjacent floor finish is dissimilar.

.9 Install metal edge strips at unprotected or exposed edges, and where flooring terminates. Secure metal strips before installation of flooring with stainless steel screws.

.10 Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

.11 Install flooring in pan type floor access covers. Maintain floor pattern.

.12 At movable partitions install flooring under partitions without interrupting floor pattern.

.13 Install feature strips and edge strips where indicated. Fit joints tightly.

3.5 INSTALLATION - BASE

.1 Fit joints tight and vertical. Maintain minimum measurement of 450 mm between joints.

.2 Mitre internal corners. At external corners, use premoulded units. At exposed ends, use premoulded units.

.3 Install base on solid backing. Bond tight to wall and floor surfaces.

.4 Adhere resilient base to vertical surfaces. Ensure there are no gaps behind base, and front lip of base cove bears firmly and uniformly on floor surfaces. Ensure permanent bond between base and surface.

.5 Set base in adhesive using a 3 kg hand roller against wall and floor surfaces to ensure full adhesive contact.

.6 Scribe and fit to door frames and other interruptions.

3.6 INSTALLATION - STAIR COVERINGS

.1 Install stair nosing, stair treads, and stair risers in one (1) piece for full width and depth of tread.

.2 Install stair skirting configured tight to stair and stringer profile.

.3 Adhere over entire surface. Fit accurately and securely.

.4 Install stair tread with nosing as per manufacturer’s installation instructions.

3.7 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove access adhesive from floor, base, and wall surfaces without damage.

.3 Clean, seal, and wax floor and base surfaces in accordance with manufacturer's written instructions.

.4 Perform initial cleaning, maintenance and preparation for commercial traffic procedures in accordance with manufacturer's written instructions, as intended for a "polish and seal" option.

3.8 PROTECTION

.1 Section 01 78 23: Protecting installed work.

.2 Prohibit traffic on floor finish for forty-eight (48) hours after installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Carpet tile.

.2 Accessories.

.3 Labour, Products, equipment, and services necessary for tile carpeting Work in accordance with Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

.2 Section 09 65 00 - Resilient Flooring: Base finish.

.3 Division 22 – Plumbing: Plumbing floor cover plate with recess for carpet.

.4 Division 26 – Electrical: Electrical and telephone floor cover plate with recess for carpet.

1.3 REFERENCE STANDARDS

.1 ASTM D2859-16(2021) Standard test method for ignition characteristics of finished textile floor covering materials

.2 ASTM D5848, Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings.

.3 ASTM E84-21a Standard test method for surface burning characteristics of building materials

.4 ASTM E648-19ae1 Standard test method for critical radiant flux of floor-covering systems using a radiant heat energy source

.5 ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

.6 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.7 ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes.

.8 CAN/ULC-S102-18 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.9 CAN/ULC-S102.2-18 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.10 CRI 104 Carpet installation standard for commercial carpet

.11 CRI Model Specification for Commercial Carpet, published by The Carpet and Rug Institute.

.12 NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source, 2019 Edition.

1.4 ACTION SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on specified products, describing physical characteristics; sizes, patterns, colours available, method of installation.

.3 Shop Drawings: Indicate the following.

.1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations.

.2 Product transportation, storage, handling, and installation requirements.

.3 Layout including seams, trims, transitions, terminations, thresholds, direction of weaves and base.

.4 Samples: Submit two (2) carpet tiles illustrating pattern design for each carpet colour selected.

.5 Submit verification to demonstrate compliance with CAN/ULCS102 and CAN/ULCS102.2.

.6 Submit proof that carpet has been tested and passed the Indoor Air Quality (IAQ) Carpet Testing Program requirements of the Carpet and Rug Institute.

.7 Submit report verifying that tuft bind meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1.

.8 Submit report outlining proposed dust control measures.

.9 Submit carpet schedule using same room designations indicated on drawings.

.10 Submit carpet manufacturer's installation instructions: Indicate special procedures and perimeter conditions requiring special attention.

.11 Submit product data sheet for each carpet, underlay, adhesive, carpet protection and subfloor filler.

.12 Submit WHMIS SDS - Safety Data Sheets acceptable to Labour Canada and Health Canada for carpet adhesive and seam adhesive. Indicate VOC content.

.13 Submit data on specified products, describing physical and performance characteristics, sizes, patterns, colours, and methods of installation.

.14 Indicate locations and lengths of seams for carpeted areas.

.15 Indicate nap, direction, open edges, special patterns, and other details required by Owner to clarify work.

.16 Submit drawings showing columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required as well as direction of carpet pile and pattern, location of edge moldings and edge bindings to Owner for review prior to installation of carpet.

.17 Submit duplicate 675 x 900 mm pieces of each type carpet specified, duplicate 225 x 225 mm pieces for each colour selected, 300 mm square pieces of undercushion, 150 mm lengths of carpet gripper and binder bars, base, divider strips.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submission procedures.

.2 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

.3 Include information on recycling of carpet including manufacturer’s reprocessing program. Indicate which portions of material are recyclable.

1.6 REGULATORY REQUIREMENTS

.1 Prequalification: compliance with Department of Consumers and Corporate Affairs regulations under "Hazardous Products Act", Part II of the Schedule, tested to CAN/CGSB-4.2-No.27.6.

.2 Indoor Air Quality: compliance with CRI/CCI Green Label Indoor Air Quality Program, CRI/CCI-IAQ requirements for maximum total volatile chemicals released into air. Label each carpet product with CRI/CCI-IAQ label.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store handle and protect materials in accordance with Section 01 61 00-Common Product Requirements, with CRI 104 and with manufacturers written instructions.

.2 Label packaged materials. For carpet tile products indicate nominal dimensions of tile and indicate installation direction.

.3 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.4 Store carpeting and accessories in location as directed by Owner. Store carpet and adhesive at minimum temperature of 18°C and relative humidity of maximum 60% for minimum of 48 hours before installation.

.5 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness. Prevent products from freezing.

.6 Store materials in area of installation for minimum period of 48 hours prior to installation.

.7 Replace defective or damaged materials with new.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with CRI 104.

.2 Moisture: Ensure substrate is within moisture limits and alkalinity limits prescribed by manufacturer. Prepare moisture testing and provide report to Owner.

.3 Temperature: Maintain ambient temperature of not less than 18°C from 48 hours before installation to at least 48 hours after completion of work.

.4 Relative humidity: Maintain relative humidity not greater than 60% RH for 48 hours before, during and 48 hours after installation.

.5 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

.6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Ventilate area of work as directed by Owner by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Provide continuous ventilation during and after carpet application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 3 days after completion of carpet installation.

.8 Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

1.9 EXTRA MATERIALS

.1 Supply extra stock materials in accordance with Section 01 78 43.

.2 Provide 5 m^2 of each colour, pattern and type of carpeting. Include adhesive and installation accessories as required to install extra materials.

.3 Extra materials to be from same production run as installed materials.

.4 Identify each package of carpet and each container of adhesive.

1.10 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.3 Provide certificate of quality compliance from tile installer upon satisfactory completion of installation.

.4 Install Work in accordance with reviewed layout diagrams and reviewed submittals.

.5 Testing of concrete floors:

.1 Test floors that have been cured for minimum 28 Days, and after preparation for Product installation is complete, and after patching and levelling compounds are fully cured.

.2 Conduct testing simultaneously on floors free of sealer, curing compounds, oil, grease, and other agents detrimental to the test and the Product performance, and in conformance with test kit manufacturer's written instructions.

.3 Locate test sites to cover representative installation areas. Do not proceed with Work when the test results do not conform to the specified requirements.

.4 Moisture vapour emission:

.1 Maximum 3 lbs. of moisture per 1,000 sq.ft. per 24 hour. Test floors to ASTM F1869 using anhydrous calcium chloride method.

.2 Provide 3 test sites for floor area up to 1,000 sq.ft., and add one test site for each additional 1,000 sq.ft. or fraction thereof.

.5 Relative Humidity (RH):

.1 Test for internal relative humidity of concrete slabs in accordance with ASTM F2170.

.2 Do not install carpet when RH exceeds manufacturer's requirements.

.6 Alkalinity:

.1 Test substrates in accordance with ASTM F710 using distilled water and pH paper. Ensure measured pH is within the pH range acceptable to carpet manufacturer for the flooring Product and adhesives to be installed.

.2 Provide two tests for every moisture vapour emission test.

1.11 WARRANTY

.1 Provide one year warranty against defects in material and workmanship from the date of Substantial Completion.

Part 2 Products

2.1 MANUFACTURERS

.1 Kraus; Product: 7041 DANUBE Charcoal.

.2 Other acceptable manufacturers offering functionally and aesthetically equivalent products.

.1 Venture; Product: Anticosti - Sphagnum 40166 - Gabarit / Gauge.

.2 Beaulieu; Product: J4505 - Dark Cloud.

.3 Similar products from Interface Inc, Tarett, Milliken and Company, or Mannington Mills Inc.

.3 Acceptable materials: Only carpeting listed in Qualification Program List (QPL) 4.129, Carpets for Commercial Use are acceptable for use on this project.

.4 Certified to Carpet and Rug Institute's IAQ requirements.

2.2 MODULAR CARPET

.1 .1 Carpet: to CAN/CGSB-4.129 and as follows.

.1 Certified for flammability to Health Canada regulations under "Hazardous Products (Carpet) Regulations", Part II of the Schedule.

.2 Maximum flame spread rating 300, maximum smoke developed classification 500.

.3 Certified to Carpet and Rug Institute's and the Canadian Carpet Institute's IAQ requirements.

.2 Carpet Tile Dimensions: minimum 500 x 500 mm unless otherwise indicated.

.3 Pattern and colours from manufacturers standard range.

.4 Performance rating: to ASTM D5252 or ASTM D5417.

.5 Construction: tufted.

.6 Pile Surface Appearance:

.1 Level loop: textured.

.7 Pipe Fibre: to CAN/CGSB-4.129.

.1 100% Nylon, anti static.

.8 Yarn Ply: 2 ply.

.9 Colourfastness to light: CAN/CGSB-4.2 No. 18.3.

.10 Yarn weight: minimum 576 g/m2 unless otherwise indicated.

.11 Pile height: 4.2 mm.

.12 Pile thickness: 2.8

2.3 SPECIAL REQUIREMENTS

.1 Soil Resistance: Drop oil and soil resistance to AATCC 118.

.2 Permanent static control: to AATCC 134, 3000V maximum at 20%RH and 22°C.

.3 Anti-microbial: to AATCC 174, 99% reduction, 0% growth.

.4 Stain resistance: to AATCC 175, 8.

2.4 ACCESSORIES

.1 Base:

.1 Resilient base: to Section 09 65 16 – Resilient Sheet Flooring.

.2 Carpet tackstrips: types recommended by carpet manufacturer.

.3 Seaming tape: types recommended by carpet manufacturer for purpose intended.

.4 Seaming sealer adhesive: type recommended by carpet manufacturer for purpose intended.

.5 Binder bars: aluminium of type recommended by carpet manufacturer.

.6 Adhesive:

.1 Multi-purpose adhesive type: recommended by carpet manufacturer for direct glue down installation, low odour, low VOC, free of volatile hydrocarbons such as toluene and mineral spirits.

.7 Carpet protection: non-staining heavy duty kraft paper.

.8 Concrete floor sealer: to CAN/CGSB-25-20, Type 1.

.9 Subfloor patching compound: Portland cement base filler, mix with water to form a cementitious paste.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify existing conditions before starting work.

.2 Verify that surfaces are smooth and flat with maximum variation of 6 mm in 3 m, and are ready to receive work.

.3 Verify concrete floors are dry to a maximum moisture content of 7%; and exhibit negative alkalinity, carbonization, or dusting.

.4 Commencement of Work means acceptance of existing conditions.

3.2 SUB-FLOOR TREATMENT

.1 Concrete shall be inspected to determine special care required to make it a suitable foundation for carpet. Cracks 3.0 mm wide or protrusions over 0.8 mm will be filled and levelled with appropriate and compatible patching compound.

.2 Do not exceed manufacturer's recommendations for patch thickness.

.3 Large patch areas are to be primed with a compatible primer.

.4 Concrete substrates shall be cured, clean and dry.

.5 Concrete substrates shall be free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that may interfere with the bonding of the adhesive.

.6 Wherever a powdery or porous concrete surface is encountered, a primer compatible with the adhesive shall be used to provide a suitable surface for glue-down installation.

3.3 PREPARATION

.1 Prepare floor to CRI-104.

.2 Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

.3 Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

.4 Vacuum clean substrate.

3.4 INSTALLATION

.1 Install carpet tile, accessories and adhesive to CRI-104 and manufacturer's written instructions.

.2 Install carpet tile accessories and adhesive in accordance with manufacturer's written instructions.

.1 Install every tile with releasable, pressure-sensitive adhesive.

.3 Integrate and blend carpet from different cartons to ensure minimal variation in colour match.

.4 Cut carpet tile clean. Double cut roll carpet seams straight. Fit carpet tight to intersection with vertical surfaces without gaps.

.5 Locate change of colour or pattern between rooms under door centerline.

.6 Fully adhere carpet tile to substrate.

.7 Place carpet tile dry over substrate.

.8 Bind cut edges where not concealed by edge strips.

.9 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.

.10 Install carpet after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.

.11 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.

.12 Use material from same dye lot. Ensure colour, pattern and texture match within any one visual area. Maintain constant pile direction.

.13 Hot melt adhesive seams and cross-joints.

.14 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.15 Install carpeting in pan type floor access covers.

.16 Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.17 Install carpet smooth and free of bubbles, puckers, and other defects.

3.5 CARPET TACKSTRIPS AND BINDER BARS

.1 Install carpet grippers at junctions of walls and vertical surfaces. Secure gripper to prevent movement.

.2 Install binder bars at exposed carpet edges and centre under doors in door openings.

3.6 SEAMS

.1 Seal edges of cut-outs with latex, binding method.

.2 Carpet visibility of seams and joints to acceptable industry standards.

3.7 BASE INSTALLATION

.1 Install carpet at junction of floor and wall.

.2 At external corners, wrap carpet base around corner and ensure that no joint occurs within 300 mm of corner. At internal corners, cut and butt carpet at corner and ensure that no other joint occurs within 300 mm of corner.

.3 Install base to walls and fitments unless otherwise indicated.

.4 Prior to installing base, fill cracks and irregularities with a filler recommended by base manufacturer.

.5 Provide solid backing over the entire area behind the base.

.6 Lay out base to keep number of joints to minimum, with no two joints closer than 450 mm apart. Make joints vertical and tight.

.7 Set base in adhesive using a 3 kg hand roller against wall and floor surfaces.

.8 Install straight and level to a maximum variation of 1:1000.

.9 Cut and fit to door frames and other obstructions.

3.8 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove excess adhesive and and other surface blemishes without damage, from floor, base, and wall surfaces.

.3 Clean and vacuum carpet surfaces.

.4 Remove yarns that protrude from carpet tile surface.

3.9 PROTECTION

.1 Protect installed carpet tile in accordance with CRI 104.

.2 Use protection methods indicated or recommended in writing by carpet tile manufacturer and carpet adhesive manufacturer.

.3 Vacuum carpets clean immediately after completion of installation. Protect traffic areas.

.4 Prohibit traffic on carpet for a period of 72 hours until adhesive is cured.

.5 Install carpet protection to satisfaction of Owner.

3.10 COMMISSIONING

.1 Train user staff in the care and cleaning of carpet.

.2 Acceptance of maintenance material turned over to Niagara Region.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Labour, Products, equipment and services necessary for painting Work in accordance with Contract Documents.

.2 Work of this Section includes, but is not limited to the following:

.1 High pressure washing and abrasive blasting.

.2 Surface preparation of substrates as required for acceptance of painting including cleaning, small crack repair, patching, caulking and making good surfaces and areas to the limits defined in this Section.

.3 Specific pretreatments noted in this Section or specified in the MPI, Architectural Painting Specification Manual, shall follow the manufacturer's recommendation for specified Products.

.4 Priming (except where preprimed with an approved primer under other Sections of the Contract) and painting of structural steel, miscellaneous metal, ornamental metal and primed steel equipment.

.5 Priming and back priming of wood materials as noted herein or specified in the MPI, Architectural Painting Specification Manual.

.6 Painting of semi concealed areas (including, but not limited to the inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).

.7 Painting and finishing of exposed to view elevator equipment and components (such as, but not limited to, doors and door frames), unless prefinished.

.8 Paint exposed-to-view mechanical (heating, ventilating, and plumbing) services and equipment (including ducts and sprinkler piping) and electrical Work unless prefinished.

.9 Repainting of existing surfaces and finishes when adjacent to new painting Work where applicable, including surface preparation, prime and finish coats in accordance with MPI repainting requirements and the manufacturer's printed instructions.

.10 If volatile/flammable materials are used, follow manufacture’s safety instructions.

.11 Include touch ups and field painting necessary to complete the Work.

1.2 REFERENCES

.1 ASTM D3359, Standard Test Methods for Measuring Adhesion by Tape Test.

.2 ASTM D4260, Standard Practice for Liquid and Gelled Acid Etching of Concrete.

.3 ASTM D4259, Standard Practice for Abrading Concrete.

.4 ASTM D6237, Standard Guide for Painting Inspectors (Concrete and Masonry Substrates).

.5 CEPA, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations.

.6 EPA, as amended by O. Reg. 347. Therefore this should just be listed as O.Reg. 347, General – Waste Management.

.7 SSPC SP 1, Solvent Cleaning.

.8 SSPC SP 2, Hand Tool Cleaning.

.9 SSPC SP 3, Power Tool Cleaning.

.10 SSPC SP 6/NACE No. 3, Commercial Blast Cleaning.

.11 SSPC-SP 7/NACE No. 4, Brush-Off Blast Cleaning.

.12 SSPC SP 11, Power Tool Cleaning to Bare Metal.

.13 SSPC SP 13/NACE No. 6, Surface Preparation of Concrete.

.14 SSPC SP 16, Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels and Non-Ferrous Metals.

.15 SSPC SP WJ 1/NACE WJ 1, Water Jet Cleaning of Metals Cleaning to Bare Metal.

.16 SSPC SP WJ 2/NACE WJ 2, Water Jet Cleaning of Metals Very Thorough Cleaning.

.17 SSPC SP WJ 3/NACE WJ 3, Water Jet Cleaning of Metals Thorough Cleaning.

.18 SSPC SP WJ 4/NACE WJ 4, Water Jet Cleaning of Metals Light Cleaning.

.19 TQAA - ACA, Trade Qualification and Accreditation Act – Apprenticeship and Certification Act.

.20 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.21 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.3 SUBMITTALS FOR REVIEW

.1 Shop Drawing(s):

.1 Submit Shop Drawings(s) indicating:

.1 Performance criteria, compliance with appropriate reference standards, characteristics and limitations.

.2 Product transportation, storage, handling, and installation requirements.

.3 Application procedures used to obtain finishes.

.2 Samples

.1 Submit 300 mm x 150 mm draw-downs of each colour a minimum of 30 Days before paint is required, as follows:

.2 Samples on same type of materials as that on which the coating is to be applied, where possible.

.3 Identify each sample with Contract number and title, colour reference, gloss/sheen level rating, date and name of applicator.

.3 Quality Assurance Submittals

.1 Submit certified documentation to confirm each Painter has a minimum of 5 years' experience on Contracts of similar complexity and scope.

.2 Submit written confirmation from the steel fabricator/supplier that the steel preparation is compatible with the finish coat materials.

1.4 CLOSE OUT SUBMITTALS

.1 Follow Section 01 77 00

.2 Submit the following for incorporation into Operation and Maintenance Manuals:

.1 Itemized list, complete with the manufacturer's name, paint type and colour for all colours used.

.2 Copy of full set of reviewed Shop Drawings and, if applicable, Marked-up Shop Drawings.

.3 Warranty information.

1.5 QUALITY ASSURANCE

.1 Comply with the requirements of MPI Manuals, except where more stringent requirements are specified in this Section.

.2 Obtain written confirmation from the fabricator/supplier of fabricated steel items for the specific surface preparation procedures and primers to be used, to ascertain appropriate manufacturer-compatible finish coat materials, before starting the Work.

.3 Qualifications:

.1 Painting Subcontractor: Minimum of 5 years' proven satisfactory painting experience of contracts of similar size and nature.

.2 Applicator: Certificate of qualification executing Work and be under the full-time supervision of a qualified representative of the Contractor.

.3 Supervision:

.1 Have Work supervised by a full-time qualified foreperson that has a minimum of 10 years' experience on contracts of similar complexity and scope. It is the responsibility of the foreperson to ensure equipment used on Site is operated by experienced personnel.

.2 Supervisor to be thoroughly conversant with the requirements of the Specification, schedules, Drawings and MPI, Architectural Painting Specification Manual, as well as the applicable VOC regulations.

.4 Mock up:

.1 Prior to starting the Work, arrange for a coordination meeting on Site with the painting Subcontractor, their foreman and applicator, the material manufacturer's representative and Niagara Region, to review conditions, surfaces and anticipated problems, and to ensure proper preparation, use of materials and proper coverage rates.

.2 Construct three 10 m² mock ups of different paint systems, as selected by Niagara Region, in locations acceptable to Niagara Region, to demonstrate workmanship, colour, and concealing ability of Products.

.3 Niagara to review and accept mock-ups in writing before the Work of this Section is to proceed.

.4 Mock ups may remain as part of the Work, if also acceptable to Niagara, and will serve as a standard for similar paint systems.

.5 Repaint over mock ups which do not form part of the Work.

1.6 SITE CONDITIONS

.1 Work areas to be clean, dry, properly cured, and properly prepared before painting commences.

.2 Do not perform painting Work:

.1 When the ambient air and substrate temperatures are below a minimum of 10°C.

.2 When the relative humidity is above 85% or the dew point is less than 3°C variance between the air/surface temperatures.

.3 Unless a minimum lighting level of 323 lux (30 foot candles) is provided on surfaces to be painted.

.4 Where dust is generated by construction activities so that airborne particles will not affect the quality of the finished surfaces.

.3 Unless environmental conditions are within MPI and paint manufacturer's recommendations, Provide suitable protective weatherproof covering or enclosure, and sufficient heating facilities to maintain minimum ambient air and substrate temperatures, for 24 hours before, during, and after paint application.

.4 Do not paint exterior surfaces immediately before, during or immediately following rain, frost or dew, and dusty/windy or foggy weather.

.5 Schedule painting of surfaces exposed to direct intense sunlight during early morning or ambient temperatures or provide suitable weatherproof covering.

.6 Ventilation to remove odours, evaporating solvents, vapours and fumes, and moisture.

.7 Protection:

.1 Provide sufficient, clean drop cloths and protective coverings for full protection including, but not limited to the following:

.1 Floors.

.2 Furnishings.

.3 Light fixtures, fire and smoke detectors.

.4 Sprinkler heads.

.5 Prefinished diffusers and registers.

.6 Prefinished equipment.

.7 Fire rating labels and equipment specification plates.

.2 Protect mechanical, electrical and special equipment, and other components of the building which do not require painting from paint spotting and other soiling during the painting process.

.3 Mask adjoining Work adjacent to Work being painted or carefully cut in without overlaps.

.8 Cleaning:

.1 Clean surfaces in preparation for application of painting.

.2 Clean surfaces soiled by spillage of paint and paint spatters.

.3 Be responsible for cleaning operations that cause damage to the surface until the Contract is complete. Repair or replace damaged Work.

.4 Leave areas clean and free from evidence of occupancy upon completion of Work.

.9 Testing: Prior to painting Work:

.1 Test concrete, masonry, and plaster surfaces for alkalinity.

.2 Test that moisture content of substrates does not exceed the following maximums:

.3 12% for concrete and masonry (clay and concrete brick/block).

.4 15% for wood.

.5 12% for plaster and gypsum board.

.6 Carry out test for dry film thickness (dft) over entire surface to be painted, as required.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the Site and store in sealed, original, labelled containers bearing the manufacturer's name, brand name, type of paint or coating, and colour designation, materials content, as well as mixing and reducing, and application requirements.

.2 Provide safe, lockable, well ventilated fireproof storage lockers to store paint, thinner, solvents, and other volatile, corrosive, hazardous, flammable, and explosive materials. Take necessary precautions and post adequate warnings as required.

.3 Maintain storage enclosures at a minimum of 10°C and maximum of 30°C ambient temperatures and in accordance with the Product manufacturer's recommendations.

.4 Post hazard warning signage in areas of storage and mixing. Install and maintain sufficient CO2 fire extinguishers of a minimum 9 kg capacity, accessible in each of the storage and mixing areas.

.5 Protect storage and mixing area floors and walls from paint drips, splatters and spills with sheets, clean plywood or metal pans where mixing is being carried out.

.6 Store oily rags, drop cloths, waste products, empty containers, and materials subject to spontaneous combustion in ULC and CSA approved sealed containers in accordance with governing fire and safety regulations, and remove from Site on a daily basis.

.7 Leave storage areas clean and free from evidence of occupancy upon completion of Work.

1.8 SCHEDULING

.1 Allow curing of concrete for 28 Days at 24°C before painting, unless the manufacturer’s Products are designed for application prior to curing for 28 Days.

.2 Indicate in writing, constraints that may affect the scheduling of particular Work activities caused by external factors.

.3 To prevent disruptions, coordinate and cooperate with Other Contractors and APP in performing Work required to complete the Contract.

.4 In occupied facilities, schedule Work to prevent disruption of occupants in and around the building and ensure painted surfaces will have dried so that occupants are not affected.

.5 Perform painting after facility working hours in accordance with Contract Schedule.

1.9 EXTRA STOCK MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one two-litre can of each type and colour of primer, stain, and finish coating when 40-50 litres are used and supply 4 litres of each type when over 150 litres are used. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver and store on site where directed by Niagara Region.

Part 2 Products

2.1 MATERIALS

.1 Primers and paint:

.1 Coatings, varnishes, stains, lacquers, and putty or plastic wood-fillers: Use only Products listed in the MPI Approved Products List, exterior and interior systems as manufacturer's premium grade and quality Products.

.2 Manufacturers:

.1 Benjamin Moore & Co. Limited.

.2 Devoe Coatings brand by PPG Architectural Coatings Canada Inc.

.3 Dulux Paints, a division of PPG Architectural Coatings Canada Inc.

.4 Ennis - Flint Inc. a division of PPG Architectural Coatings Canada.

.5 Flame Control Coatings, Inc.

.6 Glidden brand by Dulux Paints, a division of PPG Architectural Coatings Canada.

.7 ITW Polymers Coatings North America.

.8 PPG Architectural Coatings Canada Inc.

.9 PPG Canada, Inc., PPG Protective and Marine Coatings Division.

.10 Procoat.

.11 RPM International Inc.

.12 The Sherwin-Williams Company.

.2 Other materials such as cleansers, detergents and coating additives to be the highest quality Products and compatible with the paint materials being used in accordance with manufacturer’s recommendations.

.3 Materials to be lead and mercury free and comply with CEPA, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations.

.4 Materials to have good flowing and brushing properties, and dry or cure free of blemishes, sags, and air entrapment. Paint to have uniform dispersion of pigment in a homogeneous mixture. Refer to Article 3.5, Field Quality Control, for standard of acceptance requirements.

.5 Slip resistant additive (SRA): Rubber aggregate, clean/washed silica sand or ground walnut chips (interior dry areas only) for use with or as a component part of paint on horizontal surfaces as required to provide slip resistance. Where Site applied, material to either be mixed into paint (and mixed consistently to keep material in suspension) or broadcast into first or prime coat as required, in accordance with manufacturer’s recommendations.

2.2 EQUIPMENT

.1 Applicators to be of premium quality, clean, and suitable for the type of Product and application, in accordance with MPI and Product manufacturer’s recommendations.

.2 Spray painting equipment: Suited to the type and consistency of paint or coating being applied, of ample capacity, and kept clean and in good working order at all times.

2.3 MIXING AND TINTING

.1 Unless otherwise specified in this Section, paint to be ready mixed and pretinted to match finish.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's recommendations.

.3 If required, thin paint for spraying in accordance with paint manufacturer's recommendations.

.1 Do not use kerosene or any organic solvents to thin paints.

2.4 COLOUR SCHEDULE

.1 Niagara Region will select paint colours at a later date.

.2 Colour Schedule: Allow for colour selection beyond the paint manufacturer's standard colour range including light and dark tones.

.1 Colour schedule will be based upon the selection of five base colours and three accent colours. No more than eight colours will be selected for the entire project and no more than four colours will be selected in each area.

.3 Conform to paint gloss/sheen level rating requirements, listed in MPI, Architectural Painting Specification Manual.

.4 Niagara Region to have complete freedom in choice of colours in compiling the Colour Schedule and will not necessarily select colours from the standard colour charts of the manufacturer’s Products reviewed for use.

.5 Niagara Region to have the right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to Niagara Region.

2.5 PAINTING AND FINISHING SCHEDULE

.1 Perform Work in accordance with MPI premium grade finish requirements and this Section.

.2 MPI Gloss/Sheen Level Rating:

G1	Matte finish – flat
G2	Velvet
G3	Eggshell finish
G4	Satin
G5	Semi-gloss finish
G6	Gloss
G7	High-gloss finish

.3 **Exterior Concrete - Vertical Surfaces to MPI EXT 3.1**

Normal Atmosphere(Colour Finish)	The Sherwin-Williams Company	1st coat: Loxon Concrete and Masonry Primer2nd and 3rd coats: Pro Industrial Acrylic	G5
Wet Environment - Normal Atmosphere or Chemical Exposure(Colour Finish)	The Sherwin-Williams Company	1st and 2nd coats: Macropoxy 646 100 Fast Cure Epoxy Coating (Parts A & B)3rd coat: Hi Solids Polyurethane 100	G7

"	PPG Architectural Coatings Canada Inc.	1st and 2nd coats: Pitt-Guard Rapid Coat DTR Epoxy 95-245 Series (Parts A & B)3rd coat: Pitthane Ultra 95-812 Series	"
"	Benjamin Moore & Co. Limited	1st and 2nd coats: Insl-X Corotech V400 Polyamide Epoxy Coating3rd coat: Insl-X Corotech V540 Waterborne Urethane Gloss	"
Clear Water Repellent Finish(Not to be used on concrete block.)	The Sherwin-Williams Company	1st and 2nd coats: Loxon 7% Siloxane Water Repellant	G5

.4 **Exterior Wood Paneling to MPI EXT 6.4**

Plywood Siding, Fascias, Soffits, etc.	The Sherwin-Williams Company	1st coat: Exterior Oil-Based Wood Primer2nd and 3rd coats: Pro Industrial Acrylic	G5

.5 **Interior and Exterior Concrete Masonry Units (concrete block and concrete brick) to MPI EXT 4.2**

General	The Sherwin-Williams Company	1st coat: Loxon Block Surfacer Masonry Coating System 2nd coats: Pro Industrial Acrylic	G5
Wet Environment	The Sherwin-Williams Company	1st coat: Kem Cati-Coat HS Epoxy Filler/Sealer2nd coats: Macropoxy 646-100 Fast Cure Epoxy Coating (Parts A & B)	G7
"	PPG Canada, Inc., PPG Protective and Marine Coatings Division.	1st coat: Amercoat 114A2nd coats: Pitt-Guard Rapid Coat DTR Epoxy 95-245 Series (Parts A & B)	"
"	Devoe Coatings brand by PPG Architectural Coatings Canada Inc.	1st coat: Devoe Paint Devfil 1452nd coats: Devoe Paint Devran 224V Epoxy (Parts A & B)	"

.6 **Interior Concrete - Vertical Surfaces including ceilings and undersides of mezzanines, stairs, etc. to MPI INT 3.1**

Walls	The Sherwin-Williams Company	1st coat: Loxon Concrete and Masonry Primer2nd coats: Pro Industrial Acrylic	G5
Ceilings	The Sherwin-Williams Company	1st coat: Loxon Concrete and Masonry Primer2nd coats: Pro Industrial Acrylic	G3

.7 **Interior Concrete - Horizontal Surfaces (floors and stairs) to MPI INT 3.2**

Floors - Wet Environment - Slip Resistant(Low VOC)	ITW Polymers Coatings North America	American Safety Technologies brand, AS-250	G1
"	PPG Canada, Inc., PPG Protective and Marine Coatings Division.	PPG Anti-Slip Safety Flooring Systems SFT 675	G1

.8 **Interior Plaster and Gypsum Board (gypsum wallboard, drywall, sheet rock type material, etc.) to INT 9.2**

Walls	The Sherwin-Williams Company	1st coat: Promar 200 Zero VOC Interior Latex Primer2nd and 3rd coats: : Pro Industrial Acrylic	G5
Ceilings	The Sherwin-Williams Company	1st coat: Promar 400 Zero VOC Interior Latex Primer2nd and 3rd coats: Promar 400 Zero VOC Interior Latex Paint	G3
"	Dulux Paints, a division of PPG Architectural Coatings Canada Inc	1st coat: Dulux Lifemaster Interior Acrylic Primer/Sealer 591132nd and 3rd coats: Dulux Lifemaster Interior 100% Acrylic Paint 59111	"
"	PPG Architectural Coatings Canada Inc.	1st coat: Pure Performance Interior Latex Primer 9-9002nd and 3rd coats: Pure Performance Interior Latex 9-100	"
"	Benjamin Moore & Co. Limited	1st coat: Ultra Spec 500 Interior Latex Primer K5342nd and 3rd coats: Ultra Spec 500 Interior Finish K536	"

.9 **Interior Miscellaneous: Galvanized Steel (not chromate passivated - zinc coated steel) to MPI INT 5.3**

Touch-up Primer	The Sherwin-Williams Company	Zinc Clad 5 Organic Zinc-Rich Primer	G1
"	Benjamin Moore & Co. Limited	Insul-X Corotech Organic Zinc-Rich Primer	"
Low Contact/Low Traffic Areas(Pipes, Ducts, etc.)	The Sherwin-Williams Company	1st coat: Pro Industrial Pro-Cryl Universal Primer2nd coats: Pro Industrial Acrylic	G5
High Contact/High Traffic Areas(Doors, Door Frames, Railings, Pipes, etc.)	The Sherwin-Williams Company	1st coat: Pro Industrial Pro-Cryl Universal Primer2nd and 3rd coats: Hi-Solids Polyurethane 100	G7
"	Benjamin Moore & Co. Limited	1st coat: Insl-X Stix Waterborne Bonding Primer SXA-1102nd and 3rd coats: Insl-X Corotech V540 Waterborne Urethane	"

.10 **Interior Steel (Non-Galvanized) to MPI INT 5.1**

Metal Fabrications - Non-galvanized Steel(Stairs, Ladders, railing etc.)	The Sherwin-Williams Company	1st and 2nd coats: Macropoxy 646-100 Fast Cure Epoxy Coating (Parts A & B)	G5
"	PPG Architectural Coatings Canada Inc.	1st and 2nd coats: Pitt-Guard Rapid Coat DTR Epoxy 95-245 Series (Parts A & B)	"
"	Devoe Coatings brand by PPG Architectural Coatings Canada Inc.	1st and 2nd coats: Devoe Paint Devran 224V Epoxy (Parts A & B)	"
"	Benjamin Moore & Co. Limited	1st coat: Insl-X Corotech V400 Polyamide Epoxy Coating2nd coat: Insl-X Corotech V540 Waterborne Urethane	"

.11 **Interior Wood Paneling and Casework to MPI INT 6.4**

Partitions, Panels, Plywood, Veneer, Millwork, etc	The Sherwin-Williams Company	1st coat: Multi-Purpose Latex Primer2nd and 3rd coats: Pro Industrial Acrylic	G5

Part 3 Execution

3.1 EXAMINATION

.1 Verify condition of previously installed Work upon which this Section depends. Report defects to Niagara Region. Commencement of Work means acceptance of existing conditions.

3.2 PREPARATION

.1 General:

.1 Clean substrate surfaces free from dust, grease, soiling or extraneous matter which are detrimental to finish.

.2 Patch, repair, and smooth minor substrate defects and deficiencies, such as machine, tool, and sand paper marks, shallow gouges, marks and nibs.

.3 Refer to MPI, Architectural Painters Specification Manual, for surface preparation requirements of substrates not listed here.

.2 Where finish hardware, electrical coverplates, light fixtures, grilles, gratings, louvres, access panels, convector covers, enclosures, and other escutcheons and appurtenances have been installed, remove, store, and re-install to accommodate painting. Do not clean hardware with solvent that will damage or remove permanent lacquer finishes.

.3 **Alkali Content Tests and Neutralization**

.1 Test for pH level using litmus paper on dampened substrate.

.2 Neutralize surfaces over 8.5 pH with 4% solution of zinc sulphate for solvent based systems and tetrapotassium pyrophosphate for latex based systems, to below 8.0 pH, and allow to dry.

.3 Brush off any residual zinc sulphate crystals

.4 Coordinate paint system primer/sealer to be alkali-resistant.

.4 **Substrate Moisture Tests**

.1 Test for moisture content over entire surface to be painted, minimum one test/2 m² in field areas and one test/600 mm along inside corners including at ceiling to wall juncture.

.2 If any test registers above 10%, allow entire substrate surfaces, within the plane, to dry further before paint system application. Install temporary drying fans, if necessary.

.3 Retest employing same criteria as above.

.5 **Mildew removal**

.1 Scrub with solution of trisodiumphosphate and sodium hypochlorite (Javex) bleach, rinse with water and allow to dry completely.

.2 Cementitious and Masonry (Concrete, Block, Brick, Stucco, Cement Rendering):

.3 Allow curing for 28 Days before painting.

.4 Coordinate repair of protrusion-chipping grinding and honeycomb filling with responsible trades.

.5 Remove dirt, loose mortar, scale, powder, efflorescence and other foreign matter.

.6 Remove form oil and grease with trisodiumphosphate, rinse and allow to dry thoroughly.

.7 Prepare surfaces in accordance with SSPC-SP 13/NACE No. 6.

.8 Remove rust stains with solution of sodium metasilicate after thorough wetting; allow to dry thoroughly.

.6 **Concrete Floors (Existing)**

.1 Remove rust stains with solution of sodium metasilicate after thorough wetting; allow to dry thoroughly.

.7 **Concrete Floors (New)**

.1 Allow curing for 28 Days before painting.

.2 Remove contamination, acid etch, rinse with water, and allow to dry completely. Test and adjust for neutral pH.

.3 Prepare surfaces in accordance with ASTM D4260.

.8 **Galvanized Steel Sheet**

.1 Z275 (heavy coating): In accordance with SSPC-SP 7/NACE No. 4.

.2 ZF075 (light zinc coating or satin coating): Remove contamination, wash with xylene solvent.

.3 Touch-up damaged galvanized areas with organic zinc-rich primer.

.9 **Galvanized Iron and Steel**

.1 Prepare galvanized and ungalvanized metal surfaces in accordance with SSPC-SP 1.

.2 Unpassivated, unweathered and weathered: Remove oil, grease, dirt, oxide and other foreign materials in accordance with SSPC SP 1, subject to paint manufacturer’s recommendations for paint application.

.3 Manufacturer pretreated (including passivated): In accordance with SSPC SP 7/NACE No. 4.

.4 Touch-up damaged galvanized areas with organic zinc-rich primer.

.5 Structural Steel and Miscellaneous Metal Fabrications:

.6 Coordinate the following with the responsible trades:

.7 Rust, marks, mill scale and weld-burn touch-ups.

.8 Oil, grease, weld flux and other residue removal.

.9 Prime paint items, not otherwise indicated to be primed as part of another Section.

.10 Touch-up damaged galvanized areas with organic zinc-rich primer.

.10 **Structural Steel and Miscellaneous Metal Fabrications**

.1 Coordinate the following with the responsible trades:

.1 Rust, marks, mill scale and weld-burn touch-ups.

.2 Oil, grease, weld flux and other residue removal.

.3 Prime paint items, not otherwise indicated to be primed as part of another Section.

.4 Touch-up damaged galvanized areas with organic zinc-rich primer.

.11 **Gypsum Board**

.1 Apply primer/sealer paint to reveal defects and deficiencies and to equalize absorption areas.

.2 Coordinate repairs and touch-ups with the responsible trade.

.3 Reprime repairs.

.12 **Previously Painted Surfaces**

.1 Prepare existing surfaces to be repainted in accordance with paint manufacturer's recommendations.

.2 Clean as required to remove oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mould, mildew, mortar efflorescence and sealers which may impair proper bond of the new finish.

.3 Peeled, chipped, scratched or otherwise damaged surfaces to be filled, made good and sanded, to provide perfectly smooth and even surface, with surface texture matching surrounding areas.

.4 Check for compatibility by applying a test patch of the recommended paint system, covering at least 1 m². Allow to dry for 1 week before testing adhesion in accordance with ASTM D3359. If the new paint system is incompatible, complete removal of the existing paint system is required.

.5 Treat new areas as described for preparation of new Work.

.6 Factory Primed Surfaces:

.7 Touch-up damaged areas.

.8 Clean as required for top coat.

.13 **Coordinate with Other Trades to Prevent:**

.1 Damage and inadvertent activation of fire and smoke detectors.

.2 Odour and dust distribution by permanent HVAC systems including fouling of ducts and filters.

3.3 MIXING PAINT

.1 Field-mix Products in accordance with manufacturer's recommendations.

.2 Do not use kerosene or any other organic solvents to thin water-based paint.

3.4 APPLICATION

.1 Apply painting systems in accordance with the MPI, Architectural Painters Specification Manual. Apply each Product in accordance with manufacturer's recommended dry film thickness (dft).

.2 Painting systems listed are the minimum acceptable level of quality. Apply additional coats if necessary to obtain substrate hiding acceptable to Niagara Region.

.3 Tint prime and intermediate coats lighter than final topcoats for identification of each succeeding coat and to facilitate inspections. Include only manufacturer's recommended reducing and tinting accessories. Do not add adulterants.

.4 Sand lightly between coats to achieve a suitable bonding surface for subsequent coats.

.5 Apply paint uniformly in thickness, colour, texture and gloss, as determined by APP under adequate illumination and viewed at a distance of 1500 mm. Apply finishes free of

defects in materials and application which, in the opinion of APP, affect appearance and performance. Defects include, but are not limited to:

.1 Improper cleaning and preparation of surfaces.

.2 Entrapped dust, dirt, rust.

.3 Alligatoring, blisters, peeling.

.4 Scratches, blemishes.

.5 Uneven coverage, misses, drips, runs and poor cutting in.

.6 Do not apply coatings on substrates, which are not sufficiently dry. Unless indicated otherwise, allow each painting system coat to cure until dry and hard before the following coats are applied.

.7 Repaint entire areas of damaged or incompletely covered surfaces, to the nearest inside or outside corner. Patching will not be permitted.

3.5 MISCELLANEOUS PAINTING REQUIREMENTS

.1 Paint surfaces of projecting ledges above and below sight lines to match adjacent surfaces, unless otherwise specified.

.2 Paint cabinets, both inside and out.

.3 Paint door frames and doors including top, bottom, and edges.

.4 Paint access doors and frames.

.5 Finish closets and alcoves as specified for adjoining rooms.

.6 Paint light coves white whether a light lens is installed or not, unless otherwise indicated.

.7 Paint interior columns to match walls of room.

.8 Mechanical, Electrical, and Other Painting Coordination:

.9 Paint mechanical services in accordance with Divisions 20, 21, 22, 23 and as indicated herein.

.10 Coordinate painting of pipes, ducts and coverings with the Work of Divisions 22 and 23 to precede pipe colour banding, flow arrows, and other pipe identification labelling installation.

.11 Paint exposed conduit, pipes, hangers, ductwork, grilles, gratings, louvres, access panels, fire hose cabinets, registers, convector and radiator covers, enclosures and other mechanical and electrical equipment including services concealed inside cupboard and cabinet work. Apply colour and sheen to match adjacent surfaces, except as noted otherwise.

.12 Paint portions of surfaces such as duct interiors, piping, ductwork, hangers, insulation, walls and similar items, visible through grilles, louvres, convector covers, etc., matte black in colour.

.13 Remove the following to accommodate painting, carefully store, clean, then reinstall on completion of each area and when dry:

.14 Switch and receptacle plates.

.15 Fittings and fastenings.

.16 Grilles, gratings, louvres and access panels.

3.6 MECHANICAL EQUIPMENT

.1 Prime and paint the following mechanical equipment and services in their entirety:

.1 Dry and wet sprinkler piping.

.2 Standpipes.

.3 Jib crane.

.4 Monorail beam.

.5 Hangers and supports not hot-dipped galvanized.

.6 Canvas jackets of insulated piping and ducts.

.7 Exposed sanitary, storm and vent piping.

.8 Natural gas piping.

.9 Service piping, including but not limited to, compressed air, grease, oils, fuel, and vents.

.10 Air receiver tank.

.11 Ductwork and plenums except stainless steel.

.12 Other equipment and services identified in Contract Documents.

.2 Refer to Section mechanical sections for colours for mechanical services. Where colours not identified, obtain colour from Niagara Region.

.3 Coordinate painting of pipes, ducts and coverings with the Work of Divisions 22 and 23 to precede pipe colour banding, flow arrows, and other pipe identification labelling installation.

.4 Paint exposed conduit, pipes, hangers, ductwork, grilles, gratings, louvres, access panels, fire hose cabinets, registers, convector and radiator covers, enclosures and other mechanical and electrical equipment including services concealed inside cupboard and cabinet work. Apply colour and sheen to match adjacent surfaces, except as noted otherwise.

.5 Paint portions of surfaces such as duct interiors, piping, ductwork, hangers, insulation, walls and similar items, visible through grilles, louvres, convector covers, etc., matte black in colour.

.6 Remove the following to accommodate painting, carefully store, clean, then reinstall on completion of each area and when dry:

.1 Switch and receptacle plates.

.2 Fittings and fastenings.

.3 Grilles, gratings, louvres and access panels.

3.7 FIELD QUALITY CONTROL

.1 Dry film thickness tests:

.1 Test for dft over entire surface to be painted, minimum one test/2 m² in field areas and one test/600 mm along inside corners including at ceiling to wall junction.

.2 If any test registers below specified thickness, reapply paint to entire surface to nearest inside and outside corners.

.3 If test registers more than 50% above specified thickness:

.4 Consult with paint manufacturer.

.5 Determine if problem exists.

.6 Offer solutions to APP and repair as directed.

.7 Retest employing same criteria after repair.

3.8 CLEANING

.1 Clean and reinstall items that were removed before undertaking painting operations.

.2 Remove spilled, splashed, and splattered paint promptly as Work proceeds and on completion of Work. Clean surfaces soiled by paint spillage and paint splatters. Repair or replace damaged Work as directed by APP.

.3 Protect surfaces from paint droppings and dust to meet the approval of APP. Avoid scuffing newly applied paint.

.4 Restore areas used for storage, cleaning, mixing, and handling of paint to clean condition as approved by APP.

.5 Remove protective coverings and warning signs as soon as practical after operations cease.

.6 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Niagara Region.

3.9 PROTECTION

.1 Post WET PAINT signs during drying and restrict or prevent traffic where necessary. 3.5.3.2

.2 Following inspection and acceptance by APP of each room, post sign reading: PAINTING COMPLETE - NO ADMITTANCE WITHOUT CONTRACTOR'S PERMISSION.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Phenolic Toilet Compartment Partitions:

.1 Floor and ceiling anchored.

.2 Privacy Screens

.1 Floor and ceiling anchored.

1.2 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place-Concrete: For compartment anchorage to concrete substrates.

.2 Section 04 20 00 - Unit Masonry. For compartment anchorage to masonry substrates.

.3 Section 05 40 00 - Cold-Formed Metal Framing. For miscellaneous structural and support metal components required to secure compartments.

.4 Section 06 10 00 - Rough Carpentry. For compartment anchorage to frame walls.

1.3 REFERENCES

.1 ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.3 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.4 ASTM A743/A 743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.5 ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.

.6 ASTM B221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.7 ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

.8 ASTM D6578 / D6578M - Standard Practice for Determination of Graffiti Resistance.

.9 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.10 CAN/CSA B651-18, Accessible Design for the Built Environment. Canadian Standards Association (CSA International) .

1.4 SUBMITTALS FOR REVIEW

.1 Submit under provisions of Section 01 33 00 -Administrative Requirements.

.2 Product Data:

.1 Manufacturer's data sheets on each product to be used.

.2 Product Test Reports: By qualified independent testing agency indicating compliance of products with requirements.

.3 Preparation instructions and recommendations.

.4 Storage and handling requirements and recommendations

.5 Typical installation methods.

.6 Maintenance and cleaning instructions.

.3 Verification Samples: Two representative units of each type, size, pattern and color.

.1 Size: 2 x 2 inch (52 x 52 mm) minimum, in type of finish specified.

.4 Shop Drawings: Include details of materials, construction and finish.

.1 Include relationship with adjacent construction.

.2 Overall product dimensions, floor plan, elevations, sections, and details.

.3 Choice of options with details.

.5 Choice of options with details.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum five years' experience in the manufacture of toilet compartments

.1 Manufacturers seeking approval must submit the following in accordance with Division 01 requirements:

.1 Product data, including test data from qualified independent testing agency indicating compliance with requirements.

.2 Samples of each component of product specified.

.3 List of successful installations of similar products available for evaluation by .

.2 Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

.3 Installer Qualifications: Company specializing in performing Work of this section with minimum three years documented experience with projects of similar scope and complexity.

.4 Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

.5 Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.

.1 Intent of mock-up is to demonstrate quality of workmanship and visual appearance.

.2 If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.

.3 Retain mock-up during construction as a standard for comparison with completed work.

.4 Do not alter or remove mock-up until work is completed or removal is authorized.

1.6 PRE-INSTALLATION CONFERENCE

.1 Convene a conference approximately two weeks before scheduled commencement of the Work.

.2 Attendees shall include Niagara Region, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Do not deliver toilet compartments to site until building is enclosed and HVAC systems are in operation.

.2 Deliver toilet compartments in manufacturer's original packaging.

.3 Store in an upright condition. and handle in strict compliance with manufacturer's written instructions and recommendations.

.4 Protect from damage due to weather, excessive temperature, and construction operations

.5 Replace defective or damaged materials with new.

1.8 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

.1 Special Manufacturer's Warranty: Manufacturer's form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:

.1 Phenolic Core Toilet Partitions: Against delamination: 3 years.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 Bradley Corp.

.2 Global Partitions

.3 Approved alternative

.2 Requests for substitutions will be considered in accordance with provisions of Section 01 61 00 - Common Product Requirements.

2.2 MATERIALS

.1 Doors:

.1 Doors shall be constructed of ¾" solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft and surface sheets fused at high temperature and pressure.

.2 Panels:

.1 Panels shall be constructed of ½" solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft and surface sheets fused at high temperature and

.3 Pilasters:

.1 Pilasters shall be constructed of ¾" solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft and surface sheets fused at high temperature and pressure.

.4 Stainless steel sheet metal: to ASTM A167, Type 304 with No. 4 finish.

.5 Sealer: water-resistant sealer or glue as recommended by laminate manufacturer.

.6 Headrails: clear anodized, extruded aluminum, anti-grip design, cast end socket brackets.

.7 Pilaster shoe 0.8 mm stainless steel, 75 mm high.

.8 Attachment: stainless steel tamper-proof type screws and bolts.

2.3 CONSTRUCTION

.1 Door, Panel, and Pilaster.

.1 Edges are finished and polished

.2 Exposed Surfaces: No pitting, visible seams, fabrication marks, stains, telegraphing of core material, or other imperfections.

.2 Door Construction: 19 mm thick. Standard panels to be 1475 mm high, top of panels at 1780 mm above finished floor. Or door sizes as indicated on drawings.

.3 Panel Construction: 13 mm thick. Standard panels to be 1475 mm high, top of panels at 1780 mm above finished floor. Or panel sizes as indicated on drawings.

.4 Pilaster Construction: 19 mm thick. Standard panels to be 1475 mm high, top of panels at 1780 mm above finished floor. Or pilaster sizes as indicated on drawings.

.1 Pilaster with mechanically fastened leveling bar reinforcement with zinc-plated jack bolt for leveling.

.5 Brackets aka. Fittings:

.1 Stirrup Type: Ear or U-brackets; stainless steel.

.6 Phenolic Core Finish: Manufacturer's standard impregnated color.

.1 Color: As selected by Niagara Region representative from manufacturer's full range.

.7 Laminate plastic to core material ensuring core and laminate profiles coincide to provide continuous support and bond over entire surface.

.8 Provide formed and closed edges for doors, panels and pilasters. Mitre and weld corners and grind smooth.

.9 Provide internal reinforcement at areas of attached hardware and fittings. Temporarily mark location of reinforcement for grab bars.

.10 Hardware:

.1 Heavy Duty: Manufacturer's chrome-plated castings. Corrosion-resistant, tamper-resistant fasteners:

.1 Adjustable Self-Closing Hinges: Holds doors open any angle up to 90 degrees. Emergency Access feature. Return movement, gavity type. Stainless steel.

.1 Upper hinge: Operates in 3-point bearing bracket with nylon bushings.

.2 Bottom hinge: Gravity type, mounted on lower pilaster hinge bracket. Adjustable to permit door to rest at any position when not latched.

.2 Latch and Keeper: Surface-mounted slide latch. Emergency access provision. Meet requirements for accessibility at accessible

compartments. Install door-stops to prevent overswing of doors. Stainless steel.

.3 Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Stainless steel.

.4 Wall Bumper: Where door abuts wall.

.5 Door Pull: Barrier-free type suited for outswinging doors. Include interior and exterior side 163 mm D-type pull. Stainless steel.

.6 No-sightline stainless steel continuous stop and hinge filler to be No. 4 brushed finish to complement door and pilaster finish.

.7 Full height continuous channels: Type 304 stainless steel, #4 brushed finishes to connecting panel-to-pilaster, panel-to-wall, and pilaster-to-wall.

Part 3 Execution

3.1 EXAMINATION

.1 Examine work area to verify that measurements, substrates, supports, and environmental conditions are in accordance with manufacturer's requirements to allow installation.

.2 Do not begin installation until substrates have been properly constructed and prepared as per manufacturer's requirements.

.3 If substrate preparation is the responsibility of another installer, notify Niagara Region in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean 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

.1 Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

.2 Install toilet partitions and screens in spaces with operating, temperature controlled HVAC systems. Shield partitions and screens from direct sunlight.

.3 Clearances: Install with clearances indicated on Drawings. Where clearances are not indicated, allow maximum 13 mm between pilasters and panels, and 25 mm between panels and walls.

.4 Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than:

.1 Two brackets attached near top and bottom of panel.

.2 Three brackets attached at midpoint and near top and bottom of panel.

.3 Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

.5 Partition erection.

.1 Install partitions secure, plumb and square.

.2 Anchor mounting brackets to masonry or concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors, to steel supports with bolts in threaded holes.

.3 Attach panel and pilaster to brackets with through type sleeve bolt and nut.

.4 Provide for adjustment of floor variations with screw jack through steel saddles made integral with pilaster. Conceal floor fixings with stainless steel shoes.

.5 Equip each door with hinges, latch set, and each stall with coat hook mounted on door, mounting heights as indicated for accessible compartment and 1500 mm aff. for standard compartment. Adjust and align hardware for proper function. Set door open position at 30° to front. Install door bumper door mounted.

.6 Equip outswinging doors with door pulls on inside and outside of door in accordance with CAN/CSA-B651 and other referenced standards.

.7 Install hardware and grab bars.

.6 Floor-supported and overhead-braced partition erection.

.1 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device.

.2 Secure pilaster shoes in position.

.3 Secure headrail to pilaster face with not less than two fasteners per face.

.4 Set tops of doors parallel with overhead brace when doors are in closed position.

.7 Screen erection.

.1 Provide urinal stall screens consisting of panel and pilaster as specified for toilet compartments.

.2 Anchor screen panels to walls with 3 panel brackets and pilaster complete with floor and ceiling shoes, anchored to floor and ceiling.

.3 Secure to supplementary anchorage above ceiling finish to receive screen pilaster.

3.4 ADJUSTING

.1 Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation

.1 In-Swing Doors: Set hinges to hold doors open approximately 15 degrees from closed position when unlatched.

.2 Out-Swing Doors: Set hinges to return doors to fully closed position.

.3 Privacy Screen Doors: Set hinges to return doors to fully closed position.

3.5 FIELD QUALITY CONTROL

.1 Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

.2 Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.6 CLEANING AND PROTECTION

.1 Remove packaging and construction debris and legally dispose of offsite.

.2 Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

.3 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Labour, Products, equipment and services for washroom accessories Work in accordance with Contract Documents.

1.2 REFERENCES

.1 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 OBC, Ontario Building Code.

.5 CSA B651, Accessible Design for the Built Environment.

1.3 SUBMITTALS FOR REVIEW

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, electrical requirements, and building-in details.

1.4 SAMPLES

.1 Submit samples of all accessories.

.2 Samples to be returned for inclusion into work.

1.5 CLOSE OUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual.

1.6 EXTRA MATERIALS

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories .

.2 Deliver special tools to Niagara Region.

Part 2 Products

2.1 MATERIALS

.1 Stainless steel:

.1 Sheet metal: In accordance with ASTM A240/A240M, Type 304.

.2 Tubing: In accordance with ASTM A312/A312M, Type 304.

.2 Sheet steel:

.1 G90, cold rolled, commercial quality, surface preparation and pre-treatment as required for applied finish, in accordance with ASTM A653/A653M.

.3 Fasteners, Screws and Bolts:

.1 Type 304 stainless steel, tamper-proof, in accordance with ASTM A240/A240M.

2.2 ACCESSORIES FOR PUBLIC WASHROOMS

.1 Electric Hand Dryer:

.1 Low energy draw, high speed, surface mounted, hands free operation.

.2 Vandal proof with heavy gauge stainless steel.

.3 Air blow direction: downward.

.4 Adjustable drying time, adjustable power and adjustable air velocity.

.5 Electrical: 100-240 V, 4.5 A, 50 - 540 W.

.6 Finish: Heavy duty one piece stainless steel #4 brushed.

.7 Product(s) and Manufacturer(s):

.1 ExtremeAir EXT7-SS, by Canadian Dryer.

.2 Model 0197-1 by ASI Group Canada.

.3 XLERATOReco Hand Dryer, XL-SB-ECO by Excel Dryer Inc.

.4 Model 2901-2874 by Bradley Corporation.

.2 Mirror (Vandal Resistant):

.1 Dimensions: 760 mm x 460 mm.

.2 Product(s) and Manufacturer(s):

.1 B-1658 1830 by Bobrick Washroom Equipment Company.

.2 ASI 0600-B1830 1824 by ASI Group Canada.

.3 Frost 941 TG

.3 Vanity Shelf :

.1 Dimensions: 457 mm x 152 mm x 76 mm.

.2 Finish: Type 304, stainless steel with satin finish.

.3 Product(s) and Manufacturer(s):

.1 B-296 by Bobrick Washroom Equipment Company.

.2 ASI 0692-6 by ASI Group Canada.

.4 Grab Bars:

.1 Finish: Type 304 stainless steel with a satin finish and peened gripping surface.

.2 Product(s) and Manufacturer(s):

.1 B-6806 x 24, 610 mm stainless steel bar by Bobrick Washroom Equipment.

.2 B-6898.99, 762 x 762 mm stainless steel bar by Bobrick Washroom Equipment.

.3 ASI 3801 x 24, 610 mm stainless steel bar by ASI Group Canada.

.4 ASI 3807 x 4P, 762 x 762 mm stainless steel bar by ASI Group Canada.

.5 Adjustable Height Adult Changing Station:

.1 Frame: Shall be constructed of 2” powder coated steel tubing.

.2 Changing Bed: Surface shall be 1911 mm long, 800 mm wide. Can be raised and lowered with one-hand. Produced from UHMW PE 1000 to be cut resistant while providing hammock for comfort. Surface shall be designed to be replaceable in the field.

.3 Security lap strap.

.4 Front Safety Guard: One-hand operation. Guard shall lock in raised position along front side of changing bed. Guard shall have dip in top edge to facilitate caregiver reaching over guard to change patient. Guard shall rotate and lock under changing bed in stored position.

.5 Weight Capacity: Tested to support 227 kg static load.

.6 Cleaning: The unit shall be designed and tested to meet IPX4 rating and shall have no exposed wiring/cables for disinfecting and cleaning. Unit can be hosed without compromising the electronics

.7 Durability: Cycle tested through range of motion 28,000 times at 500lbs. Stress tested to 100,000 cycles with 227 kg bounce load test. Meets IK10 impact rating.

.8 Powered-Height Adjustability: Electronically adjustable from 300 mm to 1041 mm. Unit has two sets of electronic controls: located on face of wall cover; and, on front of changing bed in open, down position. Optional control pendant available for height adjustment

.9 Emergency Stop: Unit is equipped with emergency stop to break power to actuator in an emergency

.10 Safety: Unit tested to meet ISO 60601 and ISO 17966 Unit shall have a battery backup system to safely operate changing bed in the event of a power interruption.

.11 Unit designed to have redundancy by being equipped with two chains for height adjustability.

.12 Electrical: The unit shall operate at 24V / via 120V wall outlet. It shall include a grounded power cord and have a splash proof control system rated at IPX4.

.13 Product(s) and Manufacturer(s):

.1 Model KB3000-AHL as manufactured by Koala Kare Products, a Division of Bobrick.

.6 Toilet backrest:

.1 32 mm diameter x 1.6 mm stainless steel tube, concealed fastening mounting. 16 mm solid plastic laminate backrest (white finish).

.2 Backrests are required on all non-tanked water closets.

.3 Product(s) and Manufacturer(s):

.1 B-5891 by Bobrick.

.2 1028 by Frost.

.3 9574 by Bradley.

.4 3777 by ASI Group Canada.

.7 Accessories supplied by Niagara Region, install as directed by Niagara Region.

.1 Toilet paper dispenser.

.2 Paper towel dispenser.

.3 Liquid soap dispenser.

.4 Waste receptacle.

.5 Menstrual napkin disposal bin.

Part 3 Execution

3.1 PREPARATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Niagara Region. Commencement of Work means acceptance of existing conditions.

3.2 INSTALLATION

.1 Coordinate templates, inserts, and rough-in frames and verify exact location of washroom accessories for installation.

.2 Install washroom accessory fixtures, accessories, and items in accordance with manufacturer's instructions and with OBC Section 3.8 and where requirements do not conflict with OBC, the most current version of CSA B651.

.3 Install washroom accessories plumb, level, and securely and rigidly anchored to substrate surfaces and framing.

.4 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish.

.2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.

.3 Solid masonry, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.

.4 Toilet compartments: use male/female through bolts.

.5 Install grab bars on built-in anchors provided by bar manufacturer.

.6 Use tamper proof screws/bolts for fasteners.

.7 Fill units with necessary supplies shortly before final acceptance of building.

.8 Include reinforcing, anchorage and mounting devices required for installation of each product.

.9 Provide manufacturer's handling instruction, anchorage information, rough-in dimensions and templates for installation of work under this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.3 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Operation and maintenance manual approved by, and final copies deposited with Owner before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instruction for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manuals to Owner for approval. Submission of individual data will not be accepted unless directed by Owner.

.2 Make changes as required and re-submit as directed by Owner.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site Records:

.1 Owner will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built Drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.6 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 43 00 - Quality Assurance.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal

Part 2 Products

2.1 MATERIALS

.1 Do verification requirements in accordance with Section 01 79 00 - Demonstration And Training

Part 3 Execution

3.1 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.2 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.

3.3 DEMONSTRATION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.3 Instruction duration time requirements as specified in appropriate sections.

3.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A126-04(2014), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 ANSI/AWWA C700-15, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.

.2 ANSI/AWWA C701-15, Standard for Cold Water Meters-Turbine Type for Customer Service.

.3 ANSI/AWWA C702-15, Standard for Cold Water Meters-Compound Type.

.3 CSA Group (CSA)

.1 CSA-B64 Series-11(R2016), Backflow Preventers and Vacuum Breakers.

.2 CSA B79-08(R2018), Commercial and Residential Drains and Cleanouts.

.3 CAN/CSA-B356-10(R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 Plumbing and Drainage Institute (PDI)

.1 PDI-G101-17, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.

.2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.2 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: manufacturers' field reports specified.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual
specified in Section 01 78 00 - Closeout Submittals, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type,
model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Charts.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Verification: contractor's verification in accordance with Section 01 79 00 - Demonstration And Training.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79

.2 FD-1: general duty, 200 mm; cast iron body, round, adjustable head, sediment basket, nickel bronze strainer, integral seepage pan, clamping collar, and trap primer tapping.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

.3 FD-2: combination funnel floor drain, 200 mm; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral oval funnel, and trap primer.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

.4 When more than one floor drain is located in same room and served by a running trap, provide tapping or running trap, ahead of trap dip, for priming.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket, adjustable housing, cover, membrane flange and clamping collar.

.2 Access Covers:

.1 Wall Access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: nickel bronze round gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.3 Floor cleanout:

.1 Acceptable manufacturers: Zurn, Jay R. Smith.

.4 Wall cleanout:

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

2.3 NON-FREEZE WALL HYDRANTS

.1 Recessed with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Nickel
bronze box and hinged cover with operating key lock.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

2.4 WATER HAMMER ARRESTORS

.1 Stainless steel construction, bellows type: to PDI-WH201.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

2.5 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, application as indicated.

.2 Reduced pressure principal type:

.1 Acceptable manufacturers: Watts, Hersey, Febco.

.3 Double check valve assembly:

.1 Acceptable manufacturers: Watts, Hersey, Febco.

2.6 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series, vacuum breaker, atmospheric

.1 Acceptable manufacturers: Watts, Febco, Cash.

2.7 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral vacuum breaker, hose thread spout, replaceable composition disc, chrome plated in finished areas, rough brass in unfinished areas.

.1 Acceptable manufacturers: Crane, Emco, Waltec.

2.8 TRAP SEAL PRIMERS

.1 Electronic trap primer programmed as standard to provide a six second water injection to traps every 24 hours, complete with galvanized steel combination surface or recessed mount box and cover, 13 mm solder
copper inlet connection, brass ball type stop valve, slow-closing 24 VAC solenoid valve

with integral strainer, 120 - 2.12 VAC transformer, brass atmospheric vacuum breaker, PEX waterway, and anti-scaling multi-port manifold with five 13 mm outlet connections.

.1 Acceptable manufacturers: PPP Oregon, MIFAB, Primers Zurn.

.2 TP-2:

.1 Use with exposed flushometers.

.2 One piece, chrome plated flush connection, water deflector to control the amount of water diverted from the flush.

.3 10 mm elbow and flex-bend tube connection from vacuum breaker to wall, diverter wall flange and fittings.

.4 Chrome plated wall flange and fitting to connect to 15 mm NPT pipe.

.3 TP-3:

.1 Use on piping less than 25 mm.

.2 Shall be 15 mm MIP outlet.

.3 Automatic trap primer valves which activate with a 70 kPa pressure drop between 206 kPa to 1034 kPa.

.4 Water release shall be factory set, shall have large port openings and a non-corrosive brass finish.

.5 Mount exposed on wall.

2.9 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.10 PIPING SUPPORT BELOW SLAB

.1 All piping shall be supported by an approved suspended system.

.2 System Structure:

.1 Provide a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes, including all imposed loads, throughout the construction process.

.2 The system shall be designed to have the ability to temporarily position and suspend the lateral pipes to the specified height and slope until permanently anchored to the overhead structural slab via the securing hanger system. The open, underground system will then remain independent from the securing hangers.

.3 The open space of the system beneath the structural slab is designed to receive the infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact
with the soil, the uplifting soil pressure will become separate and allow the lateral pipes to be totally independent from the System.

.3 System Components:

.1 The system shall have waterproof components related to its intended performance.

.2 The system must maintain its structural integrity in all humid environments.

.3 The system must have industry-proven performance in any and all inclement conditions.

.4 The system shall be able to perform if and when submerged in water.

.5 It is recommended that all independent components not included in the system should comply with the project specifications in order to get the intended results of the designed system.

.6 All vertical All-thread must have a component secured toward the top end and be permanently affixed into the concrete slab in order to maintain the specified elevations.

.7 All System components, excluding All-thread, nuts/washers, shall be furnished by the system manufacturer.

.8 System shall be installed per the manufacturer's requirements and recommendations.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 NON-FREEZE WALL HYDRANTS

.1 Install 600 mm above finished grade and as indicated.

3.5 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures and to manufacturer's recommendations.

3.6 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code. Test under authority having jurisdiction.

.2 Pipe discharge to terminate over nearest drain or service sink.

3.7 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Owner.

.3 Install soft copper and running traps.

.4 Piping to be graded to each trap.

.5 All piping to be installed adjacent drainage piping within the suspended support system structure.

3.9 STRAINERS

.1 Install with sufficient room to remove basket for maintenance.

3.10 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.11 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Section 01 43 00 - Quality Assurance.

3.12 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.7 Access doors:

.1 Verify size and location relative to items to be accessed.

.8 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.9 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.10 Wall hydrants:

.1 Verify complete drainage, freeze protection.

.2 Verify operation of vacuum breakers.

.11 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.12 Hose bibbs, sediment faucets:

.1 Verify operation.

.13 Commissioning Reports:

.1 In accordance with Section 01 91 31 - Commissioning: Reports, supplemented as specified.

.14 Training:

.1 In accordance with Section 01 91 31 - Commissioning: Training of O&M Personnel, supplemented as specified.

.2 Demonstrate full compliance with Design Criteria.

3.13 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel, supplemented as specified.

3.14 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.15 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

1.2 REFERENCE STANDARDS

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 90.1-2016 (SI), Energy Standard for Buildings Except Low-Rise Residential Buildings, SI Edition.

.2 Electrical Equipment Manufacturers Advisory Council (EEMAC).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-B214-16, Installation Code for Hydronic Heating Systems.

.4 American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA).

.1 ANSI/NEMA MG1-2016, Motors and Generators, Includes Supplements Part 34 (2017), Part 7 (2018), Parts 12.35 to 12.50 (2018), Parts 12.59 to 12.60 (2018), Part 30 (2018) and Part 31 (2018) Motors and Generators.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings: Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or site assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Site Reports: manufacturers' site reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual
specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturer's name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.4 QUALITY ASSURANCE

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.5 Verification: contractor's verification in Assurance accordance with Section 01 79 00 - Demonstration And Training.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS

.1 Capacity: as indicated.

.2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105 degrees C continuous service.

.3 Motor: open, drip-proof, with thermal overload protection.

.4 Supports: provide as recommended by manufacturer.

.5 Acceptable manufacturers: ITT Bell & Gossett, Armstrong, Taco.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including
product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

3.3 SITE QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Verification requirements in accordance with Section 01 79 00 - Demonstration And Training.

3.4 REPORTS

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: reports, supplemented as specified. Include:

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

.3 Pump performance curves (family of curves) with final point of actual performance.

3.5 TRAINING

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M personnel, supplemented as specified.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

.3 Section 22 05 15 - Plumbing Specialties and Accessories.

.4 Section 22 11 16 - Domestic Water Piping Copper.

.5 Section 23 05 23.01 - Valves - Bronze.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME):

.1 ANSI/ASME B16.15-2018, Cast Bronze Threaded Fittings, Classes 125 and 250

.2 ANSI/ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings

.3 ANSI/ASME B16.22-2018, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

.4 ANSI/ASME B16.24-2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500

.2 ASTM International (ASTM):

.1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

.2 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube (Metric)

.3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA):

.1 ANSI/AWWA C111/A21.11-17., Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

.2 AWWA C651-14, Disinfecting Water Mains.

.4 CSA Group (CSA):

.1 CSA B242-05(R216), Groove and Shoulder Type Mechanical Pipe Couplings

.5 Department of Justice Canada (Jus):

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA)

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS)

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):

.1 MSS-SP-67-2017, Butterfly Valves

.2 MSS-SP-70-2011, Grey Iron Gate Valves, Flanged and Threaded Ends

.3 MSS-SP-71-2018, Grey Iron Swing Check Valves, Flanged and Threaded Ends

.4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves

.8 National Research Council (NRC):

.1 National Plumbing Code of Canada (NPC) 2015

.9 Transport Canada (TC):

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit product data for following: valves.

.3 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, type K: to ASTM B88M

.2 Buried or embedded:

.1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24

.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15

.3 Cast copper, solder type: to ANSI/ASME B16.18

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22

.5 NPS 2 and larger:

.1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242

.6 Cast copper alloy flared joint type: to ANSI B16.26.

2.3 JOINTS

.1 Rubber gaskets, latex-free, 1.6 mm thick: to ANSI/AWWA C11/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series

.3 Solder: silver. Brazing: lead-free (less than 0.2% lead).

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.1 Acceptable manufacturers: Victaulic, Epco, Watts.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

.1 Acceptable manufacturers: Victaulic, Epco, Watts.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 Acceptable material: Crane 1700S, Jenkins 8135, Kitz 44.

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 Acceptable material: Crane 428, Jenkins 810J, Kitz 24.

.3 NPS 2 1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

.2 Acceptable material: Crane 465 1/2, Jenkins 454, Kitz 72.

.4 NPS 2 1/2 and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

.2 Acceptable material: Crane 461, Jenkins 452J, Kitz75.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: as indicated.

.3 Acceptable material: Crane 1310, Jenkins 106 BP, Kitz 10.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

.2 Lockshield handles: as indicated.

.3 Acceptable material: Crane 7TF, Jenkins 106 BJ, Kitz 9.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Acceptable material: Crane 1707S, Jenkins 997, Kitz 14.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Acceptable material: Crane 1707, Jenkins 996, Kitz 4.

.3 NPS 2 1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

.2 Acceptable material: Crane 373, Jenkins 587J, Kitz 78.

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified.

.3 Acceptable material: Crane 9203B, Jenkins 201-J, Kitz 68.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

.3 Acceptable material: Crane 9323B, Jenkins 202J, Kitz 69.

2.8 CIRCUIT BALANCING VALVES

.1 General:

.1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports connected to differential pressure.

.2 Accuracy:

.1 Readout to be within plus or minus 2% of actual flow at design flow rate.

.3 Pressure die-cast dezincification resistant copper alloy construction, 1.7 MPa, 121°C, screwed ends, EPDM "O" ring seal, screw-in bonnet.

.1 Flow control: at least four (4) full turns of handwheel with digital handwheel and tamperproof concealed mechanical memory.

.4 Insulation:

.1 Use prefabricated shipping packaging of 5.4 R polyurethane as insulation.

.5 Drain Connection:

.1 NPS 3/4 valved and capped, suitable for hose socket.

.6 Acceptable material: Armstrong CBV, Tour & Anderson STA, Victaulic.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada, Provincial Plumbing Code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards

.4 Install cold water piping below and away from hot water, recirculation and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures in accordance with manufacturer's written instructions unless otherwise indicated. Connect to equipment in accordance with approved manufacturer's shop drawings and as per manufacturer's written instructions.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with valves.

.2 Install circuit balancing valves on recirculation systems as indicated on drawings. Balance recirculation systems using circuit balancing valves to flows as indicated on drawings. Mark settings and record on
as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Flush out, disinfect and rinse system to AWWA C651 - Disinfecting Water Mains and the approval of the Owner.

.2 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to [Provincial] potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

.3 Submit flushing and cleaning procedure for approval in accordance with Section 01 33 00 - Submittal Procedures.

.4 Upon completion, provide laboratory test reports on water quality for Owner.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to approval of Owner.

.2 Upon completion, provide laboratory test reports on water quality for Owner approval.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring HWS storage tank up to design temperature slowly.

.4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.4 Sterilize HWS and HWC systems for Legionella control.

.5 Verify performance of temperature controls.

.6 Verify compliance with safety and health requirements.

.7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning Requirements: Report Forms and Schematics.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

.4 Verification requirements in accordance with Section 01 79 00 - Demonstration And Training.

3.9 OPERATION REQUIREMENTS

.1 Operational Requirements:

.1 Cleaning materials and schedules.

.2 Repair and maintenance materials and instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

.3 Section 22 05 15 - Plumbing Specialties and Accessories.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM B32-08(2014), Standard Specification for Solder Metal.

.2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM C564-13e1, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 CSA Group (CSA)

.1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70-12(R2016), Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125.1-18/ASME A112.18.1-18, Plumbing Supply Fittings.

.4 CSA B242-05(R2016), Groove- and Shoulder-Type Mechanical Pipe Couplings.

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary drainage and vent Type DWV to: ASTM B306

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.3

.2 Wrought copper: to CAN/CSA-B125.3

.2 Solder: joints, to ASTM B32

.2 Above ground sanitary, storm, vent and indirect drains from mechanical equipment up to NPS 4, Type DWV to: ASTM B306

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.1.

.2 Wrought copper: to CAN/CSA-B125.1.

.2 Solder: to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary, storm and vent, minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.

.1 Joints:

.1 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70 orASTM C564

.2 Stainless steel clamps.

.2 Above ground sanitary, storm and vent: to CAN/CSA-B70

.1 Joints:

.1 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

.2 Groove and shoulder type couplings for cast iron complete with neoprene rubber gaskets and
stainless steel bolts and nuts: to CSA B242.

.3 Compound elastomeric couplings complete with stainless steel or cast iron clamps: to CGSB-77-GP-2M, installed to manufacturer's recommendations.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.

.2 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.

.3 Install buried pipe in approved piping support system as specified in Section 22 05 15 - Plumbing Specialties and Accessories.

.4 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.5 For threaded joints, use teflon tape applied to male thread only.

3.2 TESTING

.1 Pressure test buried systems before backfilling in accordance with the National Plumbing Code of Canada.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

3.4 VERIFICATION

.1 Verification requirements in accordance with Section 01 79 00 - Demonstration And Training.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 The installation of drainage waste and venting piping - plastic.

.2 Sustainable requirements for verification.

1.2 RELATED REQUIREMENTS

.1 Division 01- General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

.3 Section 22 05 15 - Plumbing Specialties and Accessories.

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D2235- 04(2016), Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564- 12(2018), Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 CSA Group (CSA)

.1 CAN/CSA-Series B1800- 18, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

.2 CAN/CSA B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CAN/CSA B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.4 South Coast Air Quality Management District (SCAQMD), California State

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 For buried and or above ground sanitary, storm and vent piping to:

.1 CSA-B181.1.

.2 CSA-B181.2.

.3 CSA-B182.1.

.4 Aboveground piping to meet the following:

.1 Flame spread rating: less than 25.

.2 Smoke development rating: less than 50.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564

.2 Solvent weld for ABS: to ASTM D2235

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.

.2 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.

.3 Install buried pipe in approved piping support system as specified in Section 22 05 15 - Plumbing Specialties and Accessories.

3.2 TESTING

.1 Pressure test buried systems before backfilling in accordance with the National Plumbing Code of Canada.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

3.4 VERIFICATION

.1 Verification requirements in accordance with Section 01 79 00 - Demonstration And Training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA):

.1 CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures

.2 CAN/CSA-B125.1-18/ASME A112.18.1-18, Plumbing Supply Fittings.

.3 CSA B651-18, Accessible Design for the Built Environment

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.3 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.4 LOW VOLTAGE

.1 All low voltage wiring from transformer to trim by Division 22. Refer to electrical drawings for junction box locations.

.2 Provide conduit and wiring to standards of Division 26.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series

.2 Trim, fittings: manufacture in accordance with CSA B125.1

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 WATER CLOSETS

.1 WC-1: wall mounted, top spud for exposed flush valve, ultra-low flush (4.8 l/flush) elongated.

.1 Bowl: white vitreous china, siphon jet, elongated rim, c/w bolt caps.

.1 Acceptable material: American Standard "Afwall" AF-3351.101; Zurn Z5615-BWL; Kohler K-4325.

.2 Trim: exposed hardwired sensor operated flushometer. 4.8 L/flush factory set.

.1 Acceptable material: Delta 81T201-WMSHWA, Sloan 113-1.28 ES-S, Zurn ZEMS6000AV.

.3 Seat: white elongated, open front, molded solid plastic less cover, stainless steel check hinges, stainless steel or solid brass insert posts.

.1 Acceptable material: Beneke 523, Centoco 500CC, Bemis 1955C, Olsonite #10 C.

.4 Carrier: heavy steel supports, integral feet, studs and plates, U-bolts and hardware.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

.5 Flush valve and power supply from transformer as specified in para. 2.6 of this specification section

.2 WC-2 (Barrier-free): wall mounted, top spud for exposed flush valve, ultra-low flush (4.8 l/flush) elongated.

.1 Bowl: white vitreous china, siphon jet, elongated rim, c/w bolt caps, 406 to 455 mm bowl height range.

.1 Acceptable material: American Standard "Afwall" AF-3351.101; Zurn Z5615-BWL; Kohler K-4325.

.2 Trim: exposed hardwired sensor operated flushometer. 4.8 L/flush factory set.

.1 Acceptable material: Delta 81T201-WMSHWA, Sloan 113-1.28 ES-S, Zurn ZEMS6000AV.

.3 Seat: white elongated, open front, molded solid plastic with cover, stainless steel check hinges, stainless steel or solid brass insert posts.

.1 Acceptable material: Beneke 523, Centoco 500CC, Bemis 1955C, Olsonite #10 C.

.4 Carrier: heavy steel supports, integral feet, studs and plates, U-bolts and hardware.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

.5 Flush valve and power supply from transformer as specified in para. 2.6 of this specification section

.3 WC-3: floor mounted, top spud for exposed flush valve, ultra-low flush (4.8 l/flush) elongated.

.1 Bowl: white vitreous china, siphon jet, elongated rim, c/w bolt caps, 254 mm bowl height.

.1 Acceptable material: American Standard Baby Devero 2282.001; Zurn Z-5675-BWL; Kohler K-96064-SS.

.2 Trim: exposed hardwired sensor operated flushometer. Flushometer to be mounted higher than seat. 4.8 L/flush factory set.

.1 Acceptable material: Delta 81T201-WMSHWA, Sloan 113-1.28 ES-S, Zurn ZEMS6000AV.

.3 Seat: white elongated, open front, molded solid plastic with cover, stainless steel check hinges, stainless steel or solid brass insert posts.

.1 Acceptable material: Beneke 323-5, Centoco AM 2300STSCC, Olsonite 126CAM.

.4 Flush valve and power supply from transformer as specified in para. 2.6 of this specification section.

.4 WC-4: floor mounted, top spud for exposed flush valve, ultra-low flush (4.8 l/flush) elongated.

.1 Bowl: white vitreous china, siphon jet, elongated rim, c/w bolt caps, 359 mm bowl height.

.1 Acceptable material: American Standard Madera 3451.001; Zurn Z5655-BWL1; Kohler K-25086.

.2 Trim: exposed hardwired sensor operated flushometer. Flushometer to be mounted higher than seat. 4.8 l/flush factory set.

.1 Acceptable material: Delta 81T201-WMSHWA, Sloan 113-1.28 ES-S, Zurn ZEMS6000AV.

.3 Seat: white elongated, open front, molded solid plastic with cover, stainless steel check hinges, stainless steel or solid brass insert posts.

.1 Acceptable material: Beneke 523, Centoco 500CC, Bemis 1955C, Olsonite #10 C.

.4 Flush valve and power supply from transformer as specified in para. 2.6 of this specification section.

2.3 URINALS

.1 U-1: wall mounted, ultra-low flush, exposed flush valve, top spud:

.1 Urinal: white vitreous china, washout type, integral flushing rim, extended shields, integral trap, removable stainless steel strainer, back outlet, NPS 3/4 top spud, NPS 2 outlet connection NPT

.1 Acceptable material: American Standard "Washbrook" AF-6590.001, Zurn Z5755-U; Kohler K-4992-ET.

.2 Trim: exposed hard-wired sensor operated flushometer.

.1 Acceptable material: Delta 81T231-WMSHWA, Sloan 186-1.0 ES-S, Zurn ZEMS6003PL.

.3 Carrier: heavy steel supports, integral feet, studs, top and bottom plates, U-bolts and hardware.

.1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

.4 Flush valve and power supply from transformer as specified in para. 2.6 of this specification section.

2.4 LAVATORIES

.1 L-1: vanity type, 100 mm centers:

.1 Fixture: vitreous china, front overflow, self-rimming, gasket, swivel clamps.

.1 Acceptable material: American Standard Aqualyn 0475-028, Zurn Z5114; Gerber 12-824; Kohler K-2699-4.

.2 Trim: infra-red electronic faucet:

.1 Activated by infra-red sensor responding to presence of person's hands in lavatory.

.2 Sensor: waterproof, incorporated in body of unit, with impact-resistant lens with anti-scratch coating, sensitivity adjustable from 25 mm to 350 mm.

.3 Controls: vandal-proof, c/w control box and cover, interchangeable receptacles for stainless steel sheet sensor and modular plug-type solenoid connections, single slow-closing commercial solenoid for 860 kPa, 85°C.

.4 Spout: chromeplated, with cast cover plate and vandal-resistant aerator having integral flow control for 1.9 l/minute at 413 kPa maximum.

.5 Under-counter thermostatic mixing controls with screwdriver stop.

.6 Acceptable material: Delta 591TP0258, Sloan ETF-880-4, Zurn Z6915-CWB.

.3 Waste: chrome plated cast brass NPS 1 1/4 with grid strainer, overflow holes, 114 mm centers, tailpiece, locknut, and gasket.

.1 Acceptable material: Delta 33T260, Powers Crane P3902, Chicago Faucet No. 327A.

.4 P-trap: chromeplated NPS 1 1/4, 17 gauge brass, adjustable, with cleanout and escutcheon.

.1 Acceptable material: Delta 33T311, Emco Model 805, Powers Crane P40 01.

.2 L-2: wall hung, barrier-free, 100 mm centers.

.1 Vitreous china, contoured rectangular basin, front overflow, soap depression.

.1 Acceptable material: American Standard Murro 0954.123EC Zurn Z-5320-PED; Gerber 12-384; Kohler Pinoir K-2035-4.

.2 Trim: infra-red electronic faucet:

.1 Activated by infra-red sensor responding to presence of person's hands in lavatory.

.2 Sensor: waterproof, incorporated in body of unit, with impact-resistant lens with anti-scratch coating, gooseneck, sensitivity adjustable from 25 mm to 350 mm.

.3 Controls: vandal-proof, c/w control box and cover, interchangeable receptacles for stainless steel sheet sensor and modular plug-type solenoid connections, single slow-closing commercial solenoid for 860 kPa, 85°C.

.4 Spout: chromeplated, with cast cover plate and vandal-resistant aerator having integral flow control for 1.9 l/minute at 413 kPa maximum.

.5 Under-counter thermostatic mixing controls with screwdriver stops.

.6 Acceptable material: Delta 591TP0258, Sloan ETF-880-4, Zurn Z6915-CWB.

.3 Waste: chrome plated cast brass NPS 1 1/4 P.O. plug offset with grid strainer, tailpiece, locknut, and gasket.

.1 Acceptable material: Delta 33T290, Powers Crane, Chicago Faucet.

.4 P-trap: chromeplated NPS 1 1/4, 17 gauge brass, adjustable, with cleanout and escutcheon.

.1 Acceptable material: Delta 33T311, Emco, Powers Crane

.3 L-3: wall hung, 100 mm centers.

.1 Vitreous china, contoured rectangular basin, front overflow, soap depression.

.1 Acceptable material: American Standard Lucrene 0356.015, Zurn Z-5340; Gerber 12-384; Kohler Pinoir K-2032.

.2 Trim: infra-red electronic faucet:

.1 Activated by infra-red sensor responding to presence of person's hands in lavatory.

.2 Sensor: waterproof, incorporated in body of unit, with impact-resistant lens with anti-scratch coating, gooseneck, sensitivity adjustable from 25 mm to 350 mm.

.3 Controls: vandal-proof, c/w control box and cover, interchangeable receptacles for stainless steel sheet sensor and modular plug-type solenoid connections, single slow-closing commercial solenoid for 860 kPa, 85°C.

.4 Spout: chromeplated, with cast cover plate and vandal-resistant aerator having integral flow control for 1.9 l/minute at 413 kPa maximum.

.5 Under-counter thermostatic mixing controls with screwdriver stops.

.6 Acceptable material: Delta 591TP0258, Sloan ETF-880-4, Zurn Z6915-CWB.

.3 Waste: chrome plated cast brass NPS 1 1/4 P.O. plug offset with grid strainer, tailpiece, locknut, and gasket.

.1 Acceptable material: Delta 33T290, Powers Crane, Chicago Faucet.

.4 P-trap: chromeplated NPS 1 1/4, 17 gauge brass, adjustable, with cleanout and escutcheon.

.1 Acceptable material: Delta 33T311, Emco, Powers Crane.

.4 Lavatory trim from transformer as specified in para. 2.6 of this specification section.

2.5 JANITOR MOP SINKS

.1 MPS-1: Janitor Mop Sinks:

.1 Fixture: 300 mm high, mold 600 x 600 mm terrazzo, stainless steel drain and dome strainer, lint basket, NPS 3 IPS tailpiece, continuous stainless steel caps, two 600x300 stainless steel wall guards.

.1 Acceptable material: Fiat TSB100, Stern Williams MTB-2424, Acorn Engineering TSH 24.

.2 Trim: chromeplated brass supply fitting, 203 mm centers, vacuum breaker, integral stops, top wall brace, pail hook, NPS 3/4 hose-end, aerator, cross handles, 762 mm reinforced vinyl hose, and stainless steel bracket with rubber grip.

.1 Acceptable material: Fiat 830AA, Teck 8T2386, Powers Crane P2470 VB w/hose, Stern Williams T-15-VB.

.3 Supplies: NPS 3/4 rough supplies.

.4 Accessories:

.1 Vinyl bumper guards:

.1 Acceptable material: Fiat E-77-AA, Stern Williams, Cambridge "Teck".

.2 Mop Hanger:

.1 Acceptable material: Fiat 889CC, Stern Williams T40, Cambridge "Teck".

.3 P-Trap: NPS 3.

2.6 TRANSFORMERS

.1 Provide transformers to control solenoid valve supplied with infra-red sensor trim indicated above.

.2 Transformers shall be 110 VAC to 24 VAC Class II with minimum capacity of 100VA and the capability to power up to 10 solenoids.

.3 Provide NEMA 1 panel for recessed installation with access panel, provide barrier between line voltage and low voltage wiring.

2.7 STAINLESS STEEL SINKS

.1 SS-1: Double Compartment, Countertop:

.1 Fixture: 3-hole drill, ledge back, 18-8 stainless steel, 20 gauge, self-rimming, undercoated, countertop installation, with clamps, waste fitting, open grid strainer and NPS 1-1/2 tailpiece. Size: od 790 mm X 520 mm X 200 mm.

.1 Acceptable material: Franke LBD4408P-1/3, Novanni 2007AEIB, Elkay DSE23322.

.2 Trim: Chromeplated brass deck faucet,200 mm centers, vandalproof aerator, tamperproof lever handles, swing spout, NPS 1/2 MIP/copper inlets, heavy brass cartridges.

.1 Acceptable material: Chicago Faucet No. 1100, Cambridge "Teck" 26T2133B, Powers Crane P2720L.

.3 Supplies: Chromeplated NPS 3/8 cast brass with screwdriver stops and flex risers.

.1 Acceptable material: Brasscraft, Emco, Delta 47T2512SD.

.4 P-Trap: DWV copper NPS 1 1/2 with cleanout.

.2 SS-2: Double Compartment, Countertop:

.1 Fixture: 3-hole drill, ledge back, 18-8 stainless steel, 18 gauge, self-rimming, undercoated, countertop installation, with clamps, waste fitting, open grid strainer and NPS 1-1/2 tailpiece. Size: od 790 mm X 520 mm X 250 mm deep sinks.

.1 Acceptable material: Franke Model LBD6410/PCB-3, Novanni 2007/ADJ, Elkay NLX332210.

.2 Trim: Chromeplated brass deck faucet, 200 mm centers, vandalproof aerator, tamperproof lever handles, swing spout, NPS 1/2 MIP/copper inlets, heavy brass cartridges.

.1 Acceptable material: Chicago Faucet No. 1100, Cambridge "Teck" 26T2133B, Powers Crane P2720L.

.3 Supplies: Chromeplated NPS 3/8 cast brass with screwdriver stops and flex risers.

.1 Acceptable material: Brasscraft, Emco, Delta 47T2512SD.

.4 P-Trap: DWV copper NPS 1 1/2 with cleanout.

.3 SS-3: Single Compartment, Countertop:

.1 Fixture: 3-hole drill, ledge back, 18-8 stainless steel, 20 gauge, self-rimming, undercoated, countertop installation, with clamps, waste fitting, open grid strainer and NPS 1-1/2 tailpiece. Size: od 520 mm X 510 mm X 200 mm deep sinks.

.1 Acceptable material: Franke Model LB56808/, Novanni 1017/AEI Elkay Model JP703D83, Kindred Model QSL2020/8.

.2 Trim: Chromeplated brass deck faucet, 200 mm centers, vandalproof aerator, tamperproof lever handles, swing spout, NPS 1/2 MIP/copper inlets, heavy brass cartridges.

.1 Acceptable material: Chicago Faucet No. 1100, Cambridge "Teck" 26T2133B, Powers Crane P2720L.

.3 Supplies: Chromeplated NPS 3/8 cast brass with screwdriver stops and flex risers.

.1 Acceptable material: Brasscraft, Emco, Delta 47T2512SD.

.4 P-Trap: DWV copper NPS 1 1/2 with cleanout.

.4 SS-4: Single Compartment, Countertop:

.1 Fixture: 2-hole drill, ledge back, stainless steel, 20 gauge, self-rimming, undercoated, countertop installation, with clamps, waste fitting, open grid strainer and NPS 1-1/2 tailpiece. Size: od 390 mm X 390 mm X 150 mm.

.1 Acceptable material: Franke LBS1306-1, Novanni 1001D, Elkay.

.2 Trim: Chromeplated brass deck faucet, 100 mm centers, vandalproof aerator, tamperproof lever handles, swing spout, NPS 1/2 MIP/copper inlets, heavy brass cartridges.

.1 Acceptable material: Chicago Faucet No. 895-317P, Cambridge, Powers Crane.

.3 Supplies: Chromeplated NPS 3/8 cast brass with screwdriver stops and flex risers.

.1 Acceptable material: Brasscraft, Emco, Delta 47T2512SD

.4 P-Trap: DWV copper NPS 1 1/2 with cleanout.

.5 SS-5: Single Compartment, Wall Hung:

.1 Fixture: 2-hole drill, ledge back, Type 304 stainless steel, 20 gauge, waste fitting, open grid strainer and NPS 1-1/2 tailpiece. Unit to include wall bracket, drain and faucet c/w blade handles and gooseneck spout. Size: od 380 x 432 mm X 380 mm.

.1 Acceptable material: SSP Inc., Model SEHS-17, Krowne Metal Products, Model HS-2, Aero, Model HSF.

.2 Supplies: Chromeplated NPS 3/8 cast brass with screwdriver stops and flex risers.

.1 Acceptable material: Brasscraft, Emco, Delta 47T2512SD

.3 P-Trap: DWV copper NPS 1 1/2 with cleanout.

.6 SS-6: Double Compartment, Countertop:

.1 Fixture: 3-hole drill, ledge back, 18-8 stainless steel, 18 gauge, self-rimming, undercoated, countertop installation, with clamps, waste fitting, open grid strainer and NPS 1-1/2 tailpiece. Size: od 520 mm X 510 mm X 250 mm deep sinks.

.1 Acceptable material: Franke Model LB56810, Novanni 1017AEJ, Elkay.

.2 Trim: Chromeplated brass deck faucet, 200 mm centers, vandalproof aerator, tamperproof lever handles, swing spout, NPS 1/2 MIP/copper inlets, heavy brass cartridges.

.1 Acceptable material: Chicago Faucet No. 1100, Cambridge "Teck" 26T2133B, Powers Crane P2720L.

.3 Supplies: Chromeplated NPS 3/8 cast brass with screwdriver stops and flex risers.

.4 P-Trap: DWV copper NPS 1 1/2 with cleanout.

2.8 FIXTURE PIPING

.1 Hot and cold water supplies to fixtures:

.1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with clean out on fixtures not having integral trap.

.2 Chrome plated in exposed places.

Part 3 Execution

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as indicated, measured from finished floor.

.3 For persons with disabilities: to comply with most stringent of either NBC or CSA B651

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.3 VERIFICATION

.1 Verification requirements in accordance with Section 01 79 00 - Demonstration And Training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 22 05 00 - Common Work Results for Plumbing.

1.2 REFERENCE STANDARDS

.1 Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

.1 AHRI 1010-02, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

.2 CSA Group (CSA):

.1 CAN/CSA-B45 Series-02(R2013), CSA Standards on Plumbing Fixtures.

.2 CAN/CSA B125.1-18/ASME A112.18.1-18, Plumbing Supply Fittings.

.3 CAN/CSA B651-18, Accessible Design for the Built Environment

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate, for all fixtures:

.1 Dimensions, construction details, roughing-in dimensions.

.3 Closeout Submittals:

.1 Provide maintenance data including monitoring requirements for incorporation into
manuals specified in Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 Series

.2 Trim, fittings: manufacture in accordance with CSA B125.3

.3 Number, locations: architectural drawings to govern.

.4 Drinking fountains:

.1 DF-1 water cooler: wall hung, steel cabinet and cooler top, bubbler, wall hanger, barrier-free. Unit to be complete with water filter. Provide bottle fill station integral to water cooler.

.1 Acceptable material: Oasis Model PGF8SBF, Elkay Model EZH2O, Murdock Model A171108F-BF2.

.2 Refrigerant: R134a.

.3 Electrical: 120 VAC (plug-in receptacle).

.2 DF-2:

.1 General: Bi-level, barrier-free wall mounted electric water cooler. Stainless steel construction. "Hi-Lo" arrangement shall include dual 14 gauge, satin finish, stainless steel basins. Push button operation with front accessible cartridge and flow adjustments chrome-plated, vandal-resistant bubbler.

.2 Storage tank: stainless steel garbage tank/evaporator.

.3 Refrigeration system: high-efficiency, R134a, self-contained R134a, hermetically sealed, positive start compressor with built-in overload protection. Self-contained, self-lubricated condenser fan. Copper-aluminum condenser. Provide with recessed condenser for administration areas.

.4 Electrical: 115V, single phase, 60 Hz.

.5 Acceptable material: Halsey Taylor HWUACP8LSS, Haws Model No. HWBFA8, Acorn.

.5 Trim:

.1 Waste tailpiece:

.1 Acceptable material: Delta 33T311, Cambridge, McGuire Mfg. Co.

.2 Supplier: flexible braided stainless steel riser, 3/8" IPS brass inlet supply, screwdriver slot.

.1 Acceptable material: Delta 47T2512SD, Cambridge, McGuire Mfg. Co.

.6 Fixture piping:

.1 Cold water supplies to each fixture:

.1 Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with cleanout on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

Part 3 Execution

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as indicated, measured from finished floor.

.3 Barrier-free: to comply with most stringent of either NBCC or CAN/CSA B651.

.2 Water coolers:

.1 In accordance with AHRI 1010

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this Section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust water cooler, drinking fountain flow stream to ensure no spillage.

.3 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.3 VERIFICATION

.1 Verification requirements in accordance with Section 01 79 00 - Demonstration And Training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Submit manufacturer's instructions, product literature, and data sheets for products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data and incorporate into manual.

.1 Operation and maintenance manual approved by, and final copies submitted to Owner before final uinspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner for approval. Submission of individual data will not be accepted unless directed by Owner.

.2 Make changes as required and re-submit as directed by Owner.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Owner will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.

.2 Supply one set of special tools required to service equipment as recommended by manufacturers.

Part 2 Products - Not Used

Part 3 Execution

3.1 PAINTING, REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.2 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Management System and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling,
installing, applying, protecting and cleaning of product and submit Manufacturer's Field
Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and
periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 DEMONSTRATION

.1 Owner will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate Sections.

3.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on
Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

.4 Sustainable requirements for construction and verification.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29.06 - Health and Safety Requirements.

.3 Section 01 45 00 - Quality Control.

.4 Section 01 61 00 - Common Product Requirements.

.5 Section 01 74 00 - Cleaning.

.6 Section 01 74 19 - Waste Management and Disposal.

.7 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 90.1-19, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IES co-sponsored)

.2 Electrical Equipment Manufacturers' Association Council (EEMAC).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 333 00 - Submittal Procedures.

.2 Quality Control: in accordance with Section 01 45 00 - Quality Management System.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physicaly properties.

.3 Closeout Submittals:

.1 Provide maintenance data for motors, drives and guards for incporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial Regulations..

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management.

Part 2 Products

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local electric company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified. Motors to be suitable for variable speed operation, where required.

.2 Motors under 373 W: 12 HP speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120V, unless otherwise specified or indicated.

.3 Motors 373 W and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 575 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Owner for temporary use.

.2 Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm diameter holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

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 datasheet.

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 01 74 00 - Cleaning.

.4 Section 07 84 00 - Fire Stopping

.5 Section 23 05 00 - Common Work Results for Mechanical.

.6 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Delivery materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products - Not Used

Part 3 Execution

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspections, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

.1 Install automatic air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible. Glycol drainage piping shall not terminate at a floor drain.

.4 Install manual air vents rated for glycol service, at high points in glycol systems.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.8 Install, except where indicated, to permit separate thermal insulation of each pipe.

.9 Group piping wherever possible and as indicated.

.10 Ream pipes, remove scale and other foreign material before assembly.

.11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.12 Provide for thermal expansion as indicated.

.13 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves at branch take-offs for isolating purposes except where specified.

.7 Install ball valves for glycol service.

.8 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for fire stopping.

.2 Maintain the fire-resistance rating integrity of the fire separation.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one piece type with set screws.

.1 Chrome or nickel plated brass or type 302 stainless steel..

.3 Sizes: outside diameter to cover opening or sleeve.

.1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Owner 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of Division 23.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Owner.

.6 Pay costs for repairs or replacement, retesting, and making good. Owner to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Owner.

3.12 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 07 19 - HVAC Piping Insulation.

.3 Section 23 21 13.01 - Hydronic Systems: Copper.

.4 Section 23 21 13.02 - Hydronic Systems: Steel.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-21, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.

.1 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Alignment guides:

.1 Provide as indicated.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

.4 To provide 120% of expansion joint travel.

.5 Acceptable manufacturers: Senior Flexonics, Adsco.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

3.3 PIPE CLEANING AND START-UP

.1 In accordance with Section 01 74 00 - Cleaning.

3.4 PERFORMANCE VERIFICATION

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Procedures.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B1.20.1-2013(R2018), Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International (ASTM)

.1 ASTM A276-17, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283-20, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M-18, Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25-2018, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80-2019, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit data for valves specified in this Section.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10 valves, each size. Minimum 1.

.3 Stem packing: one for every 10 valves, each size. Minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.

.2 Products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1

.2 Copper tube systems: to ANSI/ASME B16.18

.3 Lockshield Keys:

.1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic

.5 Packing: non-asbestos.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: Handwheel.

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: handwheel.

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem

.3 Operator: handwheel.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: handwheel or lockshield handles as indicated..

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed or union bonnet.

.2 Operator: handwheel.

.7 NPS 2 1/2 and over, flanged:

.1 Rising stem: to ANSI/MSS SP-80, Class 125, 860 kPA, bronze body, screw-in bonnet, solid wedge disc.

.8 Acceptable manufacturers: Crane, Newman Hattersley, Kitz.

.5 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating disc composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505

.3 Operator: handheld or lockshield handles as indicated..

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505

.3 Operator: handwheel or lockshield handles as indicated..

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem

.3 Operator: handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: handwheel or lockshield handles as indicated..

.6 Acceptable manufacturers: Crane, Newman Hattersley, Kitz.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable no. 6 composition rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Acceptable manufacturers: Crane, Newman Hattersley, Kitz.

.7 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat

.2 Pressure rating: Class 125.

.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders

.4 Disc and seat: renewable rotating disc.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

.2 Acceptable manufacturers: Crane, Newman Hattersley, Kitz.

.8 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62

.2 Pressure rating:

.1 Class 150, 1034 kPa steam.

.2 Class 600, 4136 kPa WOG.

.3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders, solder ends to ANSI..

.4 Full bore, two piece body, blow-out proof.

.5 Stem: tamperproof ball drive.

.6 Stem packing nut: external to body.

.7 Ball and seat: replaceable stainless steel solid ball and Teflon seats.

.8 Stem seal: TFE with external packing nut.

.9 Operator: removable lever handle. Stem extensions required for insulated systems.

.2 Acceptable manufacturers: Crane, Newman Hattersley, Kitz.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 05 - Installation of Pipework

.2 Section 23 05 23.01 - Valves - Bronze

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1-05, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASTM International (ASTM).

.1 ASTM A49-01(2006), Standard Specification for Heat-Treated Carbon Steel Joint Bars.

.2 ASTM A126-04, Standard Specification for Grey Iron Castings for Valves, Flanges, and Pipe Fittings.

.3 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.

.4 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM B85/B85M-08, Standard Specification for Aluminum-Alloy Die Castings.

.7 ASTM B209-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).

.2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS SP-61-03, Pressure Testing of Steel Valves.

.2 MSS SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS SP-82-1992, Valve Pressure Testing Methods.

.5 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10valves, each size, minimum 1.

.3 Stem packing: one for every 10 valves, each size, minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.3 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

Part 2 Products

2.1 MATERIAL

.1 Valves:

.1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:

.1 Gate valves: MSS SP-70

.2 Globe valves: MSS SP-85

.3 Check valves: MSS SP-71

.3 Requirements common to valves, unless specified otherwise:

.1 Inspection and pressure testing: to MSS SP-82

.2 Bonnet gasket: non-asbestos.

.3 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.4 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.5 Gland packing: non-asbestos.

.6 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62

.7 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62

.3 Seat rings: renewable bronze to ASTM B62, screwed into body

.4 Stem: bronze to ASTM B62

.5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem

.6 Seat: integral with body.

.7 Stem: wrought steel.

.2 NPS 10 - 24, non rising stem, inside crew, trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.

.2 Pressure ratings: Class 125.

.3 Disc: solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem

.4 Seat rings: renewable bronze to ASTM B62 screwed into body

.5 Stem: bronze to ASTM B62

.6 Disc: solid offset taper wedge, cast iron secured to stem.

.7 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.

.8 Stem: wrought steel.

.3 NPS 2 1/2-8, outside screw and yoke (OS&Y), trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection

.3 Seat rings: renewable bronze screwed into body.

.4 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.5 Seat rings: integral with body.

.6 Stem: nickel-plated steel.

.7 Pressure-lubricated operating mechanism.

.4 NPS 10 - 24, outside screw and yoke (OS&Y), trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: NPS 10 - 14: cast iron to ASTM A126 Class B. With bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges, yoke, yoke hub, yoke sleeve and nut.

.2 Pressure ratings: Class 125.

.1 NPS 10-12: WP = 1.4 Mpa CWP.

.2 NPS 14-24: WP = 1.03 Mpa CWP.

.3 Disc: solid offset taper wedge, bronze disc rings to ASTM B62 rolled into cast iron disc, secured to stem through integral forged T-head disc-stem connection

.4 Seat rings: renewable bronze to ASTM B62 screwed into body

.5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.6 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.

.7 Stem: nickel-plated steel.

.8 Pressure-lubricated operating mechanism.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:

.1 Approvals: UL and FM approved for fire service

.2 UL and FM Label: on valve yoke

.3 Body, Bonnet: cast iron to ASTM A126 Class B.

.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements

.5 Packing gland: bronze.

.6 Stem: manganese bronze. Diameter to ULC C-262 (B).

.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B)

.8 Bosses for bypass valve, drain: on NPS 4 and over.

.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: EPDM coated cast iron with bronze disc rings.

.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.

.11 Pressure rating:

.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.

.2 NPS 14-1.2: 1.2 MPa CWP.

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:

.1 Body: with multiple-bolted bonnet.

.2 WP: 860 kPa steam, 1.4 MPa CWP.

.3 Bonnet-yoke gasket: non-asbestos.

.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc

.5 Seat ring: renewable, regrindable, screwed into body.

.6 Stem: bronze to ASTM B62

2.5 CHECK VALVES

.1 Swing check valves, Class 125:

.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.

.1 NPS 18 and over: cast iron to ASTM A126 Class C

.2 Ratings:

.1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.

.2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.

.3 NPS 18 and over: 1.03 MPa CWP.

.3 Disc: rotating for extended life.

.1 NPS 8 and over: bronze-faced cast iron.

.4 Seat rings: renewable bronze to ASTM B62 screwed into body

.5 Disc: A126 Class B, secured to stem, rotating for extended life.

.6 Seat: cast iron, integral with body.

.7 Hinge pin: exelloy; bushings: malleable iron.

.8 Identification tag: fastened to cover.

.2 Swing check valves, NPS 2 1/2 - 8 Class 250:

.1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin

.2 Flanged ends: 2 mm raised face with serrated finish.

.3 Rating: 250 psi steam; 500 psi CWP.

.4 Disc: rotating for extended life.

.1 Up to NPS 3: bronze to ASTM B61

.2 NPS 4 - 8: iron faced with ASTM B61 bronze

.5 Seat rings: renewable bronze to ASTM B61, screwed into body

.6 Hinge pin, bushings: renewable, bronze to ASTM B61

.7 Hinge: galvanized malleable iron.

.8 Identification tag: fastened to cover.

Part 3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Clean installed products in accordance to manufacturer's recommendation.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

.2 Section 23 05 48 - Vibration Control for HVAC Piping and Equipment

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-2020, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A125-1996(2018), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Canadian Standards Association(CSA Interational)

.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-18, Hot-Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA W59-18, Welded Steel Construction.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture.

.5 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP-58 and ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into
pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP-58.

.2 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers, to withstand events as specified in Section 23 05 48 - Vibration Control for HVAC Piping and Equipment.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Quality assurance submittals: submit the following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner will make available 1 copy of systems supplier's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.2 Packaging Waste Management: remove for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Ensure steel hangers in contact with copper piping are copper piping are copper plated..

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip..

.1 Rod: 9mm UL listed, 13 mm FM approved for sprinkler systems..

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, MSS-SP58.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, M.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP-58.

.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies

.2 Steel brackets.

.3 Sway braces for seismic restraint systems: to Section 23 05 48 - Vibration Control for HVAC Piping and Equipment.

.6 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel black.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP-58 clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for riveting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.

.10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black.

.2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42

.3 Bolts: to ASTM A307

.4 Nuts: to ASTM A563

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^{3}density insulation plus insulation protection shield to: MSS SP58, galvanized sheet carbon steel. Length designed for maximum 3 m span

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-58.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR)

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Support from structural members. Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

.1 Plumbing piping: to most stringent requirements of National Plumbing Code of Canada, Provincial Code or authority having jurisdiction..

.2 Copper piping: up to NPS 1/2: every 1.5 m.

.3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.4 Within 300 mm of each elbow.

.1

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

.5 Pipework greater than NPS 12: to MSS SP69

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Vibration isolation materials and components, seismic control measures and their installation.

.2 Related Requirements

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 01 74 00 - Cleaning.

.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS)

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30durometer natural rubber; maximum loading 415 kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

.1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.

.3 Cadmium plate for outdoor 100% relative humidity installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

.6 Performance: as indicated.

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

.6 Performance: as indicated.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

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 datasheet.

3.2 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 After delivery and storage of Products.

.2 After preparatory work is complete but before installation commences.

.3 Twice during the installation, at 25% and 60% completion stages.

.4 Upon completion of installation.

.3 Submit manufacturer's reports to Owner within 3 days of manufacturer representative's review.

.4 Make adjustments and corrections in accordance with written report.

.2 Inspection and Certification:

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.2 Provide Owner with notice 24 hours in advance of commencement of tests.

.3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

.4 Submit complete report of test results including sound curves.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 Related Requirements

.1 Division 01 - General Requirements.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 Canadian Standards Association (CSA International)

.1 CSA/CSA B149.1-20, Natural Gas and Propane Installation Code.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13-, Standard for the Installation of Sprinkler Systems, 2019 edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

.1

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Owner.

.2 Colours for legends, arrows: to following table:

.1

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

.1

Contents	Background colour marking	Legend
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing Vent	Green	SAN. VENT
Refrigeration Suction	Yellow	REF. SUCTION

Refrigeration Liquid	Yellow	REF. LIQUID

2.4 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.5 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.6 LANGUAGE

.1 Identification in English.

.2 Use one nameplate and label for each language.

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 datasheet.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise

.2 Provide ULCorCSA registration plates as required by respective agency

.3 Identify systems, equipment to conform to PWGSC PMSS

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Owner within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, 7th Edition (2016).

.2 National Environmental Balancing Bureau (NEBB) Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2015, 8th Edition.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 COORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started confirm in writing to Owner adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Owner in writing proposed procedures which vary from standard.

.3 During construction, coordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 22 and Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Owner for verification of TAB reports.

1.9 START OF TAB

.1 Notify Owner 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weatherstripping, sealing, and caulking.

.3 Pressure, leakage, other tests specified elsewhere Division 23.

.4 Provisions for TAB installed and operational.

.5 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Liquid systems:

.1 Flushed, filled, vented.

.2 Isolating and balancing valves installed, open.

.3 Calibrated balancing valves installed, at factory settings.

.4 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Hydronic systems: plus or minus 5%.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Owner list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Owner.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Owner, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.2 Submit 6 copies of TAB Report to Owner for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Owner/Commissioning Agent.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Owner/Commissioning Agent.

.4 Pay costs to repeat TAB as required to satisfaction of Owner/Commissioning Agent.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Owner, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Owner.

1.19 AIR SYSTEMS

.1 Standard: TAB to be most stringent of this section or TAB standards of AABC or NEBB.

.2 Do TAB of systems, equipment, components, controls specified in Divisions 22 and 23.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by AABC or NEBB.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 HYDRONIC SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, or ASHRAE.

.2 Do TAB of systems, equipment, components, controls specified Division 23.

.3 Qualifications: personnel performing TAB current member in good standing of AABC orNEBB qualified to standards of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified by standards of AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: flow rate, pressure drop (or loss), pipe size.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of all calibrated balancing valves, other equipment causing changes in conditions.

.2 At controllers, controlled device.

1.21 OTHER SYSTEMS

.1 Plumbing Systems:

.1 Flush valves: adjust to suit project pressure conditions.

.2 Pressure booster systems: test for capacity and pressures under all conditions and at all times.

.3 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates.

.2 Refrigeration systems forming part of HVAC systems.

.3 Wet pipe sprinkler in accordance with authority having jurisdiction and ANSI/NFPA 13-2002.

1.22 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

1.23 POST OCCUPANCY TAB

.1 Measure DBT, WBT, air velocity, air flow patterns, NC levels in occupied areas as designated by the Owner.

.2 Participate in systems checks twice during warranty period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of warranty period.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

1.2 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):

.1 SMACNA 016-2012, HVAC Air Duct Leakage Test Manual, 2nd edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to Owner for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Owner.

.2 Prepare report of results and submit to Owner within 24 hours of completion of tests. Include:

.1 Schematic of entire system.

.2 Schematic of section under test showing test site.

.3 Required and achieved static pressures.

.4 Orifice differential pressure at test sites.

.5 Permissible and actual leakage flow rate (L/s) for test sites.

.6 Witnessed certification of results.

.3 Include test reports in final TAB report.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3% of flow rate and pressure.

.3 Submit details of test instruments to be used to Owner at least three months before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with Owner no more than 28 days before start of tests.

.5 Re-calibrated every six months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and system components such as VAV boxes, duct heating leakage: 10%.

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 datasheet.

3.2 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:

.1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: leakage 2%.

.2 VAV box and duct on downstream side of VAV box: leakage 2%.

.3 Large low pressure duct systems up to 500 Pa: leakage 2%.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

.1 Have manufacturer of products, supplied under this Section, review Work involved in
the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before
installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to Owner.

.2 Performance Verification:

.1 Owner to witness tests and to verify reported results.

.2 To be certified by same TAB agency approved by Owner to undertake TAB on this project.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Waste Management and Disposal.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASTM International (ASTM):

.1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

.2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation

.3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

.4 ASTM C449/C449M-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement

.5 ASTM C547-07, Standard Specification for Mineral Fiber Pipe Insulation

.6 ASTM C553-02, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.7 ASTM C612-04, Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

.9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.3 Canadian General Standards Board (CGSB):

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005):

.5 ULC Standards (ULC):

.1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering

.3 CAN/ULC-S702.1997, Thermal Insulation for Mineral Fibre for Buildings.

.4 CAN/ULC S702.2-03, Thermal Insulation for Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces provided the mechanical service is not visible from floor level.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork.

.2 CRF: Code Rectangular Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used, and installation standards achieved.

1.6 QUALIFICATIONS

.1 Installer: specialist in performing work of this section, and have at least documented years successful experience in this size and type of project.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal to be in accordance with Section 01 74 19 - Waste Mangement and Disposal.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this Section)

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with or without factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this section)

.1 Mineral fibre: to ASTM C553

.2 Jacket: to CGSB 51-GP-52 Ma

.3 Maximum "k" factor: to ASTM C553

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921

.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:

.1 To ASTM B209with and without moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.6 Tape: self-adhesive, aluminum, plain, 75 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.11 Fasteners: 4 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 PREINSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: at 300 mm oc in horizontal and vertical directions, minimum two rows each side.

.7 Blank off sections of louvres to be insulated with 100 mm thick insulation sandwiched between 2 galvanized sheets of metal.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

.1

TIAC Code	Vapour Retarder	Thickness (mm)	
Rectangular cold and dual temperature supply air ducts	[C-1]	[yes]	[25]
Round cold and dual temperature supply air ducts	[C-2]	[yes]	[25]
Supply and return exposed in space being served	[C-1]	[yes]	none (unless indicated on drawing)
Fresh air ducts	[C-1]	[yes]	[50]
Mixing plenums or space being served	[C-1]	[yes]	[50]
Exhaust duct to 3000 mm from discharge location between dampers and louvres	[C-1]	[no]	[50]
Acoustically lined ducts	[none]		

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct

.1 Finishes: conform to following table:

.1

	TIAC CodeRectangular	TIAC CodeRound

Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.4 PLENUMS AND PLENUM BOXES

.1 Plenums and plenum boxes to be insulated as if considered in the system they service.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 07 92 00 - Joint Sealants

.3 Section 23 05 15 - HVAC Piping

.4 Section 23 05 29 - Hangers and Supports

.5 Section 23 21 13.01 - Hydronic Systems: Copper

.6 Section 23 21 13.01 - Hydronic Systems: Steel

1.3 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

.1 ASHRAE Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard)

.2 ASTM International (ASTM):

.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric

.2 ASTM C195-07(2019), Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.3 ASTM C335-17, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation

.4 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

.5 ASTM C449/C449M-07(2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement

.6 ASTM C533-2017, Calcium Silicate Block and Pipe Thermal Insulation

.7 ASTM C547-2019, Mineral Fiber Pipe Insulation

.8 ASTM C795-08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

.9 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.3 Manufacturer's Trade Associations:

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004)

.4 ULC Standards (ULC):

.1 CAN/ULC-S102-18, Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S702-.1:2014-AMD1, Thermal Insulation, Mineral Fibre, for Buildings

.3 CAN/ULC-S702.2-15, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: company specializing in performing the work of this section, with documented years of experience of projects of a similar nature and value as this tender. Proof to be verified after contract award.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Place excess or unused insulation and insulation accessory materials in designated containers.

.2 Dispose of unused adhesive material at official hazardous material collections site approved by Owner.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547.

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C547.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C547.

.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C547.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: to ASTM C547.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: to ASTM C534 with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52 Ma.

.3 Maximum "k" factor: ASTM C534.

.4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C533.

.2 Maximum "k" factor: to ASTM C533.

.3 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC): (exposed areas).

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint by [Owner].

.3 Minimum service temperatures: -20°C.

.4 Maximum service temperature: 65°C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.38 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at at expansion joints, valves, primary flow measuring elements flanges and unions at equipment..

.2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: PVC.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: Tape at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.

.1 Securements: Tape at 300 mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Insulation securements: SS wire.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: Tape at 300 mm oc.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.

.1 Insulation securements: SS bands.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.1

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run Out	to 1	1 1/4 - 2	2 1/2 - 4	5 - 6	8 & over
Hot Water Heating Supply, Return	60 - 94	A-1	25	38	38	38	38	38
Domestic Hot Water & Tempered Water (DHW, DHWR, TRW, TRWR)	-	A-1	25	25	25	38	38	38
Domestic CWS	-	A-3	25	25	25	25	25	25
Refrigerant Liquid, Section (RL)	4-13	A-6	25	25	25	25	25	25
Refrigerant Liquid, Suction (RS)	Below 4	A-6	25	25	38	38	38	38

.8 Finishes:

.1 Exposed indoors: [PVC] jacket.

.2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.3 Outdoors: water-proof aluminum jacket.

.4 Finish attachments: SS screws bands, at 150 mm on centre. Seals: wing closed.

.5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 23 05 00 - Common Work Results for HVAC

.3 Section 23 05 15 - Common Installation Requirements for HVAC Pipework

.4 Section 23 07 19 - HVAC Piping Insulation

.5 Section 23 05 23.01 - Valves - Bronze

.6 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.7 Section 23 21 16 - Hydronic Specialties

.8 Section 23 21 13.02 - Hydronic Systems: Steel

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Welding Society (AWS):

.1 ANSI/AWS A5.8/A5.8M-19, AMD1 Specification Filler Metals for Brazing and Braze Welding

.2 American Society of Mechanical Engineers (ASME):

.1 ANSI/ASME B16.4-16, Gray-Iron Threaded Fittings Classes 125 and 250

.2 ANSI/ASME B16.15-18, Cast Copper Alloy Threaded Fittings Classes 125 and 250

.3 ANSI B16.18-18, Cast Copper Alloy, Solder Joint Pressure Fittings

.4 ANSI/ASME B16.22-18, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings

.3 ASTM International (ASTM):

.1 ASTM B32-20, Standard Specification for Solder Metal

.2 ASTM B61-15, Standard Specification for Steam or Valve Bronze Castings

.3 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings

.4 ASTM B88M-20, Standard Specification for Seamless Copper Water Tube Metric

.5 ASTM E202-18, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Safety Data Sheets (SDS)

.5 Manufacturers Standardization Society (MSS):

.1 MSS SP67-2017, Butterfly Valves

.2 MSS SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends

.3 MSS SP71-2018, Grey Iron Swing Check Valves, Flanged and Threaded Ends

.4 MSS SP80-2019, Bronze Gate, Globe, Angle and Check Valves

.5 MSS SP85-2011, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on manufacturers catalogue literature the following: valves, components and accessories.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.

.1 Include special servicing requirements.

1.5 EXTRA STOCK MATERIALS

.1 Supply spare parts as follows:

.1 Valve seats: 1 minimum for every ten valves, each size. Minimum one.

.2 Discs: 1 minimum for every ten valves each size. Minimum one.

.3 Stem packing: 1 minimum for every ten valves, each size. Minimum one.

.4 Valve handles: 2 minimum of each size.

1.6 DELIVERY, STORAGE, AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect hydronic systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 TUBING

.1 Type K hard drawn copper tubing: to ASTM B88M

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22

.3 Cast iron threaded fittings: to ANSI/ASME B16.4

.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18

2.3 FLANGES

.1 Brass or bronze: threaded.

.2 Cast iron: threaded.

.3 Orifice flanges: slip-on, raised face, 2100 kPa.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32

.2 Silver solder BCUP: to ANSI/AWS A5.8

.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:

.1 NPS 2 and smaller: ends for soldering.

.2 Gate Valves: application: isolating equipment, control valves, pipelines:

.1 NPS 2 and under:

.1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.3 Globe valves: application: throttling, emergency bypass:

.1 NPS 2 and under:

.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.4 Drain valves: gate, Class [125] , non-rising stem, solid wedge disc, as specified Section [23 05 23.01 - Valves - Bronze].

.5 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

.6 Circuit Balance Valves (CBV)

.1 General:

.1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports connected to differential pressure.

.2 Accuracy:

.1 Readout to be within plus or minus 2% of actual flow at design flow rate.

.3 Pressure die-cast dezincification resistant copper alloy construction, 1.7 MPa, 121C, screwed ends, EPDM "O" ring seal, screw-in bonnet.

.1 Flow control: at least four (4) full turns of handwheel with digital handwheel and tamperproof concealed mechanical memory.

.4 Insulation:

.1 Use prefabricated shipping packaging of 5.3 R polyurethane as insulation.

.5 Drain connection:

.1 NPS 3/4 valved and capped, suitable for hose socket.

.6 Acceptable manufacturers: Armstrong CBV, Tour & Anderson STA, Victaulic.

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 datasheet.

3.2 PIPING INSTALLATION

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.

.3 Slope piping in direction of drainage and for positive venting.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.6 Assemble piping using fittings manufactured to ANSI standards

3.3 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.3 Install globe valves for balancing and in by-pass around control valves as indicated.

.4 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.5 Install ball valves for glycol service.

3.4 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Install in accordance with manufacturer's written instructions.

3.5 FLUSHING AND CLEANING FILLING OF SYSTEM

.1 Flush and clean in presence of Owner.

3.6 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment/glycol as specified.

3.7 FIELD QUALITY CONTROL

.1 Testing:

.1 Test system in accordance with Section 23 05 00 - Common Work Results for HVAC.

.2 For glycol systems, retest with propylene glycol to ASTM E202 , inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

.2 Balancing:

.1 Balance water systems to within plus or minus 5% of design output.

.2 Refer to Section 01 45 00 - Quality Management System for applicable procedures.

3.8 BALANCING

.1 Balance water systems to within plus or minus 5% of design output.

.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.9 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work area clean at end of each day.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.10 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hydronic systems installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 23 05 00 - Common Work Results for HVAC

.3 Section 23 05 15 - Common Installation Requirements for HVAC Pipework

.4 Section 23 05 23.01 - Valves - Bronze

.5 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.6 Section 23 21 16 - Hydronic Specialties

.7 Section 23 21 13.01 - Hydronic Systems: Copper

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA):

.1 ANSI/AWWA C111/A21.11-17, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

.2 American Society of Mechanical Engineers (ASME):

.1 ASME B16.1-20, Grey Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250

.2 ASME B16.3-16, Malleable Iron Threaded Fittings: Classes 150 and 300

.3 ASME B16.5-20, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard

.4 ASME B16.9-18, Factory-Made Wrought Buttwelding Fittings

.5 ASME B18.2.1-12, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loded Head and Lag Screws (Inch Series)

.3 ASTM International (ASTM):

.1 ASTM A47/A47M-99(2018)e1, Standard Specification for Ferritic Malleable Iron Castings

.2 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

.3 ASTM A536-84(2019)e1, Standard Specification for Ductile Iron Castings

.4 ASTM B61-15, Standard Specification for Steam or Valve Bronze Castings

.5 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings

.6 ASTM E202-18, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols

.4 CSA Group (CSA):

.1 CSA B242-05(R2021), Groove and Shoulder Type Mechanical Pipe Couplings

.2 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding

.3 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS):

.1 MSS-SP-67-2017, Butterfly Valves

.2 MSS-SP-70-2011, Grey Iron Gate Valves, Flanged and Threaded Ends

.3 MSS-SP-71-2018, Grey Iron Swing Check Valves Flanged and Threaded Ends

.4 MSS-SP-80-2019, Bronze Gate, Globe, Angle and Check Valves

.5 MSS-SP-85-2011, Grey Iron Globe and Angle Valves, Flanged and Threaded Ends

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Components and accessories.

.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:

.1 Special servicing requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.

.1 Include special servicing requirements.

1.5 EXTRA STOCK MATERIALS

.1 Supply spare parts as follows:

.1 Valve seats: 1 minimum for every ten valves, each size. Minimum one.

.2 Discs: 1 minimum for every ten valves, each size. Minimum one.

.3 Stem packing: 1 minimum for every ten valves, each size. Minimum one.

.4 Valve handles: 2 minimum of each size.

1.6 DELIVERY, STORAGE, AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect hydronic systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:

.1 To NPS 6: Schedule 40.

2.2 PIPE JOINTS

.1 NPS 2 and under: screwed fittings with PTFE tape.

.2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.

.3 Roll grooved: rigid coupling to CSA B242

.4 Flanges: weld neck to , ANSI/AWWA C111/ A21.11.

.5 Orifice flanges: slip-on raised face, 2100 kPa.

.6 Flange gaskets: to ANSI/AWWA C111/ A21.11.

.7 Pipe thread: taper.

.8 Bolts and nuts: to ASME B18.2 .1 and ASME B18.2 .2.

.9 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ASME B16.1, Class 125.

.2 Steel: to ASME B16.5

.3 Butt-welding fittings: steel, to ASME B16.9

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M.

2.4 VALVES

.1 Connections:

.1 NPS 2 and smaller: screwed ends.

.2 NPS 2-1/2 and larger: flanged ends.

.2 Gate valves: to MSS-SP-80 application: isolating equipment, control valves, pipelines:

.1 NPS 2 and under:

.1 Mechanical Rooms: Class 125, rising stem, split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.3 Globe valves: to MSS-SP [85] application: throttling, flow control, emergency bypass:

.1 NPS 2 and under:

.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.

.4 Drain valves: Gate, Class [125], non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.5 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

.2 Provide complete with valve extensions on insulated piping systems.

.6 Circuit Balancing Valves (CBV):

.1 General:

.1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports for connected to differential pressure meter.

.2 Accuracy:

.1 Readout to be within plus or minus 2% of actual flow at design flow rate.

.3 Pressure die-cast dezincification resistant copper alloy construction, 1.7 MPa, 121C screwed ends, EPDM "O" ring seal, screw-in bonnet.

.1 Flow control: at least four (4) full turns on handwheel with digital handwheel and tamperproof concealed mechanical memory.

.4 Insulation:

.1 Use prefabricated shipping packaging of 5.4 R polyurethane as insulation.

.5 Drain connection:

.1 NPS 3/4 valved and capped, suitable for hose socket.

.2 Incorporate into valve body or provided as separate item.

.6 Acceptable manufacturers: Armstrong CBV, Tour & Anderson STA, Victaulic.

Part 3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

3.2 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install gate valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.3 Install globe valves for balancing and in by-pass around control valves as indicated.

.4 Provide swing check valves in horizontal lines on discharge of pumps and as indicated.

.5 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.

.6 Coordinate ball valve extension length with pipe insulation thickness.

.7 Install ball valves for glycol service on pipes NPS 2 and down.

3.3 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Install in accordance with manufacturer's written instructions.

3.4 TESTING

.1 Test system in accordance with Section 23 05 00 - Common Work Results for HVAC.

3.5 BALANCING

.1 Balance water systems to within plus or minus 5% of design output.

.2 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.6 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hydronic systems installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 21 13.01 - Hydronic Systems: Copper.

.3 Section 23 21 13.02 - Hydronic Systems: Steel.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 2021 ASME Boiler and Pressure Vessel Code.

.2 ASTM International (ASTM):

.1 ASTM A47/A47M-99(2018)e1, Standard Specification for Ferritic Malleable Iron Castings

.2 ASTM A278/A278M-01(2020), Standard Specification for Grey Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C)

.3 ASTM A516/A516M-18, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service

.4 ASTM A536-19), Standard Specification for Ductile Iron Castings

.5 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings

.3 CSA Group (CSA):

.1 CSA B51-19, Boiler, Pressure Vessel, and Pressure Piping Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on product data expansion tanks, air vents, separators, valves, strainers.

.3 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic specialties for incorporation into manual.

.3 Submit copies of operation and maintenance manual.

1.5 DELIVERY, STORAGE, AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect hydronic specialties from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 AUTOMATIC AIR VENT

.1 Standard float vent: brass body and NPS 1/8 connection and rated at 310 kPa working pressure.

.2 Float: solid material suitable for 115-degree Celsius working temperature.

.3 Acceptable manufacturers: ITT Bell & Gossett, Armstrong, Taco, Flo-Fab.

2.2 PIPE LINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, screwed connections, Y pattern.

.2 NPS 2 1/2 to 12: cast steel body to ASTM A278/A278M , Class 30, flanged connections.

.3 NPS 2 to 12: T type with ductile iron body to ASTM A536 or malleable iron body to ASTM A47M, grooved ends.

.4 Blowdown connection: NPS 1 complete with ball valve with cap and chain. Valve to Section 23 05 23.01 - Valves - Bronze.

.5 Screen: stainless steel with 1.19 mm perforations.

2.3 LOW PRESSURE RELIEF VALVE

.1 Bronze/brass housing, full nozzle and disc, spring loaded relief valve.

.2 Capacity: matched to pump run-out setting. Relief settings as indicated on drawings.

.3 Acceptable Material:

.1 Conbraco.

.2 Spirax Sarco.

.3 Crosby.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines and blow off connections to terminate above nearest drain with exception of glygcol systems.

.3 Maintain adequate clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Owner directive.

.5 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve except at radiation and as indicated.

3.4 AIR VENTS

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

3.5 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 07 19 - HVAC Piping Insulation

.3 Section 23 05 00 - Common Work Results for Mechanical

.4 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.5 Section 23 81 23 - Computer Room Air Conditioning

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B16.22-18, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings

.2 ASME B16.24-16, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500

.3 ASME B16.26-18, Cast Copper Alloy Fittings for Flared Copper Tubes

.4 ASME B31.5-16, Refrigeration Piping and Heat Transfer Components

.2 ASTM International (ASTM):

.1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength

.2 ASTM B280-18, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

.3 CSA Group (CSA):

.1 CSA B52-18, B52 Package, Mechanical Refrigeration Code

.4 Environment Canada (EC):

.1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type ACR.

.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121°C.

.2 Brazed:

.1 Fittings: wrought copper to ASME B16.22

.2 Joints: silver solder, 45% Ag-15% Cu-5% or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300

.2 Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.3 All valves to have CRN, registration number.

.4 Acceptable manufacturers: Sporlan, Alco, Muller.

2.5 SIGHT GLASS

.1 Provide moisture indicating double sight glass upstream from expansion valve.

Part 3 Execution

3.1 GENERAL

.1 Install in accordance with CSA B52, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems and ASME B31.5.

.2 Connect to equipment with isolating valves and flanges.

.3 Provide space for servicing, disassembly and removal of equipment and components all as recommended by manufacturer.

.4 Protect all openings in piping against entry of foreign material.

3.2 INSTALLATION AND TESTING

.1 Installation shall be performed by certified refrigeration mechanics/technicians registered in Province of Ontario.

.2 Provide copy of technicians' Provincial Certificate Number and technicians' Provincial ODS Awareness Card Number to Owner prior to starting work.

.3 Refrigeration Contractor shall provide to the Condenser/Evaporator Manufacturer a detailed piping schematic prior to shop drawing acceptance. Schematic to indicate: length and run of refrigerant piping connecting outdoor condensing units and cooling coils, all bends and changes in elevation in piping, line sizes, and size and manufacturer of thermal expansion valve, pump down solenoid and moisture indicating double sight glass. Condenser/Evaporator Manufacturer to verify refrigerant piping line sizes, prior to final shop drawing submission. Install double risers where instructed by Condenser/ Evaporator Manufacturer.

.4 Upon reviewing Refrigerant Contractor's piping schematic Condenser/Evaporator Manufacturer to determine whether further refrigerant change is required. Change only with amount of refrigerant as recommended by Condenser/Evaporator Manufacturer and follow Condenser/Evaporator Manufacturer's changing instructions.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings..

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.

.3 Provide inverted deep trap at top of risers.

.4 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified.

.2 Small riser: size for 5.1 m^3/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively

.3 Test Procedure:

.1 The testing media shall be dry nitrogen. The Contractor shall perform the leak test before insulating, evacuating and charging, in the presence of the Owner.

.2 Charge the system to pressures listed above and allow it to remain under pressure for 24 hours. Maximum pressure drop shall be 34.5 kPa in 24 hours, at constant ambient temperature. For every 5.5°C drop in ambient temperature, from start of test, the maximum pressure drop may increase by 20.7 kPa.

.3 Isolate the compressor from the leak test by firmly closing the suction and discharge valves.

.4 Do not attempt to repair any leak while the system is pressurized. If any leaks are found, relieve the test pressure and perform repairs. Repeat test to ensure all leaks have been repaired.

.4 Owner shall witness all tests.

3.6 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13°C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14 Pa absolute and hold for 4 hours.

.2 Break vacuum with refrigerant to 14 kPa.

.3 Final to 5 Pa absolute and hold for at least 12 hours.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit test results to Owner.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements to Owner.

.9 Upon completion, a draft copy of the **Via Rail Niagara Station** is to be submitted to Owner for review. Upon acceptance, a signed copy is to be submitted to Owner for distribution.

3.7 CLEANING

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 07 84 00 - Fire Stopping

.3 Section 07 92 00 - Joint Sealants

.4 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

.5 Section 23 05 94 - Pressure Testing of Ducted Air Systems

.6 Section 23 32 48 - Sound Attenuation

.7 Section 23 33 00 - Air Duct Accessories

.8 Section 23 33 14 - Dampers - Balancing

.9 Section 23 33 15 - Dampers - Operating

.10 Section 23 33 16 - Dampers - Fire and Smoke

.11 Section 23 33 46 - Flexible Ducts

.12 Section 23 36 00 - Air Terminal Units

.13 Section 23 37 13 - Diffusers, Registers and Grilles

.14 Section 23 37 20 - Louvres, Intakes and Vents

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A480/A480M-18, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.5 National Fire Protection Association (NFPA)

.1 NFPA 90A-18, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-18, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-17, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

.1

Maximum Pressure Pa	SMACNA Seal Class
500	[C]
250	[C]
125	[C]

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

.1 Acceptable manufacturers: Duro Dyne, Foster, Bakor.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

.1 Acceptable manufacturers: Duro-Dyne, Bakor, Foster..

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual..

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius or short radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct, where possible.

.3 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct, where possible..

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.4 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.5 Offsets:

.1 Full radiused elbows as required or as indicated..

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.

.2 Firestopping material and installation must not distort duct.

.3 Coordinate with installer of fireproofing.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M,Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.

.3 Joints: to to ASHRAE and SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

.1 Acceptable material: Ductmate Canada Ltd., Mez Industries, Ward Industries (for proprietary joints).

2.8 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)	
up to 750	25 x 25 x 3	6	undefined
751 to 1050	40 x 40 x 3	6	
1051 to 1500	40 x 40 x 3	10	

1501 to 2100	50 x 50 x 3	10	
2101 to 2400	50 x 50 x 5	10	
2401 and over	50 x 50 x 6	10	

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.1 Acceptable manufacturers: Myatt, Grinnell, Erico.

.2 For steel joist: manufactured joist clamp or steel plate washer.

.1 Acceptable manufacturers: Grinnell, Myatt, Erico.

.3 For steel beams: manufactured beam clamps:

.1 Acceptable manufacturers: Grinnell, Myatt, Erico.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with ASHRAE, SMACNA and as indicated..

.2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with ASHRAE and SMACNA..

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with as follows:

.1

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Weld joints of bottom and side sheets.

.2 Seal other joints with waterproof mastic.

.3 Slope horizontal branch ductwork down towards equipment served.

.1 Slope header ducts down toward risers.

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete test before performance insulation or concealment Work.

.8 Test to be witnessed by Owner. Provide 21 days notice prior to testing.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.3 ASTM E90-09(R2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 ASTM E477-13e1, Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA 1966, HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition

.2 SMACNA 016-2012, HVAC Air Duct Leakage Test Manual, 2nd edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide separate shop drawings for each piece of attenuation equipment complete with product data.

1.4 PERFORMANCE RATING DATA

.1 Provide performance rating data, certified by professional engineer or accredited test laboratory and supported by calculations and verified by test results in accordance with referenced standards as follows:

.1 Silencer: insertion loss, pressure drop at design conditions.

.2 Acoustic plenums: transmission loss and acoustical absorption.

.3 Acoustical performance measurements in accordance with ASTM E477, ASTM E90 and ASTM C423, except where specified otherwise.

Part 2 Products

2.1 SILENCERS WIT ACOUSTIC MEDIA (MEDIUM VELOCITY)

.1 Outer casings of silencers shall be fabricated from not less than 20 ga. galvanized steel in accordance with ASHRAE Guide or SMACNA recommended construction for high pressure
ductwork. Seams shall be lock-formed and mastic pressure ductwork. Center body tail sections shall be fabricated from not less than 22 ga. galvanized perforated steel.

.2 Silencers shall not leak air or fail structurally when subjected to a differential air pressure of 8 inches of water gauge inside to outside of the casing.

.3 Filler material shall be inorganic material or glass fibre packed under at least 15% compression. Materials shall be inert, vermin and moisture proof.

.4 Combustion rating of the filler material shall be not less than the following when tested in accordance with ASTM E84, NFPA Standard 90A or UL No. 723:

.1 Flame spread rating: 15

.2 Smoke development rating: 5

.5 Acoustical testing shall conform to ASTM E477 standard method of testing duct liner material and manufactured silencers for acoustical and air flow performance. Tests shall be run both with and without air flowing through the silencer at not less than three different airflow rates. All ratings shall be based on test data from a nationally known, qualified, independent laboratory. Test methods shall eliminate effects due to end reflection, vibration, flanking transmission, and standing waves in the reverberant room. Airflow and
pressure loss measurements shall be made in accordance with applicable portions of ASME,
AMCA, and ADC airflow tests.

.6 The Dynamic Insertion Loss in dB for silencers shall not be less than that shown on the schedule on Drawing No. H-W5-7709-413.

.7 Performance as indicated.

.8 Acceptable manufacturer: Vibro Acoustics, Vibron, VAW, EH Price.

2.2 ABSORPTION AND INSULATING MEDIA

.1 Acoustic quality, glass fibre, bacteria and fungus resistant; free of corrosion causing or accelerating agents; packed to density to meet performance requirements; and meet NBC fire requirements or requirements of CFFM for duct lining.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Noise flanking: where indicated, install in wall sleeve with uniform clearance around to ensure no contact of silencer with wall sleeve. Pack with flexible, non hardening caulking on both sides of sleeves.

.3 Instrument test ports: install at inlet and outlet to permit measurement of insertion loss and pressure loss.

.4 Suspension: to manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa..

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.3 Instructions: submit manufacturer's installation instructions.

.4 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards CSA B228.1.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.66 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Doors to be full swing or removable door..

.6 Acceptable manufacturers: Mifab, SMS, Acudor.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated

.2 Acceptable manufacturers: Duro Dyne, Dynair, AeroDyne.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.5 Acceptable manufacturers: Duro Dyne, Metalaire, Titus.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

.3 Acceptable manufacturers: Duro Dyne, NovaFlex, Imperial Mfg. Group.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors:

.1 Size:

.1 600 x 600 mm for person size entry.

.2 300 x 300 mm for servicing entry.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other air handling systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations.

.3 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Where applicable, submit manufacturer's printed product literature, specifications and
datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 300 mm.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon or bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

.6 Acceptable manufacturers:

.1 Nailor.

.2 EH Price.

.3 Titus.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA

.3 Maximum blade height: 100 mm.

.4 Bearings: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Acceptable manufacturers:

.1 Nailor.

.2 EH Price.

.3 Titus.

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 datasheet.

3.2 INSTALLATION

.1 Install on all branch ducts and where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions

.3 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.4 Dampers: vibration free.

.5 Ensure damper operators are observable and accessible.

3.3 FIELD QUALITY CONTROL

.1 Tests:

.1 Tests to demonstrate that system is functioning as specified.

3.4 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Where applicable, Material Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Performance data.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed unless otherwise specified.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.4 Performance:

.1 Leakage: in closed position less than 2% of rated air flow at 250 Pa differential across damper.

.5 Operator: by Division 25.

.6 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

.7 Acceptable manufacturers:

.1 Belimo.|

.2 Tamco.

.3 Ventex.

.4 Ruskin.

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, steel construction spring-assisted with nylon bearings, install where indicated.

.2 Acceptable manufacturers:

.1 Nailor.

.2 EH Price.

.3 Titus.

.4 Ruskin.

2.3 RELIEF DAMPERS

.1 Automatic multi-leaf double V-type dampers with ball bearing centre pivoted and counter-weights set to open at 25 Pa static pressure, as indicated.

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 datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.

1.2 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-18, Standard for the Installation of Air Conditioning and Ventilating Systems.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112-10, Standard Test Method of Fire Test of Fire Damper Assemblies.

.2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.

.3 ULC-S505-2004, Standard for Fusible Links for Fire Protection Service.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Fire dampers.

.2 Smoke dampers.

.3 Fire stop flaps.

.4 Operators.

.5 Fusible links.

.6 Breakaway joint design.

.3 Indicate the following:

.1 Fire dampers.

.2 Smoke dampers.

.3 Fire stop flaps.

.4 Operators.

.5 Fusible links.

.6 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement to have blades out of airstream, listed and bear label of ULC, and meet requirements of CFFM and ANSI/NFPA 90A. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.

.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

.11 All dampers to be functionally tested after installation. Provide tag near access verifying test.

.12 Acceptable manufacturers: Ruskin, Nailor, E.H. Price, Greenheck, Alumavent.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.1 100% of damper operation shall be verified and witnessed by Owner. Fusible link removal and replacement are to be witnessed, as well as full range movement of the damper.

.2 Tags are to be placed on the fire damper access door after verification and are to be signed off by Owner. The tag should provide additional space to document subsequent periodic testing.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
Firestopping to be completed by Division 7 and in strict accordance with the fire damper manufacturer's installation instructions.

.5 Co-ordinate with installer of firestopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install heavy gauge angles and break-away joints of approved design on each side of fire separation.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-18, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-18, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.4 Underwriters' Laboratories (UL)

.1 UL 181-2013, Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S110-13, Standard Methods of Tests for Air Ducts.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.4 Acceptable manufacturers: Omni Duct Systems, Anco Products Inc., Superior Air Ducts.

2.2 NON-METALLIC - UNINSULATED

.1 Non-collapsible, coated mineral-based fabric type mechanically bonded to, and helically supported by, external steel wire.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.3 NON-METALLIC - INSULATED

.1 Non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory-applied, flexible mineral fibre thermal insulation with vapour barrier reinforced mylar/neoprene laminate jacket.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Thermal loss/gain: 1.31 W/m^2. degrees C mean.

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC-S110.

.2 Install in accordance with manufacturer's instructions.

.3 Install in accordance with SMACNA.

.4 Support in accordance with SMACNA.

.5 Maximum fully stretched length: 1.5 m

.6 Provide rigid duct elbow between all flexible ducts and diffusers.

.7 Limit flex duct use to connections between branch ductwork and diffusers or terminal units.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

1.2 REFERENCE STANDARDS

.1 Air Movement and Control Association (AMCA):

.1 AMCA 201-02(R2011), Fans and Systems.

.2 AMCA 210-16, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 AMCA 300-14, Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301-14, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.5 AMCA 302-73(R2012), Application of Sone Loudness Ratings for Non-Ducted Air Moving Devices.

.6 AMCA 303-79(R2012), Application of Sound Power Level Ratings for Fans.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate following:

.1 Airflow.

.2 Noise data.

.3 Static pressure.

.4 Electrical requirements.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 FANS - GENERAL

.1 Standard of rating:

.1 AMCA Publication 201 for fan application.

.2 AMCA Publication 302 for application of sone loudness ratings for non-ducted air moving devices.

.3 AMCA Publication 303 for application of sound power ratings for ducted air moving devices.

.4 Performance: to ANSI/AMCA Standard 210. Unit to bear ANSI/AMCA certified seal.

.2 Sound level ratings to comply with AMCA Standard 301, tested to AMCA Standard 300.

2.2 CEILING EXHAUST FANS

.1 Centrifugal direct drive, with plug-in type, electric motor suitable for ceiling installation, zinc coated rectangular metal housing.

.2 Sizes and capacity: as indicated.

.3 Side duct outlet with integral backdraft damper.

.4 Wall cap/soffit vent complete with spring loaded backdraft damper with neoprene gasket.

.5 Unit c/w variable speed potentiometer.

.6 White polymeric grille.

.7 Acceptable manufacturers: Greenheck, Cook, Broan.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations.

3.3 BALANCING

.1 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

3.4 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other divisions.

.2 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 - Vibration and Seismic Control for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 34 00.13 - Domestic Fans.

1.2 REFERENCE STANDARDS

.1 Air Movement and Control Association (AMCA):

.1 AMCA 210-16, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 American Society for Testing Materials (ASTM International):

.1 ASTM E84-19, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.4 International Organization of Standardization (ISO):

.1 ISO 3741-2010, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.5 National Fire Protection Association (NFPA):

.1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2018 edition.

.6 Underwriter's Laboratories (UL):

.1 UL 181, Factory-Made Air Ducts and Air Connectors (2013).

.2 UL 723, Tests for Surface Burning Characteristics of Building Materials (2018).

.7 Underwriters Laboratories of Canada (ULC)"

.1 CAN/ULC S102.2-2018, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air terminal units and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Test data: to ANSI/AMCA 210.

.1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.

.2 Sound power level with minimum inlet pressure of 0.25 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency.

.3 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Capacity.

.2 Pressure drop.

.3 Noise rating.

.4 Leakage.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in Management and accordance with Section 01 74 19 - Waste Management and Disposal.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of units delivered on site.

.2 Inform unit supplier of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and corrected by contractor on site.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with four duct diameters of straight inlet duct, same size as inlet.

.4 Locate controls, dampers and access panels for easy access.

3.4 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

3.5 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 COMMISSIONING

.1 To Section 01 91 13 - General Commissioning (CX) Requirements.

.2 All operating controls shall be packaged and fully wired.

3.7 BALANCING

.1 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

.3 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500Pa

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.2 Samples:

.1 Samples are required for following:

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Plaster frames where set into plaster or gypsum board.

.2 Concealed fasteners.

.3 Colour: white.

2.2 SUPPLY GRILLES AND REGISTERS

.1 General: steel, size as indicated, opposed blade dampers.

.2 Adjustable louvres, 20 mm spacing.

.3 Acceptable manufacturers: E.H. Price, Nailor, Titus.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: steel, size as indicated, opposed blade dampers.

.2 Types: as indicated.

.3 Acceptable manufacturers: E.H. Price, Nailor, Titus.

2.4 DIFFUSERS

.1 Steel, 600 mm x 600 mm square with adjustable cones, neck size as indicated.

.2 Steel: 345 and 457 mm round with adjustable cones, neck size as indicated.

.3 Steel louvred face supply registers with blades fixed at 45 degree, size as indicated.

.4 Acceptable manufacturers: E.H. Price, Nailor, Titus.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible, color to match.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 BALANCING

.1 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.

.3 Section 23 33 15 - Dampers Operating.

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

.1 Factory manufactured galvanized steel hinged at curb line.

.1 Complete with integral birdscreen of 2.7 mm diameter ss wire.

.2 Backdraft damper.

.3 Maximum throat velocity 3.3 m/s.

.4 Shape: as indicated.

.2 Birdscreens:

.1 Complete with integral birdscreen of 2.7 mm diameter ss wire. Use [12] mm mesh on exhaust [19] mm mesh on intake.

.3 Dampers: in accordance with Section 23 33 15 - Dampers Operating.

.4 Roof curbs: 305 mm high, of same manufacturer and built to suit model specified.

.5 Acceptable manufacturers: Greenheck, Cook, Penn.

2.2 GOOSENECK HOODS

.1 Thickness: to ASHRAE and SMACNA.

.2 Fabrication: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint considered class A seal.

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm diameter ss wire. Use [12] mm mesh on exhaust [19] mm mesh on intake.

.6 Horizontal motorized damper.

.7 Dampers: in accordance with Section 23 33 15 - Dampers Operating.

.8 Roof curbs: built to suit gooseneck hood.

2.3 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: drainable blade stormproof pattern, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: prime coated with anodized colour finish. Colour: to Owner's approval.

.9 Acceptable Material: Airolite, Ruskin, Ventex.

.10 Provide AMCA certified ratings for pressure drop, free area and water penetration.

.11 Free area velocity and pressure drop beginning point of water penetration per AMCA Standard 511: 375 m/min and 57 Pa.

.12 Provide extended sill, 14 GA aluminum.

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 datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 23 36 00 - Air Terminal Units

.3 Section 23 72 00 - Air-to-Air Energy Recovery Equipment.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI Approved).

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-115.10-M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.14-M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.3 CAN/CGSB-115.15-M91, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.

.3 Underwriters' Laboratories of Canada:

.1 ULC S111-07, Standard Method of Fire Tests for Air Filter Units.

.4 National Fire Protection Association (NFPA):

.1 ANSI/NFPA (Fire) 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, 2017 Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

.3 Spare filters: in addition to filters installed immediately prior to acceptance by Owner, supply 1 complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50°C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 ACCESSORIES

.1 Holding frames: permanent "T" section or channel section construction of galvanized steel or extruded aluminum, 1.6 mm thick, except where specified.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side and/or from face of filter bank.

2.3 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: side access, by air handling unit manufacturer.

.3 Performance:

.1 Average atmospheric dust spot efficiency 30% to ASHRAE 52.2.

.2 Average synthetic dust weight arrestance 90% to ASHRAE 52.2.

.4 Fire rated: to ULC-S111.

.5 Nominal thickness: 100 mm.

.6 Acceptable manufacturers:

.1 Flanders.

.2 AAF.

.3 Farr.

2.4 CARTRIDGE TYPE FILTERS, 80-85% EFFICIENCY

.1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.

.2 Holding frame: side access, by air handling unit manufacturer.

.3 Media support: welded wire grid.

.4 Performance: average atmospheric dust spot efficiency 80-85% to ASHRAE 52.2

.5 Fire rated: to ULC-S111.

.6 Acceptable manufacturers:

.1 Flanders.

.2 AAF.

.3 Farr.

2.5 FILTER GAUGES - DIAL TYPE

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure 0 to 250 Pa.

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 datasheet.

3.2 INSTALLATION GENERAL

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.3 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.4 FILTER GAUGES

.1 Install type across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Upon 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 Condensing unit package.

.2 Charge of refrigerant and oil.

.3 Controls and control connections.

.4 Refrigerant piping connections.

.5 Motor starters.

.6 Electrical power connections.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-In-Place Concrete

.2 Section 23 05 13 - Motors

.3 Section 23 05 48 - Vibration Isolation: Placement of Vibration Isolators

.4 Section 23 23 00 - Refrigerant Piping and Specialties

1.3 REFERENCE STANDARDS

.1 STD 210/240: 2017 Performance rating of unitary air-conditioning and air source heat pump equipment.

.2 STD 365(I-P): 2009 Commercial and industrial unitary air conditioning condensing units.

.3 STD 15: 2019 Safety standard for refrigeration systems and designation and classification of refrigerants (ANSI Approved).

.4 STD 23.1: 2019 Methods for performance testing positive displacement refrigerant compressors
and condensing units that operate at subcritical pressures of the refrigerant (ANSI Approved).

.5 STD 90.1(SI): 2019 Energy standard for buildings except low-rise residential buildings (ANSI approved; IES co-sponsored).

.6 STD 90.1(I-P): 2019 Energy standard for buildings except low rise residential buildings (ANSI approved, IES co-sponsored).

.7 NEMA 250-2020 Enclosures for electrical equipment (1,000 Volts maximum).

.8 CSA (Canadian Standards Association).

.9 UL (Underwriters Laboratories Inc.).

.10 UL 207-2009 Standard for Refrigerant Containing Components and Accessories, Nonelectrical (8th Edition).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate components, assembly, dimensions, weights and loadings, required clearances and location and size of field connections. Include schematics layouts showing condensing units, cooling coils, refrigerant piping and accessories required for complete system.

.3 Informational Submittals:

.1 Design Data: indicate pipe and equipment sizing.

.2 Installation Data: manufacturer's special installation requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: include start-up instructions, maintenance instructions, parts lists, controls and accessories.

.3 Warranty Documentation: 1. Compressors: Manufacturer's standard.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals .

.2 Extra Stock Materials: provide two (2) of complete change of lubricating oil.

1.7 DELIVERY, STORAGE, AND HANDLING

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

.2 Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

.3 Protect units on site from physical damage. Protect coils.

1.8 WARRANTY

.1 Section 01 78 00 - Closeout Submittals.

.2 Provide a five (5) year warranty to include coverage for refrigerant compressors.

Part 2 Products

2.1 MANUFACTURERS

.1 Manufacturers:

.1 York/Johnson Controls.

.2 Engineered Air.

.3 Trane.

.4 McQuay.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Provide a five (5) year warranty to include coverage for refrigerant compressors.

2.3 MANUFACTURED UNITS

.1 Units: self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, wind deflector.

.2 Construction and Ratings: to AHRI 210/240.

.3 Testing: to ASHRAE 23.1.

.4 Performance Ratings: Energy Efficiency Rating(EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE/IES 90.1 (SI).

2.4 CASING

.1 House components in welded steel frame with steel panels with weather resistant, baked enamel finish.

.2 Mount starters, disconnects and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

.3 Provide removable access doors or panels with quick fasteners and piano hinges.

2.5 CONDENSING UNITS

.1 Base Rail:

.1 Unit shall have base rails on a minimum of 4 sides.

.2 Base rail mounted lifting lugs shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.

.3 Base rail shall be a minimum of 15 gauge thickness.

.2 Top panel:

.1 Shall be a multi piece top panel.

.3 Electrical Connections:

.1 All unit power wiring shall enter unit cabinet at a single, factory prepared, and knockout location.

.2 Through-the-base capability.

.1 Standard unit shall have a through-the-base electrical location(s) using a raised, embossed portion of the unit base-pan.

.2 Optional, factory approved, watertight connection method must be used for through-the-base electrical connections.

.3 No base-pan penetration, other than those authorized by the manufacturer, is permitted.

.4 Units shall meet the wind load requirements under Florida Building Code 2017 as per ASCE 7-16.

.5 Units are certified with wind resistance ratings of 186 MPH as certified by independent structural engineers.

2.6 FANS AND MOTORS

.1 Vertical discharge driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.

.2 Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or three phase, with permanent lubricated ball bearings and built in overhead protection. Refer to Section 23 05 13.

.3 Horizontal discharge, double width, double inlet centrifugal type condenser fans, equipped with roller or ball bearings with grease fittings extruded to outside of casing,V-belt drive with belt guard.

.4 Motors as indicated, in compliance with Section 23 05 13.

2.7 COMPRESSORS

.1 Compressor: Hermetically Sealed Swing Type.

.2 Mounting: statically and dynamically balance rotating parts and mount on rubber in shear vibration isolators. Refer to Section 23 05 48.

.3 Lubrication System: centrifugal oil pump with oil charging valve, oil level sight glass and magnetic plug or strainer.

.4 Motor, constant speed, suction gas cooled with electronic sensor and winding over temperature protection, designed for across the line starting. Provide with starter

.5 Capacity Reduction Equipment: suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start, controlled from room thermostat. Hot gas bypass.

.6 Sump Oil Heater: evaporates refrigerant returning to sump during shut down. Energize heater thermostatically.

2.8 SPECIAL FEATURE OPTIONS AND ACCESSORIES

.1 Phase Monitor:

.1 Shall provide protection against phase reversal, phase loss, and phase unbalance.

.2 Switch shall automatically shut off unit control circuit if any of the above conditions is detected.

.3 Shall have visual LED indication of operational status.

.2 Coil Guard:

.1 Shall contain all materials necessary to field install a coil guard.

.2 Shall provide protection for the fins and tubes on the entire exposed surfaces of the outdoor coil.

.3 Unit-Mounted, Non-Fused Disconnect Switch:

.1 Switch shall be factory installed, internally mounted.

.2 National Electric Code (NEC) and UL approved nonfused switch shall provide unit power shutoff.

.3 Shall be accessible from outside the unit.

.4 Shall provide local shutdown and lockout capability.

.4 Low Ambient Kit:

.1 Shall contain an integrated low ambient controller to regulate condenser head pressure at low ambient temperatures by varying the amount of airflow through the condenser.

.2 Shall allow units to operate in cooling mode down to -18° C outdoor ambient.

.3 Shall be required when mechanical cooling is required at temperatures below -4° C.

2.9 PERFOMANCE

.1 Follow on schedule of drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Complete structural, mechanical and electrical connections to manufacturer's installation instructions.

.3 Install units on vibration isolation. Refer to Section 23 05 48.

.4 Install units on concrete base as indicated. Refer to Section 03 30 00.

.5 Provide connection to refrigeration piping system and evaporators. Refer to Section 23 23 00. Comply with ASHRAE 15.

.6 Provide charge of refrigerant and oil.

3.2 DEMONSTRATION AND TRAINING

.1 Section 01 78 00 - Demonstrating installed work.

.2 Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.

.3 Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.4 Shut down system if initial start up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.5 Provide cooling season startup and winter season shutdown for first year of operation.

.6 Inspect and test for refrigerant leaks every 8 weeks during first year of operation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 26 05 00 - Common Work Results for Electrical

1.2 SUMMARY

.1 Section Includes:

.1 Materials, components and installation for heat reclaim devices.

.2 Sustainable requirements for verification.

1.3 REFERENCE STANDARDS

.1 Air Movement and Control Association (AMCA):

.1 ANSI/AMCA 210-16, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 84-2013, Method of Testing Air-to-Air Heat/Energy Exchangers.

.3 Canadian Standards Association (CSA International):

.1 CAN/CSA C439-18, Standard Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA):

.1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.

.6 Underwriters Laboratories (UL):

.1 UL 1812, Ducted Heat Recovery Ventilators (2010).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate following:

.1 Capacities.

.2 Sound power levels.

.3 Installation instructions.

.4 Start-up instructions.

.5 O&M instructions.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.5 Certificates:

.1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

1.5 QUALITY ASSURANCE

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordinate with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

1.8 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Filters to be changed at substantial completion date (SCD) and one spare set of filters to be turned over to Owner for stock.

Part 2 Products

2.1 GENERAL

.1 Comply with ASHRAE 84.

2.2 AIR-TO-AIR FIXED PLATE EXCHANGER (HRV-1)

.1 Indoor packaged heat recovery ventilation unit suitable for indoor installation. Unit shall consist of crossflow polypropylene exchanger core, ventilation air fan, exhaust air fan, motorized dampers, temperature sensors and microprocessor controls.

.2 Unit shall be constructed in accordance with CSA C22.2 and UL 1812 and shall carry CSA and UL labels of approval.

.3 Insulation shall comply with ANSI/NFPA 90A requirements for flame spread and smoke generation.

.4 Airflow data shall comply with ANSI/AMCA 210 method of testing.

.5 Acceptable manufacturers: Venmar Ventilation Inc. HRV, Annexair, Vanee, NuAire.

.6 Shall conform to CAN/CSA C439.

2.3 UNIT CABINET

.1 Cabinet shall be constructed of prepainted 20 gauge G60 mill galvanized steel.

.2 Cabinet shall have 12 gauge mill galvanized frame.

.3 Cabinet shall be insulated throughout with foil faced fire retardant material.

.4 Full access door on the left side of the cabinet shall hinge up and be fully removable.

2.4 OPERATING CHARACTERISTICS

.1 Unit shall be capable of providing a constant volume of air with external static pressures as indicated below.

.1 Airflow: as indicated on the schedule in the drawings.

.2 External Static Pressure: as indicated on the schedule in the drawings.

.3 Electrical: as indicated on the schedule in the drawings.

2.5 FANS

.1 Direct drive, double inlet fan wheels with forward curve blades shall be designed for continuous operation at all operating speeds. Fan wheels shall be satin coat galvanized steel.

.2 Fan shall be provided with internal vibration isolation mounts.

2.6 MOTORS

.1 Motors shall be single speed, continuous duty, permanently lubricated, and matched to the fan loads.

.2 Motor must include a 15% service factor.

.3 Motors shall be 4 pole type operating at 1725 RPM at full airflow.

.4 All motor starter overload devices shall be supplied with phase loss protection.

2.7 HEAT COIL

.1 Plate fin type: tubes mechanically bonded to fins.

.2 Factory tested with air under water.

.3 Capacities: as indicated on drawings.

.4 Ratings: certified by manufacturer. Submit with shop drawings actual cooling and heating fluid entering and leaving conditions for stated air side requirements.

.5 Tubes: copper.

.6 Fins: aluminum.

.7 Pressure tests: 1.7 MPa.

2.8 ELECTRICAL REQUIREMENTS

.1 Unit shall have a single point power connection only, complete with main disconnect.

.2 Supply power: as indicated on the drawings.

.3 Magnetic combination starters to be breaker type with Hand-Off-Auto switch and pilot light.

2.9 FILTERS

.1 Provide 30% DSE filters.

2.10 CONTROLS

.1 Unit shall be provided with a factory- mounted and factory-wired microprocessor control operating on 115 V/1 ph./60 Hz.

.2 All service connectors shall be quick disconnect type.

.3 Unit circuitry shall allow the following operational characteristics:

.1 Remote fan interlock on call for ventilation.

.4 Unit controls shall have the following capabilities:

.1 Unit shall be energized by the Energy Monitoring and Control Systems (EMCS).

.2 Unit defrost mode shall be exhaust only.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

3.3 FIELD QUALITY CONTROL

.1 Tests:

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Verification requirements in accordance with Section 01 79 00 - Demonstration and Training.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 COMMISSIONING

.1 To Section 01 91 13 - General Commissioning (CX) Requirements.

.2 All operating controls shall be packaged and fully wired.

3.6 BALANCING

.1 Balance heating coil flows to within plus or minus 5% of design output.

.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

.3 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 -Submittal Procedures

.2 Section 01 74 19 - Waste Management and Disposal

.3 Section 01 78 00 - Closeout Submittals

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.1-92, Gravimetric and Dust Spot Procedures for Testing Air-Cleaning Devices
Used in General Ventilation for Removing Particulate Matter.

.2 ASTM International (ASTM):

.1 ASTM C547-19, Specification for Mineral Fiber Pipe Insulation

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10-M90, Disposable Air Filters For Removal of Particulate Matter from
Ventilating Systems.

.2 CAN/CGSB-115.15-M91, High Efficiency, Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.

.4 CSA Group (CSA)

.1 CSA B52-18, Mechanical Refrigeration Code

.2 CSA C656-14, Performance Standard for Split-System and Single-Package Central Air Conditioners and Heat Pumps

.5 Environment Canada, (EC)/Environmental Protection Services (EPS)

.1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada-1994, Ozone-Depleting Substances Alternatives and Suppliers List.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Indicate major components and accessories including sound power levels of units.

.3 Type of refrigerant used.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management And Disposal.

1.6 WARRANTY

.1 For refrigeration compressors, the 12 months warranty period prescribed in subsection GC 3.13 of DCL 250 - Standard Construction Contract Documents - General Conditions is
extended to 5 years.

Part 2 Products

2.1 GENERAL

.1 Integrated package: to CAN/CSA-C656.

.2 System type:

.1 Air flow arrangement: horizontal.

.2 Cooling: direct expansion.

.3 Condensing: air cooled.

2.2 DESCRIPTION

.1 Cooling and dehumidifying capacity, with fan heat extracted: based on computer room environment of 22 degrees C dry bulb and 50% R.H. (plus or minus 1 degree C and 5% R.H.), with minimum supply air temperature of 14 degrees C and minimum control dead-band of 3% R.H. separating humidification and dehumidification capable to operate at low ambient temperature of - 40 deg.C .

.2 Unit capacity: as per schedule on drawings.

.3 The air conditioning system shall be a packaged air cooled split system with variable compressor speed inverter technology. The outdoor unit shall be pre-charge with R-410A refrigerant. The system shall consist of a wall mounted evaporator section with wired controller and a horizontal discharge, single phase power, matching outdoor condensing unit.

2.3 OUTDOOR UNIT

.1 The outdoor unit shall be compatible with the indoor unit.

.2 The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all functions necessary for operation and it shall be completely factory assembled.

.3 This unit shall be capable of operating at -40 degrees C ambient temperature without additional low ambient controls.

.4 The outdoor unit shall have the ability to operate with the tubing length between the indoor and the outdoor units with sufficient oil return and without additional requirement for field supplied line segments, or refrigerant pipe traps.

.5 The unit shall be test run at the factory prior to being supplied.

.6 The casing shall be constructed from galvanized steel plate and finished with rust protector such as acrylic paint Munsell 3Y7.8/1.1 or equal.

.7 The fan grille shall be of ABS plastic or similarly suitable material.

.8 The unit shall be furnished with an AC fan as per the manufacturer's recommendations to match the capacity of the indoor unit.

.9 The fan blades shall be of aerodynamic design for quiet operation.

.10 The fan motor bearings shall be permanently lubricated.

.11 The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front.

.12 The L-shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build-up.

.13 The coil shall be protected with an integral metal guard.

.14 Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be controlled by a microprocessor-controlled step motor.

2.4 COMPRESSOR

.1 The compressor shall be a Hermetric rotary compressor with a Variable Compressor Speed Inverter Technology.

.2 The compressor shall be driven by inverter circuit to control compressor speed.

.3 The compressor speed shall match the room load.

.4 The outdoor unit shall have high pressure safety switch and overcurrent protective device.

2.5 ELECTRICAL

.1 Both the outdoor and indoor units shall be 208V, 1 phase, 60 Hz.

.2 The outdoor unit shall be controlled by the microprocessor located in the indoor unit.

.3 The control signal between the indoor and the outdoor units shall be pulse signal 24 volts DC.

.4 The unit shall have pulse amplitude modulation circuit which shall enable the unit to use 98% of input power supply.

2.6 INDOOR UNIT

.1 The indoor unit shall be factory assembled, wired and tested.

.2 All factory wiring and internal piping, control circuit board and fan motor shall be contained within the unit. The indoor unit shall pull room air at the top and dispel conditioned air at the bottom.

.3 The unit in conjunction with the remote wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch.

.4 Refrigerant piping for the indoor unit shall be charged with helium gas before shipment from the factory.

.5 Return air shall be filtered by means of an easily removable and washable filter.

.6 The casing shall be ABS plastic and have a munsell 3.4Y7.7/0.8 finish or equal.

.7 Multi-directional drain and refrigerant piping offering four direction for refrigerant piping and two directions for draining shall be standard.

.8 The unit casing shall have a side plate with holes for suspending bolts which shall secure the unit suspending firmly from the hidden ceiling.

.9 The evaporator fan shall produce a horizontal air jet as directed by the discharge louvres.

.10 The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

.11 Manual adjustable louvers shall be provided to laterally change the direction of airflow.

.12 A motorized valve shall close the outlet port when operation is stopped, and shall also automatically direct air flow in a vertical direction for uniform air distribution.

.13 The fan shall consist of Low, Mid and High speeds.

.14 The evaporator coil shall be of nonferrous construction with aluminum strake pre-coated fins on copper tubing. All tube joints shall be brazed with phoscopper or silver alloy.

.15 The coils shall be pressure tested at the factory.

.16 A condensate pan and drain shall be provided under the coil.

.17 Condensate pump, thermally protected, 15 W, 60 Hz, fully potted, self priming with suction lift to 1.2 m, with gravity inlet, assembled inline reservoir complete with lid and sensor cable, float, and stainless steel filter, inlet hose and vinyl breather and discharger tubes.

2.7 CONTROLS

.1 The system shall have a wired controller to perform input functions necessary to operate the system.

.2 The wire controller shall have multi-language large DOT liquid crystal display and a weekly timer with multiple pattern settings per day.

.3 The controller shall consist of the following:

.1 On-Off switch.

.2 Cool/Dry fan selector.

.3 Thermostat setting.

.4 Timer mode.

.5 High/Low fan speed.

.6 Auto vane selector.

.7 Check mode switch.

.8 Test Run.

.4 The controller shall have a built-in temperature sensor. It shall also consist of two microprocessors interconnected by a single non-polar two-wire cable.

.5 Controls field wiring shall run direct from the indoor unit to the controller with no splices, and manufacturer shall provide 2 conductor non-polar 22 AWG stranded wire for connection to remote controller.

.6 The system shall have self-diagnostics with codes for indoor and outdoor unit displayed on wired remote panel.

.7 Controller shall display operating conditions such as pipe temperatures, compressor operating conditions, LEV opening pulses, sub-cooling and discharge super heat.

.8 The microprocessor within the wall mounted remote controller shall provide automatic cooling, display setpoint and the room temperature.

.9 Control system shall control the continued operation of the air sweep louvers as well as provide On/Off switching.

.10 The microprocessor located in the indoor unit shall have the capability to monitor return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit, and shall have BACnet interface for connection to the BAS in accordance with Div.25.

.11 The control voltage from the controller to the indoor unit shall be 12 volts, DC.

.12 The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC.

.13 The system shall be capable of automatic restart when power is restored after power interruption.

2.8 ACCEPTABLE MANUFACTURERS

.1 Mitsubishi, Lennox, Samsung , York/Johnson Controls , Fujitsu.

2.9 REFRIGERANT PIPING, VALVES, FITTINGS AND ACCESSORIES WITHIN UNIT

.1 To CSA B52.

.2 Include for each refrigerant circuit:

.1 Thermal expansion valve, external equalizing type.

.2 Combination filter-dryer.

.3 Solenoid valves.

.4 Liquid sight glass with moisture indicator.

.5 Refrigerant line insulation: flexible elastomeric unicellar to ASTM C 547, 12 mm minimum thickness and as per local Code requirements.

.6 Refrigerant Charge:

.1 Holding charge of refrigerant applied at factory.

2.10 SEQUENCES OF OPERATIONS

.1 Refer to the Flow Diagrams and Controls drawings for schematics and sequences of operations.

2.11 ENVIRONMENTAL CONTROLS

.1 Solid state electronic control system.

.2 Wall mounted control to include following:

.1 Manual operation and adjustment:

.1 On-Off air conditioning system control.

.2 Room temperature set point, indicator and sensitivity adjustment controller.

.3 Room humidity set point, indicator and sensitivity adjustment controller.

.4 Alarm silencing switch for each alarm point.

.5 Compressor lead-lag selection switch.

.6 Alarm circuits test switch.

.2 Operational: Visual and Audible Alarm:

.1 Loss of air flow.

.2 Loss of liquid flow.

.3 High room temperature.

.4 Low room temperature.

.5 High humidity.

.6 Low humidity.

.7 High head pressure.

.3 Operational: Visual Display:

.1 Cooling each stage.

.2 Reheat stage 1 and 2.

.3 Humidification.

.4 Dehumidification.

.5 Change filter.

2.12 REFRIGERANT CHARGE

.1 Charge refrigerant system at factory, seal and test.

Part 3 Execution

3.1 GENERAL

.1 Install as indicated, to manufacturer's recommendations, and to EPS 1/RA/2

.2 Manufacturer to certify installation.

.3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.

3.2 EQUIPMENT PREPARATION

.1 Provide services of manufacturer's site engineer to set and adjust equipment for operation as specified.

END OF SECTION

Part 1 General

1.1 SYSTEM DESCRIPTION

.1 The variable capacity, heat pump heat recovery air conditioning system shall consist of air-to-air outdoor unit and DX indoor unit, for use with R410A a Variable Refrigerant Flow zoning system.

1.2 QUALITY ASSURANCE

.1 The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

.2 All wiring shall be in accordance with the National Electrical Code (N.E.C.).

.3 The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

.4 All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.

.5 A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Unit shall be stored and handled according to the manufacturer’s recommendation.

1.4 CONTROLS

.1 The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

.2 System controls and control components shall be installed in accordance with the manufacturer’s written installation instructions.

.3 Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

.4 System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

.5 Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

.6 System shall be capable of email generation for remote alarm annunciation.

.7 Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in this type controls system configuration and operation. The representative shall provide proof of certification for c Controls Applications Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

1.5 WARRANTY

.1 The units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.

.1 If the systems are:

.1 designed by a certified Designer using respective design system,

.2 installed by a contractor that has successfully completed the Manufacturer's three day service course, AND

.3 verified with required materials submitted to and approved by the Manufacturer's Service Department, which include necessary required documents and equipment settings

.2 Then the units shall be covered by an extended manufacturer's limited warranty for a period of ten (10) years to the original owner from date of installation.

.3 In addition the compressor shall have a manufacturer's limited warranty for a period of ten (10) years to the original owner from date of installation.

.4 If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

.5 This warranty shall not include labor.

.2 Manufacturer shall have a minimum of thirty (30) years of HVAC experience in the Canadian market.

.3 All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

.4 The system shall be installed by a contractor with extensive install and service training on this type of equipment. The mandatory contractor service and install training should be performed by the manufacturer.

Part 2 Products

2.1 FIRST FLOOR (MAIN) HVAC SYSTEM AND OUTDOOR UNIT

.1 General:

.1 The First Floor (Main) HVAC System shall consist of the outdoor unit, indoor units, and net DDC (Direct Digital Controls) controls system as indicated on the schedules drawing . The hyper-heating outdoor unit shall be used specifically with the associated VRF components. The outdoor units shall be equipped with multiple circuit boards that interface to the NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped, wired and run tested at the factory.

.1 The model nomenclature and unit requirements are shown in the schedules drawing. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s).

.2 The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

.3 Outdoor unit shall have a sound rating no higher than 58 dB(A) individually or 61 dB(A) twinned. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

.4 Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated.

.5 There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.

.6 Outdoor unit shall be able to connect to up to 48 indoor units depending upon model.

.7 The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

.8 The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

.9 The outdoor unit, in accordance with the Manufacturer's recommendations, shall have the ability to operate with a maximum height difference of 50 meters (164 feet) and have total refrigerant tubing length of 550 - 800 meters (1804-2625 feet). The greatest length is not to exceed 165 meters (541 feet) between outdoor unit and the indoor units without the need for line size changes or traps.

.10 The outdoor unit shall have rated performance of heating operation at –110C (13°F) ambient temperatures and cooling mode down to 23°F ambient temperatures, without additional low ambient controls. The unit shall maintain 100% heat output at –180C (0oF) without a supplemental heat source or a second compressor to boost low ambient heating performance. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

.11 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

.12 Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed.

.2 Heat Interchanger circuit.

.1 The outdoor unit shall contain a heat interchanger circuit for sub-cooling liquid prior to entering the outdoor coil during the heating mode.

.2 The interchanger shall be of a copper tube within a tube construction.

.3 The interchanger circuit refrigerant flow shall be controlled by an electronic expansion valve.

.3 Unit Cabinet:

.1 The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

.4 Fan:

.1 Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 Pa (0 in.) WG external static pressure, but capable of normal operation under a maximum of 61Pa (0.24 in.)WG external static pressure via dipswitch.

.2 All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

.3 All fan motors shall be mounted for quiet operation.

.4 All fans shall be provided with a raised guard to prevent contact with moving parts.

.5 The outdoor unit shall have vertical discharge airflow.

.5 Refrigerant:

.1 R410A refrigerant shall be required for the outdoor unit systems.

.2 Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

.6 Coil:

.1 The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

.2 The coil fins shall have a factory applied corrosion resistant blue-fin finish.

.3 The coil shall be protected with an integral metal guard.

.4 Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

.5 The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

.7 Basepan Heater:

.1 Each outdoor unit module shall be equipped with a basepan heater. Basepan heater shall activate only when compressor is operating in heating mode at an outdoor ambient temperature of 40C (39F) or below. If an alternate manufacturer is selected, any additional material, cost, and labor to meet basepan heater condition and performance shall be incurred by the contractor.

.8 Compressor:

.1 Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.

.2 A crankcase heater(s) shall be factory mounted on the compressor(s).

.3 The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.

.4 The compressor will be equipped with an internal thermal overload.

.5 The compressor shall be mounted to avoid the transmission of vibration.

.6 Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

.9 Controls:

.1 The outdoor unit shall have the capability of up to 8 levels of demand control for each refrigerant system.

.10 Electrical:

.1 The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.

.2 The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).

.3 The outdoor unit shall be controlled by integral microprocessors.

.4 The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.2 BRANCH CIRCUIT (BC) CONTROLLERS FOR HVAC SYSTEMS

.1 General:

.1 The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices with no subcooling risk bubbles in liquid supplied to LEV and are not allowed.

.2 The BC (Branch Circuit) Controllers shall be specifically used with this system. These units shall be equipped with a circuit board that interfaces to the NET controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity. The BC Controller shall be suitable for use in plenums in accordance with UL1995 ed 4.

.2 BC Unit Cabinet:

.1 The casing shall be fabricated of galvanized steel.

.2 Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.

.3 The unit shall house two tube-in-tube heat exchangers.

.3 Refrigerant:

.1 R410A refrigerant shall be required.

.4 Refrigerant Branches:

.1 All BC Controller refrigerant pipe connections shall be brazed or flared.

.5 Refrigerant Valves:

.1 The unit shall be furnished with multiple branch circuits which can individually accommodate up to 16 kW (54,000 BTUH) and up to three indoor units. Branches may be twinned to allow more than 16 kW (54,000 BTUH).

.2 Each branch shall have multiple two-position valves to control refrigerant flow.

.3 Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

.4 Linear electronic expansion valves shall be used to control the variable refrigerant flow.

.6 Integral Drain Pan:

.1 An Integral resin drain pan and drain shall be provided

.7 Electrical:

.1 The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz.

.2 The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

.3 The BC Controller shall be controlled by integral microprocessors.

.4 The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.3 FIRST FLOOR INDOOR UNITS - 4 WAY CEILING RECESSED CASSETTE WITH GRILLE INDOOR UNIT

.1 General:

.1 The ceiling indoor unit shall be a four-way cassette style that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

.2 Unit Cabinet:

.1 The cabinet shall be a compact 570 mm x 570 mm (22-7/16” wide x 22-7/16” deep) so it will fit within a standard 240 mm (24”) square suspended ceiling grid.

.2 The cabinet panel shall have provisions for a field installed filtered outside air intake.

.3 Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

.3 Fan:

.1 The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.

.2 The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

.3 The indoor fan shall consist of three (3) speeds, Low, Mid, and High.

.4 The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.

.5 The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

.4 Filter:

.1 Return air shall be filtered by means of a long-life washable filter.

.5 Coil:

.1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

.2 The tubing shall have inner grooves for high efficiency heat exchange.

.3 All tube joints shall be brazed with phos-copper or silver alloy.

.4 The coils shall be pressure tested at the factory.

.5 A condensate pan and drain shall be provided under the coil.

.6 The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 500 mm (19-3/4” inches) above the condensate pan.

.7 Both refrigerant lines to the indoor units shall be insulated in accordance with the installation manual and manufacturer’s recommendations.

.6 Electrical:

.1 The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

.2 The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

.7 Controls:

.1 This unit shall use controls provided by the Manufacturer to perform functions necessary to operate the system.

.2 Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

.3 Control board shall include contacts for control of external heat source. External heat may be energized as second stage with -170C to -130C (1.8°F – 9.0°F) adjustable deadband from set point.

.4 Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

.5 Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.4 FIRST FLOOR INDOOR UNITS - LOW PROFILE CEILING-CONCEALED DUCTED INDOOR UNIT

.1 General:

.1 The Low Profile unit shall be a ceiling-concealed ducted indoor fan coil that mounts above the ceiling with a rear return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The concealed unit shall be compatible to be used with the outdoor unit and BC Controller. The concealed indoor unit shall support individual control using NET DDC controllers. Low Profile models shall have an extremely compact profile 200 mm (7-7/8”) which requires minimal ceiling space. Low Profile models shall feature external static pressure settings up to 50 Pa (0.20 in.) WG. Units shall have the ability to control supplemental heat via connector CN24 and a 12 VDC output. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

.2 Indoor Unit:

.1 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

.3 Unit Cabinet:

.1 The cabinet shall be space saving, low profile, ceiling-concealed ducted.

.2 The cabinet panel shall have provisions for a field installed filtered outside air intake.

.4 Fan:

.1 The indoor unit fan shall be an assembly with one Sirocco fan direct driven by a single motor.

.2 The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

.3 The indoor fan shall consist of three (3) speeds, High, Mid, and Low.

.4 The indoor unit shall have a ducted air outlet system and ducted return air system.

.5 Filter:

.1 Return air shall be filtered by means of a standard factory installed return air filter.

.6 Coil:

.1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

.2 The tubing shall have inner grooves for high efficiency heat exchange.

.3 All tube joints shall be brazed with phos-copper or silver alloy.

.4 The coils shall be pressure tested at the factory.

.5 A condensate pan and drain shall be provided under the coil.

.6 The unit shall be provided with an integral condensate lift mechanism able to raise drain water 533 mm (21 inches) above the condensate pan.

.7 Both refrigerant lines to the Low Profile models indoor units shall be insulated in accordance with the installation manual.

.7 Electrical:

.1 The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.

.2 The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

.8 Controls:

.1 This unit shall use controls provided by the Manufacturer to perform functions necessary to operate the system. Please refer to details on controllers and other control options in this specification.

.2 Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

.3 Control board shall include contacts for control of external heat source. External heat may be energized as second stage with -170C to -130C (1.8°F – 9.0°F) adjustable deadband from set point.

.4 Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

.5 Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.5 SECOND FLOOR HVAC SYSTEM AND OUTDOOR UNIT

.1 General:

.1 The Second Floor HVC System shall consist of outdoor unit , indoor unit and net DDC (Direct Digital Controls) controls system as indicated on the schedules drawing. The Second Floor outdoor unit shall be specifically used with the associated VRF components. The outdoor units shall be equipped with multiple circuit boards that interface to the NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped, wired and run tested at the factory.

.1 The model nomenclature and unit requirements are shown in the schedules drawing. All units requiring a factory supplied twinning kit shall be piped together in the field, without the need for equalizing line(s).

.2 Outdoor unit shall have a sound rating no higher than 62 dB(A) individually or 65 dB(A) twinned. Units shall have a sound rating no higher than 51 dB(A) individually or 55 dB(A) twinned while in night mode operation.

.3 Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.

.4 The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.

.5 Both refrigerant lines from the outdoor unit to indoor units shall be insulated.

.6 The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

.7 The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection.

.8 The outdoor unit in accordance with the Manufacturer’s recommendations, shall have the ability to operate with a maximum height difference of 50 / 90 meters (164 feet /294 feet optional) and have a total refrigerant tubing length of 1000 meters (3280 feet). The greatest length is not to exceed 165 meters (541 feet) between the outdoor unit and the indoor units without the need for line size changes or traps.

.9 The outdoor unit shall be capable of operating in heating mode down to – 200 C (-4°F) ambient temperature or cooling mode down to – 50 C (23°F) ambient temperature, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

.10 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

.11 Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend “no or reduced heating” periods shall not be allowed.

.2 For Unit Cabinet, Fan , Refrigerant, Compressor, Electrical refer to respective sections under 2.1. FIRST FLOOR (MAIN) HVAC SYSTEM AND OUTDOOR UNIT.

.3 Coil:

.1 The outdoor heat exchanger shall be of zinc coated aluminum construction with turbulating flat tube construction.

.2 The coil fins shall have a factory applied corrosion resistant blue-fin finish.

.3 A stainless steel pipe connects the aluminum coil to copper piping.

.4 The coil shall be protected with an integral metal guard.

.5 Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

.6 The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

2.6 SECOND FLOOR INDOOR UNIT - CEILING CONCEALED DUCTED INDOOR UNIT

.1 General:

.1 The Second Floor Indoor Unit shall be a ceiling concealed ducted indoor fan coil that mounts above the ceiling with a fixed rear return and a horizontal discharge supply, and shall have a modulating linear expansion device. The Second Floor concealed ducted indoor unit shall be used with the associated outdoor unit and BC Controller. The Second Floor concealed ducted indoor unit shall support individual control using NET DDC controllers. The Second Floor concealed ducted indoor unit shall feature external static pressure settings up 250 Pa (1.00 in.) WG. The Unit shall have the ability to control supplemental heat via connector CN24 or CN4F and a 12 VDC output. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

.2 Indoor Unit:

.1 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

.3 Unit Cabinet:

.1 The cabinet shall be ceiling-concealed, ducted.

.2 The cabinet panel shall have provisions for a field installed filtered outside air intake.

.4 Fan:

.1 The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.

.2 The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

.3 The indoor unit shall have a ducted air outlet system and ducted return air system.

.5 Filter:

.1 Return air shall be filtered by a field-supplied filter.

.2 Optional rear return filter box with long-life filter shall available for this indoor unit.

.6 For Coil , Electrical and Controls Sections refer to respective sections under 2.4.FIRST FLOOR INDOOR UNITS – LOW PROFILE CEILING -CONCEALED (MAIN) HVAC SYSTEM AND OUTDOOR UNIT.

2.7 IT ROOM HEAT PUMP

.1 General:

.1 System Description:

.1 The Heat Pump/Cooling Only system shall be a ductless split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, a matched capacity indoor section that shall be equipped with a wired wall-mounted, wireless wall-mounted, wireless handheld, or other remote controller.

.2 Quality Assurance:

.1 The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

.2 All wiring shall be in accordance with the Canadian Electrical Code (C.E.C.), provincial and local codes as required.

.3 The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210/240 and bear the ARI Certification label.

.4 The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

.5 A dry air holding charge shall be provided in the indoor section.

.6 The outdoor unit shall be pre-charged with R-410A refrigerant for 70 feet (21 meters) of refrigerant tubing; for 100 feet (30 meters) of refrigerant tubing.

.7 System efficiency shall meet or exceed SEER / HSPF values below: 1.

.3 Delivery, Storage and Handling:

.1 Unit shall be stored and handled according to the manufacturer's recommendations.

.2 The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

.2 Warranty:

.1 The units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

.2 Manufacturer shall have over thirty (30) years of continuous experience in the Canadian market.

.3 Outdoor Unit Design:

.1 General:

.1 The outdoor unit shall be compatible with the wall mounted indoor units.

.2 The connected indoor unit shall be of the same capacity as the outdoor unit.

.3 The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.

.4 The outdoor unit shall be capable of cooling operation down to ambient temperature of 0°F for heat pump systems and -20°F (-29°C) for cooling only systems without additional low ambient controls (optional wind baffle shall be required).

.5 The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.

.6 System shall operate at up to a maximum refrigerant tubing length as per table below between indoor and outdoor units without the need for line size changes, traps or additional oil for 225 ft (69m).

.7 The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

.8 Outdoor unit sound level shall not exceed 47 dBA(A) for Cooling and 48 dBA(A).

.2 Cabinet:

.1 The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a Munsell 3Y 7.8/1.1 finish.

.2 Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.

.3 Easy access shall be afforded to all serviceable parts by means of removable panel sections.

.4 The fan grill shall be of ABS plastic.

.3 Fan:

.1 The unit shall be furnished with a single DC fan motor.

.2 The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.

.3 The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

.4 Coil:

.1 The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.

.2 Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be control by a microprocessor controlled step motor.

.3 All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ACR Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.852 W/m2K (0.27 BTU-inch/hour per Sq Ft / °F) , a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 25.4 mm (1”) thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

.5 Compressor:

.1 The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology.

.2 The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.

.3 To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant at low outdoor ambient temperature. No crankcase heater is to be used.

.4 The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

.6 Electrical:

.1 The electrical power of the unit shall be 208volts or 230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

.2 Power for the indoor unit shall be supplied from the outdoor unit via Control using three (3) fourteen (14/12) gauge AWG conductors plus ground wire connecting the units.

.3 The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.

.4 The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

.7 Operating Range:

Operating Range		**Indoor Air Intake Temperature**	**Outdoor Air Intake Temperature**
	Maximum	D.B. 90F (32C)W.B. 73F (23C)	D.B. 115F (46C)

Cooling	Minimum	D.B. 66F (19C)W.B. 59F(15C)	D.B. 0F(-18C)/:-20F (-29C)
Heating**	Maximum	D.B. 82F(28C)	D.B. 70F(21.1C)
	Minimum	D.B. 50F (10C)	D.B. 12F/-4F

.1 Unit shall be able to provide 100% cooling capacity when operating at: 0°F (-18°C) / -20°F (-29°C) outdoor air temperature when a wind baffle is used.

2.8 INDOOR UNIT SELECTION AND SPECIFICATION - WALL MOUNTED TYPE

.1 General:

.1 The wall-mounted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board and fan motor. The unit shall have a self diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

.2 Cabinet:

.1 All casings, regardless of model size, shall have the same white finish.

.2 Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.

.3 There shall be a separate back plate which secures the unit firmly to the wall.

.3 Fan:

.1 The indoor fan shall be statically and dynamically balanced to run on a single motor with permanently lubricated bearings.

.2 A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).

.3 A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

.4 Filter:

.1 Return air shall be filtered by means of an easily removable, washable filter.

.5 Coil:

.1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.

.2 The coils shall be pressure tested at the factory.

.6 Electrical:

.1 The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the A-Control system. For A-Control, a three (3) conductor AWG-14/3 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

2.9 SYSTEM CONTROL

.1 System Control:

.1 The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN24 and a 12 VDC output.

.1 For A-Control, a three (3) conductor 14 gauge AWG wire with ground shall provide power feed and bidirectional control transmission between the outdoor and indoor units. . If code requires a disconnect mounted near the indoor unit, a 3-Pole Disconnect shall be used – all three conductors must be interrupted.

.2 The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

.3 The indoor unit control board shall have auxiliary control contact connectors to provide: Lossnay Control X, Back-up Heat , Remote Switch, Central Control , IP Terminal

.2 Remote Controllers:

.1 All remote controllers need to be ordered separately from the unit.

.2 Wired MA Remote Controller (PAR-33MAA)

.1 The Backlit Wired MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group).

.2 The Backlit Wired MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers) or with other Backlit Wired MA Remote Controllers, with up to two remote controllers per group.

.3 The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

.4 Indoor units shall be equipped with an optional “i-see® Sensor” kit, providing i-See® Sensor technology providing uniform temperature detection and automatically response to adjust the set temperature to provide uniform comfort from floor to ceiling.

.3 Acceptable Manufacturers:

.1 Mitsubishi, Trane, Lennox, Samsung , York/Johnson Controls , Fujitsu.

2.10 CONTROLS

.1 Overview:

.1 General:

.1 The Controls Network (CN) shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

.2 Electrical Characteristics:

.1 General:

.1 The CN shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.

.2 Wiring:

.1 Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

.2 Control wiring for the ME remote controller shall be from the remote controller to the first associated indoor unit NET connection. The remote controller shall be assigned an NET address.

.3 Control wiring for the Simple MA and Wireless MA remote controllers shall be from the remote controller (receiver) to the first associated indoor unit then to the remaining associated indoor units in a daisy chain configuration.

.4 Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

.5 The centralized controller shall be capable of being networked with other centralized controllers for centralized control.

.3 Wiring Type:

.1 Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Manufacturer’s output.

.2 Network wiring shall be CAT-5 with RJ-45 connection.

.3 Controls Network:

.1 The Controls Network (CN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

.2 CN: Remote Controllers Backlit Simple MA Remote Controller:

.1 The Backlit Simple MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall be compact in size, approximately 80 mm x 125 mm (3” x 5”) and have limited user functionality. The Backlit Simple MA supports temperature display selection of Fahrenheit or Celsius. The Backlit Simple MA Remote Controller shall allow the user to change on/off, mode (cool, heat, auto, dry, setback and fan), temperature setting, and fan speed setting and airflow direction. The Backlit Simple MA Remote Controller shall be able to limit the set temperature range from the Backlit Simple MA. The Backlit Simple MA Remote controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Simple MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Simple MA Remote Controller shall display a four-digit error code in the event of system abnormality/error.

.2 The Backlit Simple MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall be compact in size, approximately 80 mm x 125 mm (3” x 5”) and have limited user functionality. The Backlit Simple MA supports temperature display selection of Fahrenheit or Celsius. The Backlit Simple MA Remote Controller shall allow the user to change on/off, mode (cool, heat, auto, dry, setback and fan), temperature setting, and fan speed setting and airflow direction. The Backlit Simple MA Remote Controller shall be able to limit the set temperature range from the Backlit Simple MA. The Backlit Simple MA Remote controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Simple MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Simple MA Remote Controller shall display a four-digit error code in the event of system abnormality/error.

.3 The Backlit Simple MA Remote Controller shall require no addressing. The Backlit Simple MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to connection terminal on the indoor unit. The Simple MA Remote Controller shall require cross-over wiring for grouping across indoor units.

.1 Centralized Controller (Web-enabled).

.4 Central Controller (Non-Web)

.1 TC-24 Touch Controller:

.1 The TC-24 Touch Controller features a 125 mm (5 inch) wide color LCD touch panel. The settings for air conditioning units can be changed by touching the corresponding icons on the display. There are 3 buttons on the panel of TC-24; ON/OFF, SET BACK and HOLD enabling simple and quick batch operation. One TC-24 can control up to 24 groups/units of air conditioners. Operation status is displayed on easy-to-read LCD. The group currently operating can be seen at a glance with the operation status display. TC-24 can perform functions such as ON/OFF, Operation mode changeover, temperature setting and prohibit operation by local remote controller. Up to 12 patterns of weekly schedule can be set. “ON/OFF”, “Operation mode”, “Set Temperature”, “Fan speed”, “Air flow direction” and “Permit / Prohibit local operation” can be scheduled with up to 16 settings in one pattern. Up to 5 patterns of today’s schedule can be set. Independent LOSSNAY operation is possible. Automatic ventilation, Normal ventilation and Ventilation with heat exchanger can be switched from the system controller. TC-24 is equipped with a system changeover function which an operation mode can be switched to an optimal mode depending on indoor temperature setting and target temperature of each group or a representative indoor unit.

Part 3 Execution

3.1 INSTALLATION

.1 General:

.1 Rig and install in full accordance with manufacturer’s requirements, project drawings, and contract documents. Refer to the manufacturer’s installation manual for full requirements.

.2 Location:

.1 Locate indoor and outdoor units as indicated on drawings. Provide service clearance per manufacturer's installation manual. Adjust and level outdoor units on support structure.

.2 For climates that experience snowfall, mount the outdoor unit a minimum of 305 mm (12") above the average snowfall line. In climates where this height requirement proves unfeasible, the outdoor units may be installed at the average snowfall line provided regular snow removal in the area surrounding the units keeps the snow line below the bottom of the units.

.3 Components / Piping:

.1 Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer's installation manual for full instructions.

.2 Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.

.3 Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.

.4 Refrigerant pipe for system shall be made of phosphorus deoxidized copper, and has two types.

.1 ACR "Annealed": Soft copper pipe, can be easily bent with human's hand.

.2 ACR "Drawn Temper": Hard copper pipe (Straight pipe), being stronger than Type-O pipe of the same radical thickness.

.5 The maximum operation pressure of R410A air conditioner is 4.30 MPa [623psi] . The refrigerant piping should ensure the safety under the maximum operation pressure. Refer to recommend piping specifications in Manufacturer's engineering manual. Pipes of radical thickness 0.7mm or less shall not be used.

.6 Flare connection should follow dimensions provided in manufacturer's installation manuals.

.4 Insulation:

.1 Refrigerant lines, as well as any valves, shall be insulated end to end with 12mm (½") closed-cell pipe insulation for piping up to 25mm (1"in) diameter, or 19 mm (¾") for piping 28.5 mm (1-1/8") and larger, with a thermal conductivity no greater than 0.852 W/m2K (0.27 BTU-in/hr sq.ft oF). If state or local codes require insulation other than that specified above, the greater insulation shall be used.

.5 Electrical:

.1 Installing contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor. Refer to Division 26 (Master Format 2004) for additional information.

.6 Third Party Controls:

.1 Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

3.2 MAINTENANCE TOOL SOFTWARE AND MN-CONVERTER (CMS-MNG-E)

.1 The Maintenance Tool, via the MN-Converter (CMS-MNG-E), shall enable the user to monitor and record the following parameters in a centralized system.

.1 Outdoor Unit:

.1 Operation Mode (Cooling Only, Heating Only, Cooling Main, Heating Main).

.2 Compressor Frequency, amperages, and voltages.

.3 Compressor high- and low-side pressure.

.4 System Temperatures.

.5 Outdoor temperature.

.6 Status of reversing valve.

.2 BC Controller:

.1 Valve ON/OFF status.

.2 Temperatures.

.3 Pressures.

.3 Indoor Unit:

.1 Entering Air Temperature.

.2 Entering/Leaving Refrigerant Temperature.

.3 Superheat/Subcool temperatures.

.4 LEV position.

.5 Room temperature setpoint.

.6 Unit Mode and Status (Heat, Cool, Dry, Auto, Fan).

.2 The Maintenance Tool shall have the additional feature of controlling the following system components manually:

.1 Indoor Unit:

.1 Indoor Unit ON/OFF.

.2 Mode (Heat, Cool, Dry, Auto, Fan).

.3 Room Temperature Setpoint.

.4 Fan speed.

.5 LEV Position.

.2 BC Controller:

.1 Valve OPEN/CLOSE.

.2 LEV Position.

.3 The Maintenance Tool shall be connectable to either the TB3 or TB7 communication bus lines on the NET controls via alligator connectors.

.4 The Maintenance Tool shall be connectable to a PC via a USB cable.

.5 Trended data from Maintenance Tool shall be available to export to a data file for offline analysis.

3.3 VRF PROJECT SUPERVISION

.1 General:

.1 VRF Manufacturer shall provide on-site Project Supervision as outlined in this specification section, providing: onsite technical review of installed VRF systems,

review of activities related to the installation of the VRF system, VRF system components and associated controls.

.2 All Project Supervision field activities shall be completed by an employee of the VRF manufacturer whose primary job responsibilities are to provide direct technical support of their product; sales staff or in-house support staff are not permitted to complete this scope of work.

.3 All Project Supervision field activities shall be completed by an employee of the VRF manufacturer whose primary job responsibilities are to provide direct technical support of their product; sales staff or in-house support staff are not permitted to complete this scope of work.

.4 The installing contractor shall assist the VRF manufacturer, in their completion of the system review and have available onsite a technician with appropriate diagnostic tools, materials and equipment, as required, for the duration of the inspection process. The technician assisting the VRF manufacturer shall be fully licensed and insured to complete necessary duties as directed by the VRF manufacturer.

.5 The installing contractor shall have been certified by the manufacturer to install VRF systems, having attended and successfully completed a minimum 3- day VRF Service & Installation course at an approved training facility. A copy of this certificate shall be presented to the VRF manufacturer prior to the commencement of installation activity.

.6 VRF manufacturer shall provide [4] onsite visits during the course of the project's completion. Additional site visits, if requested, shall require approval by the owner's representative and will be billed accordingly.

.7 Onsite visits shall be conducted at installation milestones noted below. The installing contractor is responsible to coordinate each visit at the appropriate milestone, giving the VRF manufacturer a minimum 2-week notice prior to each visit.

.2 Site Visit:

.1 Each site visit shall consist of a single visit, not exceeding an [8] hour period. All visits shall occur during regular business hours of 8:30AM-4PM, Monday thru Friday.

.2 Activates to be completed during each Site-Visit are as follows:

.1 Meet with designated representative from the VRF installation contractor to discuss field activities and provide technical support related to the VRF systems.

.2 Review installed VRF systems for compliance with manufacturer's installation, service and engineering specifications.

.3 Assist the contractor in updating the VRF Design software for as-built purposes and for calculating the appropriate refrigerant charge.

.4 Provide a field report identifying any installation issues requiring attention. Report shall provide detailed information containing:

.1 Issue reference number.

.2 Priority Level of issue.

.3 Equipment M# & Reference TAG#.

.4 Status of issue.

.5 Description of issue being identified.

.6 Recommendation for corrective action.

.7 Follow-up requirements, if required.

.3 Project Close Out Documents:

.1 Documents completed during the project Supervision process shall be compiled and presented to the owner's representative at the completion of field activities.

.2 Close out documentation shall include:

.1 Project Supervision report outlining activities completed under this scope of work.

.2 As-built VRF design file depicting Model numbers and kW (BTU) capacity ratings of equipment installed, refrigerant pipe size & connection lengths between each system component, calculated refrigerant charge.

.3 Issue report.

3.4 VRF SYSTEM COMMISSIONING

.1 General:

.1 The VRF Manufacturer shall oversee and assist the installing contractor with the start up and commissioning of VRF equipment as outlined below. This process will be completed in two phases. Phase one shall cover the Pre-Start-Up inspection process, Phase two will cover the Physical Start-Up & Commissioning of Equipment.

.2 All VRF System Commissioning activities shall be completed by an employee of the VRF manufacturer whose primary job responsibilities are to provide start up and commissioning of their products; sales staff or in-house support staffs are not permitted to complete this scope of work.

.3 A factory certified representative may assist the VRF manufacturer's personnel in the completion of certain elements of work contained within this specification. Activities completed by a Factory Certified Representative shall be supervised onsite by the VRF manufacturer. Certified representatives shall not be used in lieu of the manufacturer's personnel.

.4 The installing contractor shall have been certified by the manufacturer to install VRF systems, having attended a minimum 3- day VRF Service & Installation course at an approved training center. A copy of this certificate shall be presented as part of the VRF equipment submittal process.

.5 The installing contractor shall assist the VRF manufacturer in their completion of the system review and have available a technician with appropriate diagnostic tools, materials and equipment, as required, for the duration of the inspection process. The technician shall be fully licensed and insured to complete necessary duties as directed under the supervision of the VRF manufacturer.

.6 Upon completion of the Equipment Start-Up & VRF Commissioning process, the VRF manufacturer shall provide a formal report outlining the status of the system, in electronic format only. Contained within this report shall be copies of all field inspection reports, required action items and status, Manufacturers design software As-Built, equipment model & serial numbers.

.7 Completion of the Equipment Start-Up and VRF Commissioning process shall verify that the VRF system has been installed per the Engineer's design intent

and complies with the VRF manufacturers engineering and installation specifications related to their equipment.

.8 Compliance with federal, state and local codes as well as other authorities having jurisdictions are not part of this process and are the responsibility of the installing contractor.

.2 Pre Start-Up Inspection:

.1 Contractor shall employ the services of the VRF manufacturer to provide a comprehensive field review of the completed VRF system installation, prior to the physical start up and operation of equipment. Upon satisfaction that the system meets the VRF manufacturer's installation requirements and specifications, the contractor shall be allowed to proceed with the physical start up and operation of equipment.

.2 Prior to the pre-start-up inspection, all systems components shall be in a final state of readiness having been fully installed and awaiting inspection.

.3 The installing contractor shall provide the VRF manufacturer a copy of the electronic design file used in the design and engineering process of the system being inspected. This electronic design file shall have been completed on software approved by the specified VRF manufacturer and shall have been updated to reflect as-built conditions.

.4 The installing contractor shall have prepared the refrigeration piping systems per equipment installation and service manuals. All refrigerant piping systems, upon completion of assembly, shall have been pressurized to a minimum 600 PSI, using dry nitrogen, and held for an uninterrupted 24HR period, with acceptable change due to atmospheric conditions.

.1 A record of the pressure check process shall be recorded and tagged at the outdoor unit. The tag shall contain the following information: date & time of pressure check start, fill pressure, outdoor temperature at start & stop, date & time of pressure check completion, and the person's full name & company information completing the pressure check.

.2 The installing contractor shall engage the General Contractor as a witness of the pressure check process, confirming that all steps and procedures related to the pressure check where properly followed and that the system held the holding pressure of 600PSI for a period of 24hr hours, with acceptable change due to atmospheric conditions. Witness information, including full name, company name, title, phone number and signature shall be recorded on same pressure tag used by installing contractor.

.5 Upon completion of the 600 PSI pressure check, the system shall be evacuated to a level of 500 microns, where it will be held for a period of 1HR with no deflection. The installing contractor shall utilize the triple evacuation method per the equipment install and service manuals.

.1 Evacuation start & stop dates, times, and persons involved shall be recorded and tagged at the outdoor equipment.

.2 Installing contractor shall digitally capture a photo of the micron gauge reading, at the conclusion of the 1hr holding period, for each system and provide a copy to the VRF manufacturer. Each photo shall contain a tag providing the outdoor units Serial number.

.6 Upon the completion of the 500-micron hold, the calculated additional refrigerant charge can be added. The calculated refrigerant charge shall have been calculated using the VRF manufacturers design software.

.1 Total refrigerant charge of the system shall be recorded and displayed at the outdoor unit by permanent means.

.7 A review of the equipment settings shall be completed, with recommendations provided to improve system performance, if applicable. Physical changes of system settings will be completed by the contractor. Electronic recording of final DIP switches shall be provided as part of the commissioning report.

.8 A comprehensive review and visual inspection shall be completed for each piece of equipment following a detailed check list, specific to the equipment being reviewed. A copy of the inspection report shall be provided as part of the manufacturers close out documentation. Any deficiencies found during the inspection process shall be brought to the attention of the installing contractor for corrective action. Any system components that are not accessible for proper inspection shall be noted as such.

.9 Indoor Equipment report shall contain:

.1 Model & Serial Number.

.2 Equipment location.

.3 Equipment Tag/Identification number.

.4 Network Address & Port Assignment.

.5 Digital recording of equipment settings.

.6 Mounting/support method.

.7 Seismic restraints used.

.8 Proper service clearance provided.

.9 Wiring and connection points are correct.

.10 High voltage reading(s) within acceptable range.

.11 Low voltage reading(s) within acceptable range.

.12 Type of Remote Controller used and its location.

.13 Occupied space temperature sensing location.

.14 Air temperature readings within acceptable range.

.15 Condensate pump interlock method.

.16 Fan E.S.P. setting.

.17 Air Filter condition.

.18 Height differential setting in heat mode.

.19 Noise level acceptable.

.20 Refrigerant pipe connected and insulated properly.

.21 Condensate pipe connected and insulated properly.

.22 Condition of connected ductwork.

.23 Fresh air connected.

.24 Humidifier connected and checked.

.25 Review of air balance report complete.

.26 Other interlocked systems, i.e. baseboard heat, booster fan etc.

.10 Outdoor Air Cooled equipment report shall contain:

.1 Model & Serial Number.

.2 Equipment location.

.3 Equipment Tag/Identification number.

.4 Network Address & Port Assignment.

.5 Digital recording of equipment settings.

.6 Mounting/support method.

.7 Seismic restraints used.

.8 High Wind Tethering method.

.9 Proper service clearance provided.

.10 Defrost Condensate removal addressed.

.11 Wiring and connection points are correct.

.12 High voltage reading(s) within acceptable range.

.13 Low voltage reading(s) within acceptable range.

.14 Control Network settings.

.15 Noise level setting.

.16 Refrigerant pipe installed and insulated properly.

.17 Low ambient operation settings.

.3 Physical Start-Up & Commissioning of Equipment:

.1 Upon proper equipment start up by the contractor, following the manufacturers guidelines and specifications, an employee of the VRF manufacturer shall complete a review of the system performance and complete the following tasks:

.1 Check and confirm all communication addressing of system components.

.2 Check and confirm each indoor unit, individually, is properly piped and wired by commanding the indoor unit on, in either heat or cool mode and verifying proper response.

.1 This process shall be digitally recorded and included as part of the close out documentation.

.3 Electronically record a minimum of one-hour of operational data per refrigeration system.

.4 Electronically record selector switch positions on all indoor and outdoor equipment.

.5 The VRF manufacturer shall retain the electronically recorded data, collected during the start-up and equipment commissioning process, at a designated location within the US for future reference.

.4 Close-Out Information:

.1 The VRF manufacturer shall issue a System Performance report at the completion of all fieldwork. Contained within this report shall be an overview of the system performance, recommendations, field reports, all electronic data, and as-built design file.

.5 VRF Equipment Warranty:

.1 Having successfully completed the Pre-Inspection, Start-Up & Equipment Commissioning processes and fulfilling all requirements, as outlined in the VRF manufacturers Extended Warranty Process. Along with installing contractor being certified by the VRFR manufacturer to install VRF systems, having attended a minimum 3- day VRF Service & Installation course at an authorized training center.

.2 The equipment shall be provided with the following warranty per the VRF manufacturer's warranty policy:

.1 Compressor: 7-year part only.

.2 Parts: 5-years part only.

.3 Labor: no labor coverage provided by VRF Manufacturer.

3.5 OWNER TRAINING AND TECHNICAL SUPPORT

.1 General:

.1 The VRF manufacturer shall provide the owner's representative a minimum []-hour VRF Operation and Maintenance training class covering systems installed under this scope of work.

.2 Training program is to be provided at the time of owner occupancy.

.3 Owner shall provide a suitable location, onsite, to conduct the VRF Operation and Maintenance class.

.4 Training material shall be provided to participants in electronic format.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System(WHMIS).

.1 Material Safety Data Sheets (MSDS).

.2 Hydronic Institute of Boiler and Radiator Manufacturers (IRB).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specification and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on drawings:

.1 Equipment, capacity, piping, and connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

.3 Special enclosures.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout submittals:

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 CAPACITY

.1 As indicated, based on 83 degrees C average water temperature, 11 degrees C temperature drop and 18 degrees C at entering air temperature.

2.2 FINNED TUBE RADIATION

.1 Heating elements: NPS 3/4 seamless copper tubing, 1.2 mm minimum wall thickness, mechanically expanded into flanged collars of evenly spaced aluminum fins, 100 x 100 mm nominal, 130 fins per metre suitable for sweat fittings.

.2 Element hangers: plastic lined cradle type providing unrestricted longitudinal movement on enclosure brackets. Space brackets 900 mm centres maximum.

.3 Standard enclosures: 1.6 mm thick steel complete with components for wall-to-wall or complete with die formed end caps having no knock-outs, with inside corners, outside corners, as indicated. Provide full length channel and sealer strip at top of wall edge. Height as indicated. Joints and filler pieces flush with cabinet. Support rigidly top and bottom, on wall mounted brackets. Joints and filler pieces clear of grilles located to provide easy access to valves and vents. Provide access doors for valves, vents, traps. Sloped top and bottom with stamped grilles. Finish cabinet with factory applied baked primer coat. Color to be approved by Owner.

.4 Special enclosures: as indicated.

.5 Dimensions for enclosures: measure site conditions. Do not scale from drawing.

.6 Provide for noiseless expansion of components.

.7 Acceptable material: Engineered Air WF-1B, Sigma SWE-SS, Rosemax, Trane, Modine.

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 datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and reviewed shop drawings.

.3 Provide for pipe movement during normal operation.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with Owner if different from that indicated prior to installation.

.6 Valves:

.1 Install valves with stems upright or horizontal unless approved otherwise.

.2 Install isolating ball valves on inlet and lockshield globe balancing valves on outlet of each unit.

.7 Venting:

.1 Install automatic air vent on upfed finned tube radiation.

.8 Clean finned tubes and comb straight.

3.3 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 23 05 00 - Common Work Results for Mechanical.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

.3 Submit product data sheets for unit heaters. Include:

.1 Product characteristics.

.2 Performance criteria.

.3 Mounting methods.

.4 Physical size.

.5 kW rating, voltage, phase.

.6 Cabinet material thicknesses.

.7 Limitations.

.8 Colour and finish.

.4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Equipment, capacity and piping connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

1.4 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM C916-20, Standard Specification for Adhesives for Duct Thermal Insulation

.2 ASTM C1071-19, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

.2 ULC Standards (ULC):

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.3 Underwriters' Laboratories (UL):

.1 UL 2021-2015, Fixed and Location-Dedicated Electric Room Heaters

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Waste management and disposal to be in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 CABINET UNIT HEATERS

.1 Cabinet: type as indicated, 1.6 mm thick steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet.

.2 Finish with factory applied primer coat.

.3 Special cabinets and front panels: as indicated.

.4 Coils: aluminum fins mechanically bonded to copper tubes. Hydrostatically tested to 1 MPa.

.5 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.

.6 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.

.7 Filters:

.1 Filters shall be located behind an integral access door. Filters are 25 mm throwaway.

.8 Capacity: as indicated.

.9 Control:

.1 2-speed switch with integral overloads in cabinet.

.2 Control thermostat: by Section 25.

.10 Acceptable manufacturers:

.1 Engineered Air.

.2 Trane.

.3 Rosemex.

.4 Sigma Corporation.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Provide double swing pipe joints as indicated.

.3 Check final location with Owner if different from that indicated prior to installation.

.1 Should deviations beyond allowable clearances arise, request and follow directive.

.4 Hot water units: for each unit, install ball valve on inlet and lockshield globe balancing valve on outlet of each unit. Install drain valve at low point.

.1 Install manual air vent at high point.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Vibration isolators: to Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment.

.8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.2 COMMISSIONING

.1 To Section 01 91 13 - General Commissioning (CX) Requirements.

.2 All operating controls shall be packaged and fully wired.

3.3 BALANCING

.1 Balance unit and cabinet heater flows to within plus or minus 5% of design output.

.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 05 01 - EMCS: General Requirements

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least 99% during test period.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Ownerthat Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Final Report: submit report to Owner.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Owner before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Ownerbefore interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.6 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

.2 Carry out commissioning in presence of Owner.

.3 Inform, and obtain approval from, Ownerin writing at least 14 days before commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of Owner until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software.

.7 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner.

1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2months before tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

Part 3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Manager.

.3 Commission integrated systems using procedures prescribed by Commissioning Manager.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

.1 General: consists of site tests of equipment just before installation.

.2 Testing may be on site or at Contractor's premises as approved by Owner.

.3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.

.4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

.5 Additional instruments to include:

.1 DP transmitters.

.2 DP switches used for dirty filter indication and fan status.

.6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0and 500Pa, to hold steady at any setting and with direct output to milli-amp metre at source .

.7 After setting, test zero and span in 10% increments through entire range while both increasing and decreasing pressure.

.8 Transmitters above 0.5 % error will be rejected.

.9 DP switches to open and close within 2% of setpoint.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate site hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Owner. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system and provide:

.1 2 technical personnel capable of re-calibrating site hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Owner's acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final startup testing.

.5 O&M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Owner.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.

.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 Before beginning of 30day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

.2 Test to last at least 30consecutive 24 hour days.

.3 Tests to include:

.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

.4 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Commissioning Managerto verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Commissioning Manager and Owner, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Commissioning Manager and Owner operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00 - Demonstration and Training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements.

.2 Section 25 05 01 - EMCS: General Requirements

1.2 DEFINITIONS

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Owner 30 days before anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one week after completion of training program that training has been satisfactorily completed.

1.4 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Owner reserves right to approve instructors.

1.5 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.6 TIME FOR TRAINING

.1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.8 TRAINING PROGRAM

.1 Two (2) day program to begin before 30 day test period at time mutually agreeable to Contractor, Owner and Commissioning Manager.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during 30 day test period.

.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.

.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.2 Equipment maintenance training: provide personnel with 2 days training within 5 day period in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.

1.9 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.10 MONITORING OF TRAINING

.1 Owner to monitor training program and may modify schedule and content.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 05 54 - EMCS: Identification

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 Institute of Electrical and Electronics Engineers (IEEE).

.1 IEEE 260.1-2004, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE 135-2016, BACnet--A Data Communication Protocol for Building Automation and Control Networks.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1-00(R2011), Canadian Metric Practice Guide.

.5 Consumer Technology Association (CTA).

.1 CTA-709.1-D-2014, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act, 2012 (S.C. 2012, c. 19, s. 52)

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Safety Data Sheets (SDS).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act(TDGA), 1992, c. 34.

1.3 ABBREVIATIONS AND ACRONYMS

.1 Acronyms used in EMCS:

.1 AEL - Average Effectiveness Level

.2 AI - Analog Input

.3 AIT - Agreement on International Trade

.4 AO - Analog Output

.5 BACnet - Building Automation and Control Network.

.6 BC(s) - Building Controller(s).

.7 BECC - Building Environmental Control Centre.

.8 CAD - Computer Aided Design.

.9 CDL - Control Description Logic.

.10 CDS - Control Design Schematic.

.11 COSV - Change of State or Value.

.12 CPU - Central Processing Unit.

.13 DI - Digital Input.

.14 DO - Digital Output.

.15 DP - Differential Pressure.

.16 ECU - Equipment Control Unit.

.17 EMCS - Energy Monitoring and Control System.

.18 HVAC - Heating, Ventilation, Air Conditioning.

.19 IDE - Interface Device Equipment.

.20 I/O - Input/Output.

.21 ISA - Industry Standard Architecture.

.22 LAN - Local Area Network.

.23 LCU - Local Control Unit.

.24 MCU - Master Control Unit.

.25 NAFTA - North American Free Trade Agreement.

.26 NC - Normally Closed.

.27 NO - Normally Open.

.28 OS - Operating System.

.29 O&M - Operation and Maintenance.

.30 OWS - Operator Work Station.

.31 PC - Personal Computer.

.32 PCI - Peripheral Control Interface.

.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.

.34 PID - Proportional, Integral and Derivative.

.35 RAM - Random Access Memory.

.36 SP - Static Pressure.

.37 ROM - Read Only Memory.

.38 TCU - Terminal Control Unit.

.39 USB - Universal Serial Bus.

.40 UPS - Uninterruptible Power Supply.

.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Point Object Type: points fall into following object types:

.1 AI (analog input).

.2 AO (analog output).

.3 DI (digital input).

.4 DO (digital output).

.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.

.2 Refer also to Section 25 05 54 - EMCS: Identification.

1.5 SYSTEM DESCRIPTION

.1 Refer to control schematics for system architecture.

.2 EMCS is to have the capability to remove monitored, but will not be connected via Base Communications as part of this project.

.3 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Control devices as listed in I/O point summary tables.

.3 Data communications equipment necessary to effect EMCS data transmission system.

.4 Field control devices.

.5 Acceptance tests, technical support during commissioning, full documentation.

.6 Wiring interface coordination of equipment supplied by others.

.7 Miscellaneous work as specified in these sections and as indicated.

.4 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Owner before installation.

.3 Location of controllers as reviewed by Owner before installation.

.4 Provide utility power to EMCS and emergency power to EMCS as indicated.

.5 Metric references: in accordance with CAN/CSA Z234.1.

.5 Language Operating Requirements:

.1 Provide English operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.

.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).

.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in English.

.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit for review:

.1 Equipment list and systems manufacturers within 10 days after award of contract.

.2 Complete control schematics with corresponding sequences of operation.

.3 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Owner, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Submit certificate of acceptance from authority having jurisdiction to Owner.

1.7 QUALITY ASSURANCE

.1 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

Part 2 Products

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to CTA 709.1, ASHRAE STD 135.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 05 01 - EMCS: General Requirements

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA):

.1 CSA C22.1-18, The Canadian Electrical Code, Part I 9th Edition), Safety Standard for Electrical Installations (24th Edition)

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.

.2 Submit to Owner for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by 3 mm thick melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: as required.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain or plastic tie.

.2 Sizes: 50 mm x 100mm mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name and point address.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Owner.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment includingmotors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS".

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Owner during "Preliminary Design Review".

Part 3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 84 00 - Fire Stopping

.2 Section 25 05 54 - EMCS: Identification

.3 Section 26 05 00 - Common Work Results for Electrical

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI):

.1 ANSI/ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressures Fittings.

.2 IEEE ANSI C2-2012, National Electrical Safety Code.

.3 NFPA 7-2023, National Electrical Code.

.2 CSA Group (CSA):

.1 CSA C22.1-21, Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations

.2 CAN/CSA C22.2 No. 45.1-07(R2017), Electrical Rigid Metal Conduit.

.3 CAN/CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CAN/CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.

.5 CAN/CSA-C22.3 No. 1-15, Overhead Systems.

.6 CAN/CSA-C22.3 No. 7-20, Underground Systems.

1.3 SYSTEM DESCRIPTION

.1 Electrical:

.1 Provide power wiring from existing emergency power panels to EMCS field panels. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.

.2 Hard wiring between field control devices and EMCS field panels.

.3 Communication wiring between EMCS field panels and OWS's including main control centre BECC.

.4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.5 Refer to wiring diagrams included as part of flow diagrams in Section 26 05 00 - Common Work Results for Electrical. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval by engineer before commencing work.

.2 Pneumatic:

.1 Pneumatic tubing, valves and fittings for field control devices.

.3 Mechanical:

.1 Pipe Taps Required For EMCS equipment will be supplied and installed by EMCS Contractor.

.2 Wells and Control Valves Shall Be Supplied by EMCS Contractor and Installed by EMCS Contractor.

.3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by EMCS Contractor. Costs to be carried by designated trade.

.4 Structural:

.1 Special steelwork as required for installation of work.

1.4 PERSONNEL QUALIFICATIONS

.1 Qualified supervisory personnel to:

.1 Continuously direct and monitor all work.

.2 Attend site meetings.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: refer to Section 01 73 00 - Execution supplemented as specified herein.

.2 Repair all surfaces damaged during execution of work.

.3 Turn over to Owner existing materials removed from work not identified for re-use.

Part 2 Products

2.1 PIPING

.1 Waste Fuel F34 (Jet Fuel) Piping: refer to Section 23 11 13 -Facility Fuel Oil Piping.

.2 Sleeves, escutcheons: refer to Section 23 05 15 - Common Installation Requirements for Mechanical Pipework.

.3 Hangers and supports: refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment.

.4 Insulation: refer to Section 23 07 19 - Thermal Insulation for Piping.

2.2 SPECIAL SUPPORTS

.1 Structural grade steel, primed and painted after construction and before installation.

2.3 PIPING FOR PNEUMATIC CONTROL SYSTEMS

.1 Copper:

.1 Tubing:

.1 Fittings: wrought copper solder type to ANSI/ASME B16.22, and 95.5 antimonial tin solder. At instruments use compression fittings.

.2 At panels and junction boxes where there is a transition from plastic to copper use bulkhead fittings.

.2 Plastic:

.1 Flame retardant, black PVC with minimum burst strength 1.3 MPa at 23 degrees Celsiusinstalled in conduit.

.2 Fittings: compression or barbed type as required.

2.4 WIRING

.1 As per requirements of Division 26.

.2 For 70V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1

.3 For wiring under 70 V use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.

.4 Sizes:

.1 120V Power supply: to match or exceed breaker, size #12 minimum.

.2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.

.3 Field wiring to digital device: 20 AWG stranded twisted pair.

.4 Analog input and output: shielded #20 minimum stranded twisted pair. Wiring must be continuous without joints.

.5 More than 4 conductors: #22 minimum solid copper.

.5 Terminations:

.1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.5 CONDUIT

.1 As per requirements of Division 26.

.2 Electrical metallic tubing to CAN/CSA C22.2 No. 83. Flexible and liquid tight flexible metal conduit to CAN/CSA C22.2 No. 56. Rigid steel threaded conduit to CAN/CSA C22.2 No. 45.1

.3 Junction and pull boxes: welded steel.

.1 Surface mounting cast FS: screw-on flat covers.

.2 Flush mounting: covers with 25 mm minimum extension all round.

.4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.

.5 Outlet boxes: 100 mm minimum, square.

.6 Conduit boxes, fittings:

.1 Bushings and connectors: with nylon insulated throats.

.2 With push pennies to prevent entry of foreign materials.

.7 Fittings for rigid conduit:

.1 Couplings and fittings: threaded type steel.

.2 Double locknuts and insulated bushings: use on sheet metal boxes.

.3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.

.8 Fittings for thin wall conduit:

.1 Connectors and couplings: steel, set screw type.

2.6 WIRING DEVICES, COVER PLATES

.1 Conform to CSA

.2 Receptacles:

.1 Duplex: CSA type 5-15R

.2 Single: CSA type 5-15R

.3 Cover plates and blank plates: finish to match other plates in area.

2.7 STARTERS, CONTROL DEVICES

.1 Across-the-line magnetic starters:

.1 Enclosures: CSA Type 1, except where otherwise specified.

.2 Size, type and rating: to suit motors.

.2 Starter diagrams:

.1 Provide copy of wiring and schematic diagrams - mount one copy in each starter with additional copies for operation and maintenance manual.

.3 Auxiliary Control Devices:

.1 Control transformers: 60 Hz, primary voltage to suit supply, 120 V single phase secondary, VA rating to suit load plus 20% margin.

.2 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.

.3 Hand-Off-Automatic switch: heavy duty type, knob lever operator.

.4 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.

.4 Finish for starters:

.1 Exterior: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Interior: white.

2.8 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

.1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.

.1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.

.2 Exposed conduits or cables:

.1 50 mm diameter and smaller: one-hole steel straps.

.2 Larger than 50 mm diameter: two-hole steel straps.

.3 Suspended support systems:

.1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.

.2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete

3.2 PIPING

.1 Oil Piping: refer to Section 23 11 13 - Facility Fuel Oil Piping.

.2 Insulation: refer to Section 23 07 19 - Thermal Insulation for Piping.

3.3 MECHANICAL PIPING

.1 Install piping straight, parallel and close to building structure with required grades for drainage and venting.

.2 Ream ends of pipes before assembly.

.3 Copper tubing not to come into contact with dissimilar metal.

.4 Use non-corrosive lubricant or Teflon tape on male screwed threads.

.5 Clean ends of pipes, tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.

.6 Install di-electric couplings where dissimilar metals joined.

.7 Sleeves:

.1 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.

.2 Caulking:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere: provide space for fire stopping by Section 07 84 00 - Fire Stopping. Maintain the fire-resistance rating integrity of the fire separation.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

.8 Pressure tests:

.1 Pressure test all piping systems modified under this contract to 1 1/2 times maximum working pressure or 860 kPa (whichever is greater) for 4 hours without loss of pressure. Test all piping systems modified under this contract by means of visual inspection of each connection.

.2 Isolate equipment, components, not designed to withstand test pressure.

.9 Introduce system pressure carefully into new piping.

3.4 SUPPORTS

.1 Install special supports as required and as indicated.

3.5 PNEUMATIC CONTROL SYSTEMS

.1 General:

.1 Install tubing in accessible concealed locations, straight, parallel and close to building structure with required grades for drainage and venting.

.2 Install drip legs and drains at low points.

.3 Tubing to be free from surface damage.

.4 Tubing NOT to pass through or touch unheated ducts or enclosures.

.5 Do not cover pneumatic tubing with insulation.

.6 Test tubing, check joints after connection to system.

.2 Copper tubing:

.1 Not to come into contact with dissimilar metal. Use non-metallic stand-offs on air handling systems.

.2 Install dielectric couplings where dissimilar metals are connected.

.3 Plastic tubing:

.1 Inaccessible locations: install plastic tubing in conduit.

.2 Inside panels: install in tube trays or racks, or clip individually to back of panel.

.3 Multiple tube bundles: install in tube trays, conduit or armoured flexible cable.

3.6 ELECTRICAL GENERAL

.1 Do complete installation in accordance with requirements of:

.1 Division 26, this specification.

.2 CSA 22.1 Canadian Electrical Code

.3 ANSI/NFPA 70

.4 ANSI C2

.2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage contacts and mark to prevent accidental injury.

.3 Do underground installation to CAN/CSA-C22.3 No.7, except where otherwise specified

.4 Conform to manufacturer's recommendations for storage, handling and installation.

.5 Check factory connections and joints. Tighten where necessary to ensure continuity.

.6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.

.8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.

.9 Install conduits, and sleeves before pouring of concrete.

.10 Holes through exterior wall and roofs: flash and make weatherproof.

.11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.

.12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.7 CONDUIT SYSTEM

.1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow

for future expansion capabilities specified for systems. Maximum conduit fill not to exceed 40%. Design drawings do not show conduit layout.

.2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.

.3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Owner before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.

.4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.

.5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.

.6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.

.7 Limit conduit length between pull boxes to less than 30 m.

.8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.

.9 Fastenings and supports for conduits, cables, and equipment:

.1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.

.2 Provide adequate support for raceways and cables, sloped vertically to equipment.

.3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Owner.

.10 Install polypropylene fish cord in empty conduits for future use.

.11 Where conduits become blocked, remove and replace blocked sections.

.12 Pass conduits through structural members only after receipt of Owner's written approval.

.13 Conduits may be run in flanged portion of structural steel.

.14 Group conduits wherever possible on suspended or surface channels.

.15 Pull boxes:

.1 Install in inconspicuous but accessible locations.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper or foam to prevent entry of construction material.

.4 Provide correct size of openings. Reducing washers not permitted.

.5 Mark location of pull boxes on record drawings.

.6 Identify AC power junction boxes, by panel and circuit breaker.

.16 Install terminal blocks or strips indicated in cabinets to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.17 Install bonding conductor for 120 volt and above in conduit.

3.8 WIRING

.1 Install multiple wiring in ducts simultaneously.

.2 Do not pull spliced wiring inside conduits or ducts.

.3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension

.4 Tests: use only qualified personnel. Demonstrate that:

.1 Circuits are continuous, free from shorts, unspecified grounds.

.2 Resistance to ground of all circuits is greater than 50 Megohms.

.5 Provide Owner with test results showing locations, circuits, results of tests.

.6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

.7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

.8 Do not allow wiring to come into direct physical contact with compression screw.

.9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.9 WIRING DEVICES, COVER PLATES

.1 Receptacles:

.1 Install vertically in gang type outlet box when more than one receptacle is required in one location.

.2 Cover plates:

.1 Install suitable common cover plate where wiring devices are grouped.

.2 Use flush type cover plates only on flush type outlet boxes.

3.10 STARTERS, CONTROL DEVICES

.1 Install and make power and control connections as indicated.

.2 Install correct over-current devices.

.3 Identify each wire, terminal for external connections with permanent number marking identical to diagram.

.4 Performance Verification:

.1 Operate switches and controls to verify functioning.

.2 Perform start and stop sequences of contactors and relays.

.3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.11 GROUNDING

.1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.

.2 Install separate grounding conductors in conduit within building.

.3 Install ground wire in all PVC ducts and in tunnel conduit systems.

.4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.12 TESTS

.1 General:

.1 Give 14 days written notice of intention to test.

.2 Conduct in presence of Owner and authority having jurisdiction.

.3 Conceal work only after tests satisfactorily completed.

.4 Report results of tests to Owner in writing.

.5 Preliminary tests:

.1 Conduct as directed to verify compliance with specified requirements.

.2 Make needed changes, adjustments, replacements.

.3 Insulation resistance tests:

.1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.

.2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Owner and authority having jurisdiction.

3.13 IDENTIFICATION

.1 Refer to Section 25 05 54 - EMCS: Identification.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 05 01 - EMCS: General Requirements

1.2 REFERENCE STANDARDS

.1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations

.2 CSA Group (CSA):

.1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings

1.3 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit detailed preventative maintenance schedule for system components to Owner.

.3 Submit detailed inspection reports to Owner.

.4 Submit dated, maintenance task lists to Owner and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.

.2 Device type and range.

.3 Measured value.

.4 System displayed value.

.5 Calibration detail

.6 Indication if adjustment required,

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Owner, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Owner in accordance with Section 01 78 00 - Closeout Submittals"As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.5 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:

.1 Initiate service calls when EMCS is not functioning correctly.

.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.3 Furnish Owner with telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS within 48 hours after receiving request for service.

.5 Perform Work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.5 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Owner.

1.6 SERVICE CONTRACTS

.1 Provide in-depth technical expertise and assistance to Owner and Commissioning Manager in preparation and implementation of service contracts and in-house preventive maintenance procedures.

.2 Service Contracts to include:

.1 Annual verification of site points for operation and calibration.

.2 4 visits per year.

.3 4 responses to emergency calls during day, per year.

.4 Complete inventory of installed system.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Owner as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

.1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.

.2 Check and Calibrate each site input/output device in accordance with CSA Z204.

.3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

.1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.

.2 Check equipment cooling fans as required.

.3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.

.4 Review system performance with Owner to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

.1 Minor inspection.

.2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.

.4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.

.5 Provide mechanical adjustments, and necessary maintenance on printers.

.6 Run system software diagnostics as required.

.7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

.1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 05 01 - EMCS - General Requirements

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA):

.1 CSA T530-99(R2004), Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications)

.2 CSA T568.1-4-05(R2010), Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements - Addendum 4 - Recognition of Category 6 and 850 nm Laser-Optimized 50/125 um Multimode Optical Fiber Cabling.

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements:

.1 IEEE 802.3-2018, IEEE Standard for Ethernet.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA):

.1 TIA/EIA 568 SET, Commercial Building Telecommunications Cabling Standard Set, 2009.

.2 TIA 569, Commercial Building Standard for Telecommunications Pathways and Spaces, 2012.

.4 Treasury Board Information Technology Standard (TBITS):

.1 TBITS 6.9-2000, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS - General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529.1-4, CSA T530, TIA 569 and TBITS 6.9.

.1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.

.2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to include, but not limited to:

.1 EMCS-LAN.

.2 Modems.

.3 Network interface cards.

.4 Network management hardware and software.

.5 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).

.1 High speed, high performance, local area network over which MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.

.2 EMCS-LAN to: BACnet,.

.3 Each EMCS-LAN to be capable of supporting at least 50 devices.

.4 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.

.5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.

.6 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.

.7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.

.1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.

.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.

.1 Network medium: shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Hardware and software requirements for an Operator Work Station (OWS) in a Building Energy Monitoring and Control System (EMCS), including primary, secondary, portable and remote OWS's.

1.2 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 05 01 - EMCS: General Requirements

.3 Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

.2 Portable OWS: used as remote dial-up OWS with same capabilities as primary OWS including graphic display.

.3 Remote Auxiliary OWS: performs identical user interface functions as primary OWS.

1.4 OWS SYSTEM DESCRIPTION

.1 Consists of commercially available personal computer in current production, with sufficient memory and processor capacity to perform functions specified.

.2 Primary OWS to include:

.1 Report printer.

.2 Colour graphics printer.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

1.6 ENVIRONMENTAL CONDITIONS

.1 OWS to operate in conditions of 10°C to 32°C and 20% to 90% non-condensing RH.

Part 2 Products

2.1 OWS HARDWARE

.1 PC system to include:

.1 Processor: Pentium IV micro-processor, operating at minimum clock speed of 2 Gigahertz, capable of supporting software necessary to perform functions specified in this section. System backplane bus (100 Megahertz) to support PCI and ISA boards.

.2 Internal clock.

.1 Uninterruptible clock: accuracy of plus or minus 5 seconds/month, capable of deriving year / month / day / hour / minute / second.

.2 Rechargeable batteries: to provide minimum 48 hours clock operation in event of power failure.

.3 Asynchronous interfaces for connection to listed peripheral devices including LAN and remote devices.

.2 Power supply unit to accept 120 V 60 Hz source and include line surge and low voltage protection for processor and its peripherals.

.3 Include UPS to provide 5 minutes minimum operation of PC, CRT and communication and peripheral devices; applies to fixed (non portable) OWSs and peripherals.

2.2 OWS PC COMPONENTS

.1 Primary OWS: IBMPC compatible with following as minimum:

.1 IDE Disk drive controller to support 4 drives.

.1 1-160 GB hard disk drive, 12 ms.

.2 1-16X DVD-RW drive.

.2 4 GB RAM minimum.

.3 Enhanced 101 key keyboard.

.4 PS2 mouse.

.5 Monitor: 19". Flat panel display TFT.

.6 Integrated HD graphics.

.7 2 Parallel Ports to support printers.

.8 4 USB 2.0 ports and 2 USB 2.0 ports.

.9 PCI Ethernet LAN Adapter to connect to local Ethernet LAN network.

.10 200 W minimum power supply.

2.3 PRINTERS

.1 Report printer: Include following features:

.1 Laser printer.

.2 Accommodate 8.5 X 11" and 8.5 X 14" paper.

.3 Minimum 1200 by 1200 dpi resolution.

.4 Minimum 16 MB RAM, expandable to minimum 72 MB RAM.

.5 Minimum 18 pages per minute print speed.

2.4 OPERATING SYSTEM (OS) OR EXECUTIVE

.1 OS to support complement of hardware terminals and software programs specified.

.2 OS to be true multitasking operating environment.

.1 MS DOS or PC DOS based software platforms not permitted.

.3 OWS software to operate in "Windows" based operating environment: Windows 2000, XP or Unix "X' Windows based system.

2.5 OWS CONTROL SOFTWARE

.1 OWS is not to form part of real-time control functions either directly or indirectly or as part of communication link. Real-time control functions to reside in MCUs, LCUs, and TCUs with peer to peer communication occurring at MCU to MCU device level.

.2 Time Synchronization Module.

.1 System to provide Time Synchronization of real-time clocks in controllers.

.2 System to perform this feature on regular scheduled basis and on operator request.

.3 User Display Interface Module.

.1 OWS software to support " Point Names" as defined in Section25 05 01 - EMCS: General Requirements.

.2 Upon operator's request in either text, graphic or table mode, system to present condition of single point, system, area, or connected points on system to OWS. Display analog values digitally to 1 place of decimal with negative sign as required. Update displayed analog values and status when new values received. Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm. For systems supporting COSV, refresh rate of screen data not to exceed 5 seconds from time of site change and system is to execute supervisory background scan every 20 seconds to verify point data value. For other systems refresh rate not to exceed 5 seconds for points displayed. Initial display of new system graphic display (with up to 30 active points), including presentation of associated dynamic data not to exceed 8 seconds.

.4 General Event Log Module: to record system activities occurring at OWS or elsewhere in system including:

.1 Operator Log-in from user interface device.

.2 Communication messages: errors, failures and recovery.

.3 Event notifications and alarms by category.

.4 Record of operator initiated commands.

.5 General Event Log:

.1 Hold minimum of 4 months information and be readily accessible to operator.

.2 Able to be archived as necessary to prevent loss of information.

.6 Operator Control Software Module: to support entry of information into system from keyboard and mouse, disk, or from another network device. Display of information to user; dynamic displays, textual displays, and graphic displays to display logging and trending of system information and following tasks:

.1 Automatic logging of digital alarms and change of status messages.

.2 Automatic logging of analog alarms.

.3 System changes: alarm limits, set-points, alarm lockouts.

.4 Display specific point values, states as selected.

.5 Provide reports as requested and on scheduled basis when required.

.6 Display graphics as requested, and on alarm receptions (user's option).

.7 Display list of points within system.

.8 Display list of systems within building.

.9 Direct output of information to selected peripheral device.

.10 On-line changes:

.1 Alarm limits.

.2 Setpoints.

.3 Deadbands.

.4 Control and change of state changes.

.5 Time, day, month, year.

.6 Control loop configuration changes for controller-based CDLs.

.7 Control loop tuning changes.

.8 Schedule changes.

.9 Changes, additions, or deletions, of points, graphics, for installed and future systems.

.11 According to assigned user privileges (password definition) following functions are to be supported:

.1 Permit operator to terminate automatic (logic based) control and set value of site point to operator selected value. These values or settings to remain in effect until returned to automatic (logic based) control by operator.

.2 Requests for status, analog values, graphic displays, logs and controls to be through user interface screens.

.12 Software and tools utilized to generate, modify and configure building controllers to be installed and operational on the OWS.

.7 Dial-up host Module for off site OWSs.

.1 Operators at dial-up OWS to be able to perform control functions, report functions, data base generation and modification functions as described for OWS's connected via LAN. Provide routines to automatically answer calls and either file or display information sent from remote panels.

.2 Operator to be able to access remote buildings by selection of facility by its logical name. Dial-up module to maintain user-definable cross-reference of buildings and associated telephone numbers without manual dialing.

.3 Local OWS may serve as dial-up host for remotely connecting OWSs, remote controllers or networks. Alarms and data file transfers handled via dial-up transactions must not interfere with local LAN activity. LAN activity not to prevent work-station from handling incoming calls.

.8 Message Handling Module - and Error Messages: to provide message handling for following conditions:

.1 Message and alarm buffering to prevent loss of information.

.2 Error detection correction and retransmission to guarantee data integrity.

.3 Informative messages to operator for data error occurrences, errors in keyboard entry, failure of equipment to respond to requests or commands and failure of communications between EMCS devices.

.9 Access Control Module.

.1 Minimum 5 levels of password access protection to limit control, display, or data base manipulation capabilities. Following is preferred format of progression of password levels:

.1 Guest: no password data access and display only.

.2 Operator Level: full operational commands including automatic override.

.3 Technician: data base modifications.

.4 Programmer: data base generation.

.5 Highest Level: system administration - password assignment addition, modification.

.2 User-definable, automatic log-off timers from 1 to 60 min. to prevent operators leaving devices on-line inadvertently. Default setting = 3 minutes.

.10 Trend Data Module: includes historical data collection utility, trend data utility, control loop plot utility. Each utility to permit operator to add trend point, delete trend point, set scan rate.

.1 Historical data collection utility: collect concurrently operator selected real or calculated point values at operator selectable rate 30-480 minutes. Samples to include for each time interval (time-stamped), minimum present value, maximum present value, and average present value for point selected. Rate to be individually selectable for each point. Data collection to be continuous operation, stored in temporary storage until removed from historical data list by operator. Temporary storage to have at least 6 month capacity.

.2 Trend data utility: continuously collect point object data variables for variables from building controllers as selected by operator, including at minimum; present value of following point object types - DI, DO, AI, AO, set points value, calculated values. Trend data utility to have capacity to trend concurrently points at operator-selectable rate of 05 seconds to 3600 seconds, individually selectable for selected value, or use of COSV detection. Collected trend data to be stored on minimum 96 hours basis in temporary storage until removed from trend data list by operator. Option to archive data before overwriting to be available.

.3 Control loop plot utility: for AO Points provide for concurrent plotting of Measured value input - present value, present value of output, and AO setpoint. Operator selectable sampling interval to be selectable between 1 second to 20 seconds. Plotting utility to scroll to left as plot reaches right side of display window. Systems not supporting control loop plot as separate function must provide predefined groups of values. Each group to include values for one control loop display.

.4 Trend data Module to include display of historical or trend data to OWS screen in X Y plot presentation. Plot utility to display minimum of 6 historical points or 6 trend points concurrently or 1 Control Loop Plot. For display output of real time trend data, display to automatically index to left when window becomes full. Provide plotting capabilities to display collected data based on range of selected value for (Y) component against time/date stamp of collected data for (X) component.

.5 Provide separate reports for each trend utility. Provide operator feature to specify report type, by point name and for output device. Reports to include time, day, month, year, report title, and operator's initials. Implement reports using report module. Ensure trend data is exportable to third party spreadsheet or database applications for PCs.

.11 Report Module: reports for energy management programs, function totalization, analog/pulse totalization and event totalization features available at MCU level. Refer also to Section 25 30 01 - EMCS: Building Controllers.

.1 Reports to include time, day, month, year, report title, operator's initials.

.2 Software to provide capability to:

.1 Generate and format reports for graphical and numerical display from real time and stored data.

.2 Print and store reports as selected by operator.

.3 Select and assign points used in such reports.

.4 Sort output by area, system, as minimum.

.3 Periodic/automatic report:

.1 Generate specified report(s) automatically including options of start time and date, interval between reports (hourly, daily, weekly, monthly), output device. Software to permit modifying periodic/automatic reporting profile at any time.

.2 Reports to include:

.1 Power demand and duty cycle summary: see application program for same.

.2 Disabled "Locked-out" point summary: include point name, whether disabled by system or by operator.

.3 Run time summary: summary of accumulated running time of selected equipment. Include point name, run time to date, alarm limit setting. Run time to accumulate until reset individually by operator.

.4 Summary of run time alarms: include point name, run time to date, alarm limit.

.5 Summary of start/stop schedules: include start/stop times and days, point name.

.6 Motor status summary.

.4 Report types:

.1 Dynamic reports: system to printout or display of point object data value requested by operator. System to indicate status at time of request, when displayed, updated at operator selected time interval. Provide option for operator selection of report type, by point name, and/or output device. Ensure reports are available for following point value combinations:

.2 Points in accessible from this OWS (total connected for this location), multiple "areas".

.3 Area (points and systems in Area).

.4 Area, system (points in system).

.5 System (points by system type).

.6 System point (points by system and point object type).

.7 Area point (points by system and point object type).

.8 Point (points by point object type).

.5 Summary report: printout or display of point objet data value selected by operator. Report header to indicate status at time of request. Ensure reports are available on same basis as dynamic reports. Provide option as to report type, point name, output device.

.6 Include preformatted reports as listed in Event/Alarm Module.

.12 Graphics Display Module: graphics software utility to permit user to create, modify, delete, file, and recall graphics required by Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

.1 Provide capacity for 100% expansion of system graphics. Graphic interface to provide user with multiple layered diagrams for site, building in plan view, floor furniture plan view and building systems, overlayed with dynamic data appropriately placed and permitting direct operator interaction. Graphic interface to permit operator to start and stop equipment, change set points, modify alarm limits, override system functions and points from graphic system displays by use of mouse or similar pointing device.

.2 Display specific system graphics: provide for manual and/or automatic activation (on occurrence of an alarm). Include capability to call up and cancel display of graphic picture.

.3 Library of pre-engineered screens and symbols depicting standard air handling components (fans, coils, filters, dampers, VAV), complete mechanical system components (chillers, boilers, pumps), electrical symbols.

.4 Graphic development, creation, modification package to use mouse and drawing utility to permit user to:

.1 Modify portion of graphic picture/schematic background.

.2 Delete graphic picture.

.3 Call up and cancel display of graphic picture.

.4 Define symbols.

.5 Position and size symbols.

.6 Define background screens.

.7 Define connecting lines, curves.

.8 Locate, orient, size descriptive text.

.9 Define, display colours of elements.

.10 Establish co-relation between symbols or text and associated system points or other graphic displays.

.5 User to be able to build graphic displays showing on-line point data from multiple MCU panels. Graphic displays to represent logical grouping of system points or calculated data based upon building function, mechanical system, building layout, other logical grouping of points which aids operator in analysis of facility operation. Data to be refreshed on screen as "changed data" without redrawing of entire screen or row on screen.

.6 Dynamic data (temperature, humidity, flow, status) to be shown in actual schematic locations, to be automatically updated to show current values without operator intervention.

.7 Windowing environment to allow user to view several graphics simultaneously to permit analysis of building operation, system performance, display of graphic

associated with alarm to be viewed without interrupting work in progress. If interface is unable to display several different types of display at same time, provide at minimum 2OWS's.

.8 Utilize graphics package to generate system schematic diagrams as required in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation, and as directed by Owner. In addition provide graphics for schematic depicted on mechanical plan flow diagrams, point lists and system graphics. Provide graphic for floor depicting room sensors and control devices located in their actual location. For floor graphic include secondary diagram to show TCU-VAV box actuator and, flow sensor. Diagram to be single line schematic of ductwork as well as associated heating coil or radiation valve. Owner to provide CAD floor layouts. Provide display of TCU-VAV's in table form, include following values as minimum; space temp, setpoint, mode, actual flow, min flow setpoint, max flow setpoint, cooling signal value, and heating signal value. Organize table by rooms and floor groupings.

.9 Provide complete directory of system graphics, including other pertinent system information. Utilize mouse or pointing device to "point and click" to activate selected graphic.

.10 Provide unique sequence of operation graphic or pop-up window for each graphic that is depicted on OWS. Provide access to sequence of operation graphic by link button on each system graphic. Provide translation of sequence of operation, a concise explanation of systems operation, from control descriptive logic into plain English language.

.13 Event/Alarm Module: displays in window alarms as received and stored in General Event Log.

.1 Classify alarms as "critical", "cautionary", "maintenance". Alarms and alarm classifications to be designated by personnel requiring password level.

.2 Presentation of alarms to include features identified under applicable report definitions of Report Module paragraph.

.3 Alarm reports.

.1 Summary of points in critical, cautionary or maintenance alarm. Include at least point name, alarm type, current value, limit exceeded.

.2 Analog alarm limit summary: include point name, alarm limits, deviation limits.

.3 Summary of alarm messages: include associated point name, alarm description.

.4 Software to notify operator of each occurrence of alarm conditions. Each point to have its own secondary alarm message.

.5 EMCS to notify operator of occurrence of alarms originating at site device within following time periods of detection:

.1 Critical - 5 seconds.

.2 Cautionary - 10 seconds.

.3 Maintenance - 10 seconds.

.6 Display alarm messages in English.

.7 Primary alarm message to include as minimum: point identifier, alarm classification, time of occurrence, type of alarm. Provide for initial message to be

automatically presented to operator whenever associated alarm is reported. Assignment of secondary messages to point to be operator-editable function. Provide secondary messages giving further information (telephone lists, maintenance functions) on per point basis.

.8 System reaction to alarms: provide alarm annunciation by dedicated window (activated to foreground on receipt of new alarm or event) of OWS with visual and audible hardware indication. Acknowledgement of alarm to change visual indicator from flashing to steady state and to silence audible device. Acknowledgment of alarm to be time, date and operator stamped and stored in General Event Log. Steady state visual indicator to remain until alarm condition is corrected but must not impede reporting of new alarm conditions. Notification of alarm not to impede notification of subsequent alarms or function of Controller's/CDL. Do not allow random occurrence of alarms to cause loss of alarm or over-burden system. Do not allow acknowledgement of one alarm as acknowledgement of other alarms.

.9 Controller network alarms: system supervision of controllers and communications lines to provide following alarms as minimum:

.1 Controller not responding - where possible delineate between controller and communication line failure.

.2 Controller responding - return to normal.

.3 Controller communications bad - high error rate or loss of communication.

.4 Controller communications normal - return to normal.

.10 Digital alarm status to be interrogated every 2 seconds as minimum or be direct interrupting non-polling type (COV). Annunciate each non-expected status with alarm message.

.14 Archiving and Restoration Module.

.1 Primary OWS to include services to store back-up copies of controller databases. Perform complete backup of OWS software and data files at time of system installation and at time of final acceptance. Provide backup copies before and after Controller's revisions or major modifications.

.2 Provide continuous integrity supervision of controller data bases. When controller encounters database integrity problems with its data base, system to notify operator of need to download copy data base to restore proper operation.

.3 Ensure data base back-up and downloading occurs over LAN without specialized operator technical knowledge. Provide operator with ability to manually download entire controller data base, or parts thereof as required.

.15 CDL Generator and Modifier Module.

.1 CDL Generator module to permit generation and modification of CDLs.

.2 Provide standard reference modules for text based systems module that will permit modification to suit site specific applications. Module to include cut, paste, search and compare utilities to permit easy CDL modification and verification.

.3 Provide full library of symbols used by manufacturer for system product installed accessible to operators for systems using graphical environment for creation of CDLs Module to include graphic tools required to generate and create new object code for downloading to building controllers.

.4 Module to permit testing of code before downloading to building controllers.

2.6 ADDITIONAL UTILITY SOFTWARE

.1 Supply and install on primary OWS, following CAD software products by Autodesk Inc. and include:

.1 AutoCAD LT latest version.

.2 Include special drivers, fonts, to ensure complete and proper functioning of software packages specified. Deliver system complete with full set of User Manuals.

.3 Enter soft copy submissions, including "Record" drawings specified in Section 01 33 00 - Submittal Procedures in OWS.

.4 Enter soft copy of Architectural, Electrical, Mechanical systems plans and "Record" drawings in OWS. Plans and drawings to be provided by Owner.

Part 3 Execution

3.1 INSTALLATION REQUIREMENTS

.1 Provide necessary power as required from local 120 V emergency power branch circuit panels for OWS's and peripheral equipment.

.1 Install tamper locks on breakers of circuit panels.

.2 Refer to UPS requirements stated under OWS Hardware in PART 2.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 01 - General Requirements

.2 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning

.3 Section 25 05 01 - EMCS: General Requirements

.4 Section 25 05 54 - EMCS: Identification

.5 Section 25 90 01 - EMCS: Site Requirements Applications and Systems

1.2 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI):

.1 ANSI/IEEE C57.13-2016, Standard Requirements for Instrument Transformers.

.2 ASTM International (ASTM):

.1 ASTM B148-18, Standard Specification for Aluminum-Bronze Sand Castings

.3 National Electrical Manufacturer's Association (NEMA):

.1 NEMA 250-2018, Enclosures for Electrical Equipment (1000 Volts Maximum)

.4 Air Movement and Control Association, Inc. (AMCA):

.1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating

.5 CSA Group (CSA):

.1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion-resistant.

.3 Operating conditions: 0 - 32°C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

2.2 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:

.1 Thermocouples: limit to temperature range of 200°C and over.

.2 RTD's: 100 or 1000 ohm at 0°C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm °C.

.3 Sensing element: hermetically sealed.

.4 Stem and tip construction: copper or type 304 stainless steel.

.5 Time constant response: less than 3 seconds to temperature change of 10°C.

.6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100, 150 mm as indicated.

.2 Room temperature sensors and display wall modules.

.1 Room temperature sensors.

.1 Wall mounting, in slotted type covers having brushed aluminum, brushed stainless steel finish, with guard as indicated.

.2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2°C.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0°C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01°C per volt change.

.3 Output signal: 4 - 20 mA into500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.

.7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50°C.

.10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.

.11 Transmitter ranges: select narrowest range to suit application.

2.4 CONTROL VALVES

.1 Body: globe style.

.1 Flow characteristic as indicated on control valve schedule: linear, equal percentage, quick-opening.

.2 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.

.3 Normally open, normally closed, as indicated.

.4 Two or three port, as indicated port, as indicated.

.5 Leakage rate ANSI class IV, 0.01% of full open valve capacity

.6 Packing easily replaceable.

.7 Stem, stainless steel.

.8 Plug and seat, bronze.

.9 Disc, replaceable, material to suit application.

.10 NPS 2 and under:

.1 Screwed National Pipe Thread (NPT) tapered female connections.

.2 Valves to ANSI Class 250, valves to bear ANSI mark

.3 Rangeability 50:1 minimum.

.11 NPS 2½ and larger:

.1 Flanged connections.

.2 Valves to ANSI Class 150 or 250 as indicated, valves to bear ANSI mark

.3 Rangeability 100:1 minimum.

2.5 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Control signal: 0-10V DC or 4-20 mA DC.

.3 Positioning time: to suit application.

.4 Fail to normal position as indicated.

.5 Scale or dial indication of actual control valve position.

.6 Size actuator to meet requirements and performance of control valve specifications.

.7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

.8 Minimum shut-off pressure: refer to control valve schedule.

2.6 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required.

.3 Panels to be lockable with same key.

2.7 WIRING

.1 For wiring under 70 volts use FT4 rated wiring. All wiring to be in conduit.

.2 Wiring must be continuous without joints.

.3 Sizes:

.1 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.

.2 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Electrical:

.1 Complete installation in accordance with Section 25 90 01 - EMCS: Site Requirements.

.2 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.3 Install communication wiring in conduit.

.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.4 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise.

3.2 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.5 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Division 01 - General Requirements

1.2 SEQUENCING

.1 Perimeter Radiation:

.1 On a drop in space temperature below the space temperature setpoint, control valve(s)
associated with perimeter radiation heat shall open.

.2 On a rise in space temperature below the space temperature setpoint, control valve(s)
associated with perimeter radiation heat shall close.

.3 EMCS shall monitor temperature and alarm if space temperature exceeds setpoint.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Labour, products, equipment, and services necessary for wires and cables 0 - 1000 V Work in accordance with the Drawings and Specifications. Cable tray with copy of ULC certificate and/or proof of CSA approvals excluding Signals scope of work.

1.2 DESIGN REQUIREMENTS

.1 Cables, wires and conductors shall be designed to withstand the environmental conditions to which they are exposed without damage or degradation of operating characteristics.

.2 The voltage drop in an installation shall not exceed.

.1 3% in a feeder or branch circuit; and

.2 5% from the supply side of the hydro service to the point of utilization.

.3 The calculation of the size of conductors to downstream equipment shall be based on the full current rating of the downstream equipment. Calculation based on demand loads or a derated load is not allowed.

.4 Cables and wires exposed to sunlight shall be sunlight resistant.

.5 There are to be no cable splices allowed below grade.

.6 Control cables shall be provided with a minimum quantity of 25% spare and unused conductors per cable (rounded up to nearest single conductor value).

1.3 RELATED REQUIREMENTS

.1 Section 26 05 31 - Splitter Boxes, Junction Boxes and Pullboxes.

.2 Section 26 05 34 - Raceway for Electrical Systems.

1.4 REFERENCE STANDARDS

.1 Ontario Electrical Safety Code (OESC).

.2 Ontario Building Code (OBC).

.3 CSA Z462, Workplace Electrical Safety.

.4 CAN3 C235, Preferred Voltage Levels for AC Systems, 0 to 50,000V.

.5 ASTM B3, Standard Specification for Soft or Annealed Copper Wire.

.6 ASTM B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

.7 ASTM D1047, Standard Specification for Poly (Vinyl Chloride) Jacket for Wire and Cable.

.8 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

.9 CSA C22.2 No. 38, Thermoset Insulated Wires and Cables.

.10 CSA C22.2 No. 49, Flexible cords and Cables.

.11 CSA C22.2 No. 74, Cables and Cable Glands for use in Hazardous Locations.

.12 CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables.

.13 CSA C22.2 No. 123, Aluminum Sheathed Cables.

.14 NFPA 130, National Fire Protection Association Standard for Fixed Guideway Transit and Passenger Rail System.

.15 CSA, Canadian Standards Association.

.16 ESA, Electrical Safety Authority and Bulletins.

.17 IEEE, Institute of Electrical and Electronics Engineers.

.18 NEMA, National Electronic Manufacturers Association.

.19 OPS, Ontario Provincial Standards.

.20 ULC, Underwriters' Laboratories of Canada.

.21 SSPC, Surface Preparation Standards.

1.5 SPARE PARTS

.1 Not applicable.

1.6 TRAINING

.1 Not applicable.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Site examination:

.1 Visually verify during site examination of cables and conductors that cable end factory temporary seals have remained intact, insulation has not been exposed to air and no moisture has entered cable insulation.

.2 Storage:

.1 Cables shipped from manufacturer with ends temporarily sealed against moisture ingress.

.2 When cables cut in field, seal exposed end using standard sealing compound and PVC tape in accordance with cable manufacturer’s recommendation.

.3 Store cable in clean dry location or as specified by manufacturer.

.3 Handling:

.1 Uncoil cable by rolling or rotating supply reel (available from manufacturer) to ease handling and prevent possible snarling and kinking. Do not pull from coil periphery or center.

.2 Take precautions necessary to prevent damage to cable from contact with sharp objects, including pulling over foreign objects or sheaves.

1.8 SUBMITTALS

.1 Product Data and Shop Drawings Package:

.1 Submit manufacturer's Product data indicating:

.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

.3 Product transportation, storage, handling, and installation requirements.

.4 Product identification.

.2 Shop Drawings:

.1 Submit Shop Drawings indicating:

.1 All cables used on Contract.

.2 If cable termination deviates from installation details, provide shop drawings for review.

.3 If cable supports deviate from installation details, provide shop drawings for review.

.4 Identification.

1.9 QUALITY ASSURANCE

.1 Manufacturers Qualifications Company specializing in manufacturing products specified in this Section with minimum 10 years documented experience.

.2 Regulatory Requirements: Furnish products listed and classified by CSA and ULC, as suitable for application, and shall be stamped accordingly.

.3 Coordination:

.1 Coordinate Work specified in this Section with work provided under other electrical work and work of other trades.

.2 Provide core drilling where required prior to commencing Work.

Part 2 Products

2.1 POWER WIRE AND CABLE

.1 All conductors shall be stranded copper.

.2 Conductors smaller than No. 12 AWG shall not be permitted for lighting or motor branch circuit wiring, except that No. 14 AWG multi-strand type conductors may be used for control circuits only. All conductors larger than No. 14 AWG shall be multi- stranded.

.3 The insulation shall be one level higher than required by Code. I.e. if 300 V insulation is required by Code then 600 V insulation shall be provided. The minimum insulation ratings shall be 600 V.

.4 Insulation shall be chemically cross-linked thermosetting polyethylene material rated RW90, and RWU90 for underground installation or as indicated on Drawings.

.5 All wires shall be free of splices between terminations unless indicated otherwise.

.6 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper and be suitable for applications as noted in governing local electrical code.

.7 "RW90" CSA certified, single copper conductor to CSA C22.2 No. 38, voltage rating as per clause 2.01.3, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.

.8 "RWU90" CSA certified, single copper conductor to CSA C22.2 No. 38, voltage rating as per clause 2.01.3, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, extra thickness X-link polyethylene (XLPE) insulation suitable for wet and buried installations, colour coded.

.9 "AC90" flexible armoured cable with "RW90" conductors and bare copper ground conductor and overall interlocked aluminium tape armour, to CSA C22.2 No. 51 (R2004).

2.2 CONNECTORS

.1 General:

.1 materials: CSA approved and/or ULC listed and labelled as required by local governing authorities and codes;

.2 certification: CSA C22.2 No. 65;

.3 connectors marked with certification, manufacturer, manufacturer catalogue number and approval for conductor size and type.

.2 Armoured cable connectors of proper squeeze type connectors and plastic anti-short bushings at terminations.

.3 Connectors for conductors connecting to devices in accordance with local governing electrical requirements, equal to Ideal Industries No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts rated, contoured wing design, fire retardant shell, twist on pressure type connectors. Wire connectors to be Marrete type other than for lighting circuit wirings.

.4 Splice connectors to line voltage branch circuit conductors and feeders to be CSA approved compression type connectors as follows:

.1 of voltage rating to suit application;

.2 typically for conductors No 8 AWG and greater;

.3 long barrel, double crimp compression; or insulated lug within NEMA rated enclosures.

.4 tin plated seamless copper tubing;

.5 chamfered barrel;

.6 colour coded for die identification;

.7 used with manufacturer’s matching dies and compression tool;

.8 covered with suitable 3M or Raychem flexible polyolefin, fire resistant, heat shrink tubing.

.5 For conductors sized #10AWG and greater, provide long barrel double crimp, 2-hole compression type lug connectors, unless otherwise noted.

2.3 CONTROL WIRE AND CABLE (MATERIAL SPECIFICATION)

.1 Insulation:

.1 RW90 or RWU90 thermosetting XLPE insulated.

.2 Minimum 600 V insulation.

.2 Conductors:

.1 Soft annealed copper having physical characteristics in accordance with ASTM B3.

.2 Minimum conductor size No.14 AWG, unless otherwise indicated on the Drawings.

.3 No.8 AWG, No.10 AWG, No.12 AWG, and No.14 AWG conductors stranded with 7 concentric strands per conductor, conforming to CSA C22.2 No. 38 Thermo-insulated wires and cables.

.3 Identification:

.1 Individual conductors of multi-conductor cable identified by a unique solid coloured insulation.

.4 Tests:

.1 Dielectric strength and insulation resistance tests performed on finished cable per CSA C22.2 No. 75 Thermoplastic-Insulated Wires and Cables.

2.4 IDENTIFICATION

.1 Provide nameplates, warning signs and labels as required by the AHJ.

Part 3 Execution

3.1 PROJECT CONDITIONS

.1 If identified in documents, verify that field measurements and conditions are as identified.

.2 Unless specifically noted, cable routing on drawings is schematic and approximate and not reflective of elevations. Route cable as required to meet project conditions. Determine exact routing and lengths on site.

.3 Confirm fire protection ratings of construction to ensure that rooms and paths of conductors are fire rated in accordance with local governing codes requirements. Include fire rated conductors as required to meet local governing codes requirements.

3.2 CO-ORDINATION

.1 Co-ordinate work with work provided under other electrical work and work of other trades.

.2 Submit any alternative cable routing to Consultant for review prior to proceeding with work.

3.3 WIRING METHODS

.1 Use wiring methods required by the Authority Having Jurisdiction (AHJ), the Ontario Electrical Safety Code (OESC), the Ontario Building Code (OBC) and as indicated on the Drawings, manufacturer’s instructions, and as specified herein.

.2 When bundling cables, comply with manufacturer’s recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

.3 Protect wire and cable from kinks.

.4 Provide grommets and strain relief where required.

3.4 INSTALLATION OF WIRES AND CABLES

.1 Supply and install conductors and cables as detailed in Drawings and Specifications and as required and as recommended by the manufacturer to ensure proper operation of all control panels and peripheral devices. Use pathways (by Division 26) to distribute the cables throughout the facility.

.2 Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connections, allow enough wire to permit at least additional 3 terminations and future moves.

.3 Make any necessary changes or additions to routing of cables and pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically install them in straight lines making 90 degree turns where required.

.4 Verify completion of Work by other trades likely to damage cable.

.5 Provide required conductors. Provide fire rated conductors for applications as required by local governing codes and standards, and requirements of local governing authorities.

.6 In applications where multiple conductors in conduit are being run, if suitable provide trapeze configuration of Unistrut type metal C-channels and threaded rod hangers to support cable/conduit from ceiling slab. Wall mounted cable/conduit brackets and ring type conduit hangers may be permitted in applications approved by Owner and reviewed

with Consultant. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation. Otherwise refer to design drawings for installation details.

.7 Conductors, unless otherwise noted, to be as follows:

.1 underground areas "RWU90";

.2 for connections to electric heating coils in supply air ductwork systems, and for connections to other electric heating equipment where use of 90 degrees C. rated conductors are recommended by heating equipment manufacturer - "RW90";

.3 climate controlled areas branch circuit wiring in accessible ceiling spaces and within stud wall construction consisting of drops down to luminaries and drops down stud walls to devices and in furniture systems - "AC90" flexible armoured cable ("BX") (maximum 6 m (20') run permitted);

.4 for climate-controlled areas wiring except as noted above or specified elsewhere in Specification or as noted on drawings - "RW90".

.8 Splicing of conductors is permitted for replacement of existing conductors and extension as noted on drawings and where approved by Owner and reviewed with Consultant. Splicing of conductors is subject to following conditions:

.1 splicing to extend existing conductors;

.2 for low voltage control and signal conductors, splicing made within an electrical box with terminal strips;

.3 for interior line voltage conductors, splicing made within an electrical box with cold shrink splice kits and mechanical compression connectors; full assembly to suit type and size of conductors and as reviewed with Consultant;

.4 for exterior line voltage conductors, splicing made with outdoor weatherproof cold shrink splice kits and mechanical compression connectors; full assembly to suit type and size of conductors and as reviewed with Consultant;

.5 splice/splice box properly identified with suitable painting or labelling;

.6 splice/splice box clearly identified on "as-built" drawings;

.7 use of pressure type twist connectors only for specific applications with prior review with Consultant, but generally not permitted;

.8 use of "split bolts" is not permitted.

.9 Install compression connectors with proper dies and compression tool as per connector manufacturer’s instructions. Install cold shrink tubing and associated materials as per manufacturer’s instructions.

.10 Coordinate responsibility for provision of control wiring for Mechanical Division equipment and equipment of other Divisions, with respective Divisions of the Work.

.11 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance with local governing electrical code or obtained from Consultant. Conductors not sized or specified of type, to be sized and of type in accordance with requirements of local governing electrical code.

.12 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted. Do not use conductors smaller than No. 6 AWG for exterior luminaire wiring unless otherwise noted.

.13 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraised.

.14 Control conductors, in addition, to be numbered with Brady Ltd. or Electrovert Ltd. Z type markers.

.15 Colour code conductors for communications systems in accordance with system component manufacturer's recommendations.

.16 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.

.17 Install low voltage conductors in conduits, unless otherwise noted within Documents.

.18 Pull in all wires in any one conduit at same time directly from reels or coil carefully to avoid damage to conductors or insulation. In accordance with cable manufacturer's recommendations.

.19 Conductors and cables shall be outdoor rated where installed outdoor and /or installed in locations where they will be exposed to weather elements, including solar radiation.

.20 Conductors and cables shall be underground rated where installed below grade underground.

.21 No joints in any conductors between any boxes or outlets. Neutral conductors unbroken throughout their length. Feeders continuous without splices throughout their entire length unless indicated otherwise.

.22 Use proper crimping tool on pressure applied specific connectors at conductor joints.

.23 Properly designate wire and cable circuits at distribution panelboards and switchboards by specified fibre tag.

.24 Use terminal lugs on conductors No.10 AWG or larger where they are terminated for connection to switchboard or other equipment. Apply lugs with proper tools.

.25 Carefully unroll cable from reels and coil and run cable as complete from one outlet or junction box to next.

.26 Seal space between cables and sleeves or wall or floor opening, with UL listed firestop putty, sealant, compound or pillow, after wires and cables have been installed.

.27 Terminal lugs: Solderless pressure-applied type lugs. Lugs to have conductivity not less than wire or cable to which they are attached.

.28 Soldering lugs: As recommended by cable manufacturer.

3.5 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are:

- .1 Nexans.
- .2 Prysmian Cables (Pirelli).
- .3 General Cable.
- .4 Aetna Cables.
- .5 Kerite Company.
- .6 Texcan.
- .7 Vitalink.
- .8 Southwire.
- .9 Or approved equal.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Labour, products, equipment, and services necessary for splitters, junction boxes, pullboxes and cabinets Work.

1.2 DESIGN REQUIREMENTS

.1 The equipment furnished and the equipment installation, wiring methods and materials used shall conform to the latest edition of the Ontario Electrical Safety Code, Electrical Safety Authority (ESA) Bulletins and Supplements issued by the Electrical Safety Authority. In case of any conflicts, the more stringent requirement shall apply.

.2 Design equipment and systems to all applicable standards of CSA, ULC, IEEE, ESA.

.3 Design equipment and systems to standards and codes to be latest editions adopted by and enforced by local authorities have jurisdiction.

.4 All splitter boxes, junction boxes, pull boxes and cabinets to be as follows except as permitted by other items in this section:

.1 Outdoor or wet indoor location: Stainless steel construction.

.2 Dry indoor location: Powder coated galvanized steel construction.

.5 Minimum thickness of boxes and cabinets steel shall be 1.9 mm.

.6 Size all boxes to accommodate the required number of conduits, conductors and terminal blocks. Provide junction boxes with 20% spare terminal blocks.

.7 Design all boxes flush mounted within roadways to accommodate heavy vehicle traffic as per.

.8 Any fabricated box which houses equipment or controls in it must have OESC or CSA approvals on the assembly.

.9 Provide device boxes of sufficient depth and width to prevent cable curvature in breach of manufacturer’s specification for bending radius.

.10 Provide device boxes of sufficient capacity to permit storage of cable working allowance without interference to outlets and terminations or compromise to cable bending radius limits.

1.3 RELATED REQUIREMENTS

.1 Section 26 05 21 - Electrical Conductors and Cables.

.2 Section 26 05 34 - Raceway for Electrical Systems.

1.4 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 ANSI/ASA 61, Gray Powder Coating.

.2 CAN/CSA C22.2 No. 0, General Requirements – Canadian Electrical Code, Part II.

.3 CAN/CSA C22.2 No. 0.4, Bonding of Electrical Equipment.

.4 CAN/CSA C22.2 No. 26, Wireways, Auxiliary, Gutters and Associated Fittings.

.5 CAN/CSA C22.2 No. 40, Cutout, Junction and Pullboxes.

.6 CAN/CSA C22.2 No. 85-M, Rigid PVC Boxes and Fittings.

.7 CAN/CSA C22.2 No. 94-M, Special Purpose Enclosures.

.8 OESC, The Ontario Electrical Safety Code.

1.6 DELIVERY, STORAGE AND HANDLING

.1 As per manufacturer's recommendations.

1.7 SUBMITTALS

.1 Product Data and Shop Drawings Package:

.1 Product Data:

.1 Submit manufacturer's Product data indicating:

.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

.3 Product transportation, storage, handling, and installation requirements.

.2 Shop Drawings:

.1 Submit Shop Drawings in accordance with Division 01 indicating:

.1 Mounting details, methods and dimensions.

.2 Enclosure type and size.

.3 Internal layout of identified components.

.4 Front panel layout of identified components.

.5 Electrical wiring diagram with internal and external connections.

.6 Bill of material listing all components.

.7 Electrical schematic with description of operations, complete with terminal numbers and field connections.

.8 Identification.

1.8 QUALITY ASSURANCE

.1 All electrical items shall be approved by CSA and/or ULC.

Part 2 Products

2.1 JUNCTION BOXES AND PULL BOXES

.1 Case 1: CSA certified for use with: rigid galvanized steel threaded conduits, liquid- tight flexible conduits:

.1 Outdoor and wet outdoor location:

.1 Enclosures shall be fabricated from minimum 1.9 mm thick stainless sheet steel and be suitable for surface or flush mounting.

.2 Enclosure shall be complete with screw on cover, a neoprene gasket for a water-tight seal and a 1.9 mm thick inner plate.

.3 Enclosures shall be minimum size of 150 mm x 150 mm x 100 mm.

.4 Type EEMAC-4X.

.2 Dry indoor location:

.1 Enclosures shall be fabricated from minimum 1.9 mm thick galvanized sheet steel, powder coated in accordance with ANSI/ASA 61, grey epoxy textured powder electrostatically applied inside and out and be suitable for surface or flush mounting.

.2 Enclosure shall be complete with screw on cover, a neoprene gasket for a water-tight seal and a 1.9 mm thick inner plate.

.3 Enclosures shall be minimum size of 150 mm x 150 mm x 100 mm.

.4 Type EEMAC-4.

.2 Case 2: CSA certified for use with rigid galvanized steel, epoxy or PVC coated inside and out rigid steel, rigid PVC, electrical metallic conduit (EMT), flexible metal conduit and armored cable but excluding:

.1 Outdoor and wet outdoor location:

.1 Enclosures shall be fabricated from minimum 1.9 mm thick stainless sheet steel and be suitable for surface or flush mounting.

.2 Enclosure shall have a screw on cover, conduit knockouts on all 4 sides, 4 internal mounting holes and bonding screw.

.3 Enclosures shall be minimum size of 150 mm x 150 mm x 100 mm.

.4 Type EEMAC-4X.

.2 Dry indoor location:

.1 Enclosures shall be fabricated from minimum 1.9 mm thick galvanized sheet steel, powder coated in accordance with ANSI/ASA 61, grey epoxy textured powder electrostatically applied inside and out and shall be suitable for surface or flush mounting.

.2 Enclosure shall have a screw on cover, conduit knockouts on all 4 sides, 4 internal mounting holes and bonding screw.

.3 Enclosures shall be minimum size of 150 mm x 150 mm x 100 mm.

.4 Type EEMAC-1.

.3 Case 3: CSA certified for use with rigid PVC conduits:

.1 Enclosures shall be fabricated of the same PVC material as and provided by the same manufacturer as PVC conduit.

.4 Where round junction boxes are used they shall be high strength and high impact resistant. Round junction boxes shall be suitable for surface or flush mounting. Enclosure shall be complete with cover, neoprene gasket, 4 tapped holes, 2 external mounting tabs, 4 tapped conduit entries and 2 close-up plugs.

.5 Junction boxes, pull boxes and fittings are to be match the finish of the raceway used.

.6 Embedded Junction Boxes and Pullboxes:

.1 Dry Indoor location:

.1 Fabricate embedded pullboxes from minimum 2.6 mm hot-dip galvanized steel.

.2 EEMAC 4.

.2 Outdoor or wet location:

.1 Fabricate embedded pullboxes from minimum 2.6 mm stainless steel.

.2 EEMAC 4X.

.3 Use extension collars for embedded junction boxes and pullboxes where reinforcing steel interferes with embedded conduits.

.4 Fabricate pullbox covers of same materials as boxes, make covers of minimum 6 mm, non-slip checker plate construction, braced as required, suitable for application.

.5 Fasten box covers by countersunk machine screws or minimum 10 mm nominal diameter bolts.

.7 Construction:welded steel enclosure.

.8 Covers Flush Mounted: 25 mm minimum extension all around.

.9 Covers Surface Mounted: screw-on stainless steel covers.

2.2 SPLITTER BOXES

.1 Dry Indoor Location:

.1 Enclosures shall be fabricated from minimum 1.9 mm thick galvanized sheet steel, powder coated in accordance with ANSI/ASA 61, grey epoxy textured powder electrostatically applied inside and out and shall be suitable for surface mounting.

.2 Type EEMAC-1, sprinkler proof.

.2 Outdoor and wet indoor location:

.1 Enclosures shall be fabricated from minimum 1.9 mm thick stainless steel and shall be suitable for surface mounting.

.2 Type EEMAC-4X.

.3 Enclosure shall have mounting holes, conduit knockouts, bracket hinges, padlocking provision, drip hood and interior panel.

.4 Splitter boxes shall be rated for minimum 600 V, amperage as indicated on Drawings and Specifications.

.5 Fire resistant backing: Fibre cement and galvanized sheet steel composite panel, 9.5 mm thick, 3DF2 by DuraSystem Barriers Inc or approved equivalent.

.6 At least two spare terminals shall be provided on each set of lugs in splitters.

2.3 IDENTIFICATION

.1 Provide identification for equipment and the sub-components. Splitters, junction boxes, pull boxes and cabinets shall have unique names.

.2 Provide nameplates, warning signs and labels as required by the AHJ.

Part 3 Execution

3.1 INSTALLATION

.1 Install splitters, junction boxes, pullboxes and cabinets in locations indicated on Drawings and Specifications to suit Site conditions.

.2 Before proceeding with installation, ensure junction/pull/splitter boxes, conduits and other electrical equipment clear mechanical, architectural and other installations.

.3 Install junction and pullboxes and splitter boxes in accordance with the Ontario Electrical Safety Code (OESC) Section 12 Wiring Methods.

.4 Set boxes and fittings square with adjacent ceiling, floor, wall or beam line and support independently of conduits entering same. Keep unused knockouts flush and tight. Unused nailing or other holes in boxes not permitted.

.5 Locate boxes to be freely accessible. Locate boxes above suspended ceilings within reach of openings for fluorescent fixtures. Install access panels where boxes inaccessible.

.6 Install pullboxes in every conduit run exceeding 45 m between termination points. Space pullboxes 45 m maximum apart. Use maximum 4 quarter bends (45 degree), 2 right angle bends (90 degree), or equivalent, in conduit run between pullboxes.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Labour, products, equipment, and services necessary for raceway for electrical systems Work.

.2 Raceway is defined as any channel designed for holding wires, cables, or busbars, and, unless otherwise qualified in the Rules of the OESC, the term includes conduit (rigid and flexible, metal and non-metallic), electrical metallic and non-metallic tubing, underfloor raceways, cellular floors, surface raceways, wireways, cable trays, busways, and auxiliary gutters.

1.2 RELATED DOCUMENTS

.1 Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.3 DESIGN REQUIREMENTS

.1 The equipment furnished and the equipment installation, wiring methods and materials used shall conform to the latest edition of the Ontario Electrical Safety Code, Electrical Safety Authority (ESA) Bulletins and Supplements issued by the Electrical Safety Authority. In case of any conflicts, the more stringent requirement shall apply.

.2 Design Electrical equipment and systems to all applicable standards of CSA, ULc, IEEE, ESA.

.3 Design electrical equipment and systems to standards and codes to be latest editions adopted by and enforced by local authorities have jurisdiction.

.4 Raceways shall be designed, supplied and installed as a complete system with all conduits, cable trays, fittings, supports, hangers and miscellaneous support materials and hardware as required for the complete systems in accordance with the applicable codes and regulations and as specified herein and on the Specifications.

.5 Raceways shall follow building line with perpendicular changes in direction.

.6 Raceways shall present a neat and clean appearance when installed.

.7 Raceways shall not be mounted directly to walls and ceilings. They shall be hung or mounted on U-channel supports.

.8 Refer to Section 2 of this Specification for design requirements of specific raceway types.

.9 Communications conduit shall be 53 mm unless indicated otherwise.

.10 Exposed conduits shall be metallic, and conduits embedded in concrete shall be non-metallic unless otherwise indicated.

.11 Conduits with an internal diameter of two inches or less shall have a bend radius at least 6 times the internal conduit diameter. Conduits greater than two inches shall have a bend radius at least 10 times the internal conduit diameter.

.12 Terminate conduits stubbed out above accessible ceiling space so that the conduit is parallel with the ceiling and provide an insulating bushing, prior to cable installation.

.13 Terminate conduit at cable trays at an accessible location within 152 mm (6 inch) of tray with an insulated bushing and provide bonding jumper or terminate conduit to the cable tray with an insulated bushing. Provide insulated bushing on conduits prior to cable installation.

1.4 RELATED REQUIREMENTS

.1 Section 26 05 21 - Electrical Conductors and Cables.

.2 Section 26 05 31 - Splitter Boxes, Junction Boxes and Pullboxes.

1.5 REFERENCE STANDARDS

.1 Ontario Electrical Safety Code (OESC).

.2 Ontario Building Code (OBC).

.3 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installations.

.4 NFPA 130, Standard for Fixed Guideway Transit and Passenger Rail Systems.

.5 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.6 ASTM E136, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace 750°C.

.7 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.8 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

.9 CSA C22.2 No. 26, Construction and Test of Wireway, Auxiliary Gutters and Associated

.10 CSA C22.2 No. 45, Rigid Metal Conduit.

.11 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.12 CSA C22.3 No. 7 Underground systems.

.13 CAN/CSA C22.2 No. 62, Surface Raceway Systems.

.14 CSA C22.2 No. 83, Electrical Metallic Tubing.

.15 CSA C22.2 No. 85, Rigid PVC Boxes and Fittings.

.16 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.

.17 CAN/CSA C22.1 No.126.2, Non-Metallic Cable Tray Systems.

.18 EEMAC E14-2, Industrial Controls and System Standard.

.19 National Electrical Manufacturers Association (NEMA)

.20 NEMA FG 1, Fibreglass and Cable Tray Systems.

.21 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.

1.6 SPARE PARTS

.1 Not applicable.

1.7 TRAINING

.1 Not applicable.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver cable tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.

.2 Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

1.9 SUBMITTALS

.1 Product Data and Shop Drawings Package:

.1 Submit manufacturer's Product data indicating:

.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

.2 Submit manufacturer's product data sheets for cable tray, fittings and accessories, indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

.4 Product transportation, storage, handling, and installation requirements.

.5 Product identification.

.6 Identify types of cable trays used.

.2 Submit Shop Drawings indicating:

.1 Location, depth and routing of conduits/ducts buried or encased in concrete.

.2 Provide conduit identification, circuit numbers, conduit routing length and conduit type.

.3 Submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Show actual cable tray installation details and suspension system.

.5 Elevations, sections and details, dimensions, gauges and finishes.

.6 Adjacent construction, elevations, sections and details of components, dimensions, gauges, finishes and relationship to adjacent construction.

.7 Fabrication and installation of cable tray, fittings and supports.

.8 The Drawings, which constitute a part of the Specifications, shall indicate the general route of the cable runway systems. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions and routing, is required.

.9 Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Delivery team is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.10 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 10 years documented experience, whose products have been in satisfactory use in similar service for not less than 10 years.

.2 Regulatory Requirements: Furnish Products listed and classified by CSA and ULC, as suitable for application.

Part 2 Products

2.1 GENERAL

.1 Equipment shall be able to withstand the environmental conditions stated in Section 26 05 00 without damage or degradation of operating characteristics.

.2 Equipment installed in classified hazardous areas shall be suitable rated for the classification.

.3 Provide raceway grounding with a minimum #12 AWG copper conductor run the whole length of the raceway in accordance with OESC (Ontario Electrical Safety Code) requirements. Raceway shall not be treated as ground or bonding path.

.4 Glyptal for exposed threads of conduits and fittings: Red Glyptal metallic type conductive compound.

.5 Supports for mounting conduit fittings, conduit, and boxes where no mounting surface is available: hot-dipped galvanized steel support.

.6 Provide raceway systems for the installation of the communications cabling. Installation shall include raceways, outlet boxes, mud rings, outlet box cover plates and terminal back boards.

2.2 RIGID-GALVANIZED STEEL (RGS) CONDUIT

.1 Material: Hot-dip galvanized steel tubing. Metallic rigid conduit other than hot-dip galvanized rigid steel is unacceptable.

.2 Applications: Indoor and dry locations. Permitted in hazardous locations in accordance with OESC, Section-18, hazardous locations and as indicated on Drawings and Specifications.

.3 Fittings:

.1 Use threaded hubs (bullet hubs) for connections to threadless junction boxes, enclosures and equipment. Threaded hubs shall be of rugged steel/malleable iron construction, electro-zinc plated, complete with nylon insulated throat.

.2 Couplings shall be threaded of rugged steel/malleable iron construction and electro-zinc plated and shall allow conduit coupling without rotating either pipe.

.3 Straps shall be steel/malleable iron construction with hot-dipped galvanized finish.

.4 Expansion/contraction fitting shall be telescopic sleeve type with bonding jumper and made of steel/malleable iron construction with hot-dipped galvanized finish.

.5 Conduit bodies shall be steel/malleable iron with zinc electroplate finish.

.6 Conduit shall be threaded at both ends.

2.3 EPOXY OR PVC COATED RIGID GALVANIZED STEEL CONDUIT (RGSEC)

.1 Material: Hot-dip galvanized steel conduit with 1.020 mm gray PVC or epoxy coating with no sags, blisters or other surface defects. Metallic rigid conduit other than hot- dip galvanized rigid steel is unacceptable.

.2 Applications: locations exposed to the environmental elements (indoor/outdoor).

.3 Fittings: All fittings (e.g. threaded hubs, couplings, conduit bodies, straps, elbows) shall be PVC or epoxy coated rigid galvanized steel and shall have no sags, blisters or other surface defects.

.4 Conduit shall be threaded at both ends.

.5 PVC/Epoxy shall be applied at factory of origin. All fittings shall be of the same type and treatment as the adjoining conduit. All repairs done on deficient conduit requiring

PVC/epoxy shall be done at factory of origin. PVC/epoxy treatment, including repairs, shall not be permitted on site and shall be done in the factory of origin.

2.4 FLEXIBLE METAL CONDUIT

.1 Material: Flexible steel armour.

.2 Restrictions: Not permitted in hazardous classified locations, embedded in concrete or aggregate, in wet locations, exposed to oil or gasoline. It shall not be subject to physical damage and limited to less than 1 m in public areas. It shall be limited to maximum 600 V.

.3 Applications: Exposed or concealed work.

.4 Fittings: Rugged steel/malleable iron construction, electro-zinc plated, nylon insulated throat complete with bushing and locknut.

.5 Grounding conductor to be installed in every conduit.

2.5 LIQUID-TIGHT FLEXIBLE CONDUIT

.1 Material: Corrosion resistant galvanized steel flexible inner core extruded with flexible durable PVC jacket. PVC jacket shall be resistant to sunlight, oils, acids and vapors while providing protection from moisture.

.2 Restrictions: Not permitted in hazardous classified locations, embedded in concrete, aggregate or cinder fill. It shall be limited to maximum 600 V.

.3 Applications: Indoor, outdoor, concealed, wet and dry locations.

.4 Fittings: Compression metallic convolution type suitable for liquid-tight conduit where exposed to moisture, made from steel/malleable iron and electro-zinc plated and chromate coated for corrosion protection, complete with body, gland, locknut, ground cone, sealing gasket and insulator.

.5 Outdoor installation must have a drip loop.

.6 Maximum length allowed is 1.5 m.

.7 Grounding conductor to be installed in every conduit.

2.6 RIGID PVC CONDUIT

.1 Restrictions: Not permitted in hazardous classified locations. It shall not be subject to physical damage. It shall be limited to maximum 600 V.

.2 Fittings: Connectors, couplings, straps, elbows, expansion joint fittings, and conduit bodies shall be of the same material as PVC tubing. Expansion/contraction fitting shall be telescopic sleeve type with O-rings gasket.

.3 Cement shall be solvent type for PVC conduit.

2.7 SURFACE AND LIGHTING FIXTURE RACEWAYS

.1 Surface Raceway System (Wiring Pulled In):

.1 Steel: CSA C22.2 No. 62, one piece, free of sharp edges.

.2 Corners, pull boxes, elbows, tees, two-piece assembly to facilitate site wiring.

.3 Finish: Gloss enamel.

.4 Switch, receptacle, extension boxes, adapters and utility fittings: As required.

.2 Surface Raceway System (Wiring Laid In):

.1 Steel: CSA C22.2 No. 62, two piece, free from sharp edges.

.2 Finish: hot dipped galvanized steel or as specified.

.3 Switch, receptacle, extension boxes, adapters and utility fittings: As required.

.3 Surface Floor Raceway System:

.1 Steel: CSA C22.2 No. 62, two piece, free from sharp edges manufactured as lay in type raceway.

.2 Finish: hot dipped galvanized steel or as specified.

.4 Channel Raceway:

.1 CSA C22.2 No. 62, steel, solid, free from sharp edges.

.5 Plastic Raceway:

.1 Plastic raceway: CSA C22.2 No. 62, rigid extruded PVC with slots on either side of raceway for exit of wiring.

.2 Channel: With solid snap on cover for entire length.

.6 Lighting Fixture Raceway:

.1 Linear fixture support system using channel type raceway with snap on cover.

.2 Channel: 1.6 mm minimum thick.

.3 Clamp hangers with threaded rod /chain /rod hangers.

.7 Fittings:

.1 Elbows, tees, couplings and hanger fittings: CSA C22.2 No. 62, manufactured as accessories to raceway supplied.

Part 3 Execution

3.1 INSTALLATION - GENERAL

.1 The raceways must be installed using tools specified by the Manufacturer. The Installers must be trained and certified by the Manufacturer.

.2 Install raceway in accordance with manufacturer’s instructions to suit specific installation requirements.

.3 Prior to installation of raceway, check installation does not hinder or obstruct equipment or space allocated to other Products.

.4 Red Glyptal metallic type conductive compound for raceways to be applied to exposed threads of conduits and fittings.

.5 Touch-up paint: In accordance with CAN/CGSB 1.181; zinc rich paint shall be used on conduits and fittings for scratches and wrench marks as work progresses.

.6 Carefully clean raceways before and after installation. Clean burrs and free inside surface from imperfections likely to damage wires or cables or injury to personnel.

.7 Immediately before wires or cables pulled into any conduit run, snake with steel band with tube cleaner equipped with spherical mandrel, diameter minimum 85% of nominal inside diameter of conduit. Remove and replace conduits not passing mandrel.

.8 Protect conduits from entrance of water or other foreign matter, by adequate and complete plugging overnight or when work temporarily suspended. Plug ends of conduits with plastic plugs to ensure plugged or capped ends form watertight seal.

.9 A drain fitting shall be provided at the lowest point of all conduits runs.

.10 Install surface mounted conduit parallel to, or at right angles to, structure lines, walls, ceilings or floors. Form bends, off-sets and supply necessary fittings for installation of conduits.

.11 Install conduits to allow conductors to be drawn-in without excessive strain or damage.

.12 Fasten exposed conduit to structures or support systems using straps, as follows:

.1 One-hole straps for conduits 50 mm and smaller.

.2 Two holes straps for conduits larger than 50 mm.

.13 Fasten conduits with anchors spaced maximum 1500 mm apart. Fasten clamps to concrete or masonry with specified anchors.

.14 Conduit fish wire: Install fish wire in conduits to facilitate wire and cable pulling and additional fish wire left in place to facilitate pulling additional wires and cables.

.15 Conduit seal: Oil base compound, non-hardening and adheres to metal, masonry, wood or plastic. Product temperature ranges from 34 to 88°C; minimum installation temperature is -12°C. Manufacturer: Panduit; Cat. No. DS1 and DS5 or approved equivalent.

.16 Install specified expansion or deflection fittings where raceways cross expansion, contraction or deflection joints.

.17 Replace broken conduits which may be caused inadvertently by construction activities.

.18 Where rigid conduit enters pullboxes, junction boxes, panelboards and cabinets, install hub fittings of same material.

.19 Install hot-dipped galvanized steel supports necessary to mount conduit fittings, conduit and boxes in locations where no mounting surface available.

.20 Flexible metal conduit shall not be used for direct connections to panelboards or switchboards.

.21 All conduit penetrations through floor slabs are to be installed to prevent water flow between floors, by means of cast in place galvanized sleeves, built up concrete pad, or sealed galvanized metal water dams. Seal conduit penetrations to prevent smoke or water passage.

.22 Conduits are to be concealed in areas accessible to public, unless indicated otherwise.

.23 Conduits are not allowed to pass through wayfinding sign boxes, light fixtures or enclosures.

.24 Conduits are not allowed to obstruct the view of signage or light fixtures.

.25 Conduits shall not create any obstruction for maintenance.

.26 Cap empty conduits and provide fish wire, allow 3 m of fish wire at each end.

.27 Conduits terminating in enclosures shall include termination hardware.

.28 Provide drainage of manholes and duct banks to storm sewer system per CSA C22.3 No. 7 Underground System.

.29 For communication surface metal raceway connections, provide a minimum 25 mm (1 inch) individual conduit from each surface raceway at cable tray or to the serving communications room.

.30 Grading of ducts shall be from the high point in the line to one or both adjacent subsurface chambers and shall be not less than 1:400. See CSA C22.3 No. 7.

3.2 EXISTING CONDUIT

.1 Assume existing conduits in Work area contain live circuits.

.2 Conduits located in Work area that obstruct and interfere with Work, shall be traced to source and rerouted. Existing equipment shall be maintained and remain operable during duration of Work.

3.3 FIRESTOPPING AND SMOKE SEALS

.1 Maintain the integrity of all floors and fire separations by installing firestopping and smoke seals for all electrical services passing through floors or fire separations.

.2 Where raceway penetrates fire rated construction, provide ULC listed and labelled, fire stopping and smoke seal materials or fittings to protect integrity of fire rated construction. Install work in compliance with ULC standards and where required by local governing codes, provide tray type suitable for plenum environments.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Labour, products, equipment and services necessary for switchboards and panelboards in accordance with the Specifications.

1.2 DESIGN REQUIREMENTS

.1 The equipment furnished and the equipment installation, wiring methods and materials used shall conform to the latest edition of the Ontario Electrical Safety Code, Electrical Safety Authority (ESA) Bulletins and Supplements issued by the Electrical Safety Authority. In case of any conflicts, the more stringent requirement shall apply.

.2 Design electrical equipment and systems to all applicable standards of CSA, ULc, IEEE, ESA.

.3 Design electrical equipment and systems to standards and codes to be latest editions adopted by and enforced by local authorities have jurisdiction.

.4 Switchboards, panelboards and panels shall be sprinkler proof design when indoors.

.5 When panels are installed in weatherproof cabinets or bunker buildings they shall be treated as indoors type, the cabinets and bunker building design shall:

.1 Provide a weather tight, heated and cooled environment like a standard indoor electrical room.

.2 Provide monitoring for hi low temperature alarms, locks or access control, monitor alarms door, occupancy, power loss etc.

.3 Include receptacles and lighting.

.6 Floor mounted switchboards or panelboard shall to be mounted on a housekeeping pad, minimum 103mm high with 53 mm of pad overlap outside the equipment’s perimeter.

.7 No panels, panelboards or switchgear are to be mounted directly to a wall. There shall be a minimum of a u channel stand-off used as the mounting.

1.3 RELATED REQUIREMENTS

.1 Section 26 28 00 - Circuit Breakers and Fuses.

1.4 REFERENCE STANDARDS

.1 Ontario Electrical Safety Code (OESC).

.2 Ontario Building Code (OBC).

.3 CSA Z462, Workplace Electrical Safety.

.4 CAN3 C235, Preferred Voltage Levels for AC Systems, 0 to 50,000V.

.5 CAN/CSA-C22.2 No.29, Panelboards and Enclosed Panelboards.

.6 CAN/CSA-C22.2 No.31, Switchgear Assemblies.

.7 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.8 CSA C22.2 No. 0.4, Bonding of Electrical Equipment.

.9 CSA C22.2 No. 5, Moulded Case Circuit Breakers, Molded – Case Switches and Circuit-Breaker Enclosures.

.10 CSA C 22.2 No. 94, Enclosures for electrical equipment, non-environmental considerations.

.11 CSA C22.2 No. 0, General Requirements - Canadian Electrical Code, Part 2.

.12 NFPA 130, National Fire Protection Association Standard for Fixed Guideway Transit and Passenger Rail System.

.13 UL, Underwriters' Laboratories.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Contractor to protect equipment from weather and moisture by covering with heavy plastic or canvas and by maintaining heat within enclosure in accordance with manufacturer's instructions.

.2 Provide energized strip heater in each cell to maintain dry condition during storage.

.3 Manufacturer responsible to ship product to site once approval to ship has been given by the Contractor.

.4 Contractor to accept equipment on site and inspect for shipping damage.

1.6 SUBMITTALS

.1 Product Data and Shop Drawings Package:

.1 Product Data:

.1 Include electrical characteristics including service type, voltage, continuous current, power (kVA), short circuit rating, interrupting ratings, vertical and horizontal power bus sizes, neutral and ground bus size and arrangements, bracing and devices withstand ratings.

.2 Include mechanical characteristics including enclosure type, outline and support point dimensions, mounting arrangements, clearance requirements, feeder's entry provisions for bus duct, cable terminal sizes, size and location of connections, finishes, etc.

.3 Include complete bill of materials. Include catalog numbers for circuit breakers, switches, fuses, transformers and other devices as required.

.4 List all options and accessories furnished.

.5 Provide detailed product data sheets or manuals for review when required to evaluate submittal.

.6 Product transportation, storage, handling, and installation requirements.

.7 Product identification.

.2 Shop Drawings:

.1 Submit Shop Drawings indicating:

.1 Wiring diagrams and control schematics.

.2 Feeders and conduit entry/exit location. Front view elevation, floor plan, top view, configuration of compartments and layouts with dimensions, weights and anchoring method indicated.

.3 Connection details between close coupled assemblies and composite floor plan of close coupled assemblies. Nameplate legends.

.4 Electrical and control drawings shall be done in electronic file format and submitted in printed and electronic editable format.

.5 Identification.

.2 Commissioning Package:

.1 Submit the following:

.1 Commissioning Plan.

.2 Commissioning Procedures.

.3 Certificate of Readiness.

.4 Performance criteria and maintenance data.

.5 Safety precautions.

.6 Test Reports: factory tests report.

.7 Manufacturer's installation instructions.

.8 Manufacturer's Field Reports: commissioning report on field tests, including test forms and confirming proper installation prior to energization.

.3 Record Documents:

.1 As built drawings including any field modifications.

.2 Operation and Maintenance Data: As built product data including any field modifications.

Part 2 Products

2.1 GENERAL

.1 switchboards and panelboards require a main meter and a main isolation breaker.

.2 Any switchboards and panelboards used as the main service board shall include spare capacity for future growth.

.3 All equipment ratings shall be selected from industry standard ratings only.

2.2 SWITCHBOARDS

.1 Factory assembled, dead front, metal enclosed and self-supporting switchboard. Complete with line and load side terminations.

.2 Bus material to be copper, silver-plated, including connections to circuit breakers and current transformers in switchboard cubicles.

.3 Bus bracing minimum 65 kA rms at 600VAC.

.4 Enclosure:

.1 Minimum CSA type 2, indoor use equipped with arc flash reduction protection.

.2 Fabricate indoor switchboard from minimum 2.68 mm (12 gauge) thick sheet metal enclosure, steel clad, bolted assembly with gasketed top plates, continuous channel-iron floor sills and steel lifting eyes.

.3 Provide three latching points and padlocked handle operating extended bar to latching points at top and bottom.

.4 Door to swing 135°.

.5 Control compartments to be installed on front of the board away from buses.

.6 Future Provisions: fully equipped spaces for future devices with bussing and bus connections.

.7 Provide 25% spare breakers on new installations.

.8 Provide 25% spare space for future additional breakers. Allow space in the room for expansion of the switchboard by one additional cabinet.

.9 Install ground bus in lower part of each switchboard section. Run continuous bare copper bus minimum 50 x 6 mm entire length of switchboard. Fabricate breaker compartment with one solderless type ground bus size 2/0 AWG.

.10 Control wiring and terminals:

.1 Complete internal control wiring and include terminal blocks for external connection.

.2 Number wiring at both ends.

.3 Make minimum control wire size No. 14 AWG copper except where larger size 12 AWG conductors needed for current-carrying requirements.

.4 Make conductors of stranded copper for fixed wiring and extra flexible copper for hinge wiring and rated for 600 volts.

.5 Clearly and permanently identify terminals and control wiring terminations.

.6 Make compression type (solderless) lugs for terminal block point for incoming control and instrument wires.

.11 Main and branch moulded case circuit breakers:

.1 See Section 26 28 00.

.2 The switchboard shall be provided with main circuit breakers with 100% rated, fixed mounted dead front breakers of frame and trip rating as indicated on Drawings and Specifications.

.12 Metering Compartments:

.1 Provide metering compartment in accordance with Local Hydro Metering standard.

.2 Meters shall be mounted at eye level (approximately at 5’-6” A.F.F), and have no exposure to 600 Volt bus or terminators.

2.3 PANELBOARDS

.1 Panelboards: To CSA C22.2 No. 29 and Canadian Electrical Code requirements, including barriers.

.2 Rated at 120/208 V or 600/347 V, 3 phase, 4 wire, for distribution of normal and emergency power for lighting circuits, control circuits, power circuits and electric heating circuits as shown on Specifications and unless noted otherwise.

.3 Panelboard interiors shall be factory assembled, with bolt-on circuit breakers and designed so circuit breakers for replacement without disturbing adjacent devices and without removing main bus connectors.

.4 Panelboard shall not be larger than 84 circuit.

.5 Panelboards are to come with tin plated copper buses, bus bracing minimum 15 kA @ 240 V AC or 22 kA @ 600 V AC unless noted otherwise.

.6 Main bus bars shall be rated for continuous current as indicated on the Specifications. Bussing shall be of sufficient cross- sectional area to meet CSA C22-2 No. 29 standard for temperature rise.

.7 Panelboard shall be copper bus type, with full capacity solid neutral design and sequence style bussing, composed of an assembly of bolted-in-place moulded case circuit breakers (refer to Section 26 28 00) Solidly bonded copper ground bus shall be provided.

.8 All circuit carrying parts shall be insulated from ground and phase-to–phase by high dielectric strength barrier or equivalent.

.9 Main circuit breaker panelboard interior shall be field convertible for top or bottom incoming feed.

.10 The panelboard shall have a meter that will connect to the remote supervisory system.

.11 All unused space provided, unless otherwise specified, shall be fully equipped for future devises, including all appropriate connectors and mounting hardware.

.12 Interior trim shall be dead-front construction to shield user from energized parts. Empty spaces shall be provided with blanking plates.

.13 Connections with solderless lugs on main and neutral busbars and at circuit breaker load terminals.

.14 Constructed from galvanized steel sheet, of thickness equal to code gauge for similar steel cabinets, fabricated by "forming up" and having spot welded seams. Panelboard cabinet assembly to comply with CSA enclosure type 2.

.15 Panelboards shall not be of the door-in-door type (interior swing door).

.16 Overcurrent devices feeding emergency equipment shall be located only in electrical equipment rooms and fitted with breaker locking devices.

.17 Provide 25% spare breakers in panelboard totaling 25% in spare ampacity capacity per panelboard.

.18 Panelboards shall be provided with type-written directories indicating loads controlled by each circuit installed in metal framed clear acetate cover, affixed to the inside cover of the panelboard.

.19 All panelboard should be equipped with main circuit breaker.

2.4 IDENTIFICATION

.1 Provide identification for equipment and the sub-components.

.2 Provide nameplates, warning signs and labels as required by the AHJ.

Part 3 Execution

3.1 SWITCHBOARDS

.1 Assemble switchboard into a fully functional complete operating unit.

.2 Install switchboard in location shown on Drawings and Specifications, make connections in accordance with codes, standards and manufacturer's installation instruction.

.3 Level switchboard equipment as shown on reviewed Shop Drawings and fasten to floor pad with bolts.

.4 Drill/Punch through enclosures only for conduits or cables actually required.

.5 Locate switchboard and secure in position. Install floor mounted switchboards on housekeeping pad.

.6 Connect main incoming feeder to line terminals of main breaker, if applicable.

.7 Connect load terminals of distribution switches or breakers to feeders.

.8 Check factory made connections for mechanical security and electrical continuity.

.9 Check trip unit settings and fuse sizes against co-ordination study to ensure proper working and protection of components.

3.2 PANELBOARDS

.1 Panelboards shall be flush, or surface mounted as required, complete with hinged locking door and flush catch, and finished with corrosion-resistant primer, equipment gray.

.2 Surface mounted panelboards shall be installed on Unistrut galvanized steel framing channels with 75 mm clear between back of panelboard and wall.

.3 Where practical, panelboards shall be grouped in proximity.

.4 Install panelboards to support channels in locations shown on Drawings and Specifications and in accordance with Manufacturer's written instructions. Use minimum of 4 fasteners for each panelboard.

.5 Where no mounting surface available, install steel supports for mounting of panelboard cabinets.

3.3 TESTING

.1 Contractor to review and test that all wiring has been connected as per the Manufacturer drawings.

.2 Switchboard to be tested on site per ESA, CSA requirements Contractor to oversee all testing and correct any deficiencies noted.

3.4 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are:

.1 Eaton;

.2 Schneider Electric (I-Line Series);

.3 Siemens Electric Ltd;

.4 Or approved equivalent.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Labour, products, equipment and services necessary for Moulded Case Circuit Breakers (MCCBs, Low Voltage), Air Circuit Breakers (ACBs, Low Voltage), Miniature Circuit Breakers (MCBs, Low Voltage)work in accordance with the Contract Documents.

1.2 DESIGN REQUIREMENTS

.1 The equipment furnished and the equipment installation, wiring methods and materials used shall conform to the latest edition of the Ontario Electrical Safety Code, Electrical Safety Authority (ESA) Bulletins and Supplements issued by the Electrical Safety Authority. In case of any conflicts, the more stringent requirement shall apply.

.2 Design Electrical equipment and systems to all applicable standards of CSA, ULc, IEEE, ESA.

.3 Design electrical equipment and systems to standards and codes to be latest editions adopted by and enforced by local authorities have jurisdiction.

.4 Devices selected in accordance with this Specification shall be in accordance with the voltage, frequency, phase, ampacity, interrupting capacity, options and protection requirements shown on the Contract Documents.

.5 Devices selected in accordance with this Specification shall be designed for use in switchboards, panelboards, and enclosures.

1.3 RELATED REQUIREMENTS

.1 Section 26 28 23 – Disconnect Switches.

1.4 REFERENCE STANDARDS

.1 Ontario Electrical Safety Code (OESC).

.2 Ontario Building Code (OBC).

.3 CSA Z462, Workplace Electrical Safety.

.4 CAN3 C235, Preferred Voltage Levels for AC Systems, 0 to 50,000V.

.5 CAN3-Z299.4, Quality Assurance Program - Category 4.

.6 ANSI, American National Standards Institute.

.7 NEMA, National Electrical Manufacturer’s Association.

.8 EEMAC, Electrical Equipment Manufacturer’s Association of Canada.

.9 CSA Z460 Canadian Standard on Lockout/Tagout.

.10 CSA Z463 Standard - Electrical Systems Maintenance.

.11 CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards, latest edition.

.12 CSA Z463 Standard - Electrical Systems Maintenance.

.13 UL 50 Enclosures for Electrical Equipment.

.14 UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures.

.15 ANSI/IEEE C37.20.1 – Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.

.16 ANSI/IEEE C37.50 – Test Procedure for Low Voltage AC Power Circuit Breakers Used in Enclosures.

.17 ANSI/IEEE C37.13 – Low Voltage AC Power Circuit Breakers Used in Enclosures.

.18 ANSI C37.16 – Preferred Ratings, Related Requirements and Application for Low Voltage Power Circuit Breakers and AC Power Circuit Protectors.

.19 UL 1558 – Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.

.20 UL 1066 – Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.5 SPARE PARTS

.1 Not applicable.

1.6 TRAINING

.1 Not applicable.

1.7 WARRANTY

.1 All electrical products to be guaranteed by manufacturer, for a minimum five (5) years, if not defined by other specifications.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Contractor to protect equipment from damage, weather and moisture in accordance with Manufacturer's instructions.

1.9 SUBMITTALS

.1 Product Data Package:

.1 Submit manufacturer's Product data indicating:

.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol.

.3 Trip unit set-up and operational features.

.2 Commissioning Package:

.1 Submit the following:

.1 Commissioning Procedures.

.2 Certificate of Readiness.

.3 Attach Source Quality Control inspection and test results to the Certificate of Readiness.

.4 Submit the following for each Product for incorporation into the Operation and Maintenance Manuals:

.1 Functional description detailing operation and control of components.

.2 Performance criteria and maintenance data.

.3 Safety precautions.

.4 Operating instructions and precautions.

.5 Component parts availability, including names and addresses of spare part suppliers.

.6 Maintenance and troubleshooting guidelines/protocol.

1.10 QUALITY ASSURANCE

.1 Regulatory requirements: All electrical items shall be approved by CSA and/or ULC.

Part 2 Products

2.1 GENERAL

.1 The following general requirements apply to all circuit breakers covered by this Specification.

.1 Circuit breakers shall be single throw.

.2 Circuit Breakers shall be “Trip-Free”.

.3 It shall be possible to open and close all breakers manually.

.4 A trip on any one pole shall trip all poles.

.5 Multi-pole applications shall be common-trip breakers with single handle.

.6 The maximum interrupting time is 5 cycles.

.7 Circuit breakers shall be 100% continuous duty unless otherwise indicated on the Contract Documents.

.8 Circuit breakers shall be provided with a direct mechanical means for indicating its closed, open and/or tripped positions at the place of operation. Lamp indication in place of a mechanical indicator will not be accepted.

.9 Service Entrance Circuit Breakers for main panelboards shall include a solid state, electronic trip unit which is capable of being coordinated with the other protective devices in the system to allow operation of protective devices closest to the fault location. The trip unit shall include communications capability as indicated on the Contract Documents.

.10 Circuit Breakers shall have a minimum symmetrical rms interrupting capacity rating, as shown in the Short Circuit Protection and Coordination Studies or Contract Documents.

.11 Circuit breakers shall include all necessary interlocks to prevent inadvertent operations and to ensure safety of operating personnel and the equipment.

.2 Circuit breaker Manufacturer shall furnish necessary bus connections, wire jumpers, bolts, nuts, washers, etc., suitably packaged and marked to facilitate assembly. Identify each shipping container with name of contents, contract number, and equipment number permanently marked and readily visible.

.3 Circuit breaker mounting methods included but are not limited to: enclosed in stand alone enclosures, wall mounted, or mounted inside panelboards/switchboards/switchgears/load-centers. Refer to Contract Documents for requirements.

2.2 MINIATURE CIRCUIT BREAKERS (MCBS) (LOW VOLTAGE)

.1 All MCBS used shall be selected from the same commonly available product range; this shall account for MCB variants such as Arc Fault Circuit Interrupters (AFCIs) and Ground Fault Circuit Interrupters (GFCIs).

.2 MCBs shall be quick make, quick break type, for manual and automatic operation with temperature compensation for 40 °C ambient.

.3 Requirements for optional features where required on the Contract Documents:

.1 Shunt trip shall directly trip the MCB.

.2 MCB auxiliary switches shall be provided, dry contacts as shown on the Contract Documents.

.3 The MCB shall be pad-lockable in the open position.

.4 MCB shall equipped with 30 mA ground fault module.

Part 3 Execution

3.1 INSTALLATION AND COMMISSIONING

.1 Manufacturer's installation and commissioning recommendations shall be followed by the installation and commissioning team.

.2 Field Inspection and Testing:

.1 Inspect each circuit breaker visually.

.2 Perform several mechanical ON and OFF operations on each circuit breaker.

.3 Verify circuit continuity on each pole in closed position.

.4 Determine that circuit breaker will trip on over current condition.

.5 Include description of testing and results in test report.

.3 Commissioning:

.1 Adjust trip settings so that circuit breakers coordinate with other over current protective devices in circuit.

.2 Adjust trip settings to provide adequate protection from over current and fault currents.

3.2 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are:

.1 Eaton;

.2 Schneider Electric (I-Line Series);

.3 Siemens Electric Ltd.;

.4 Or approved equivalent.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Labour, products, equipment, and services necessary for disconnect switches Work.

1.2 DESIGN REQUIRMENTS

.1 The equipment furnished and the equipment installation, wiring methods and materials used shall conform to the latest edition of the Ontario Electrical Safety Code, Electrical Safety Authority (ESA) Bulletins and Supplements issued by the Electrical Safety Authority. In case of any conflicts, the more stringent requirement shall apply.

.2 Design Electrical equipment and systems to all applicable standards of CSA, ULC, IEEE, ESA.

.3 Design electrical equipment and systems to standards and codes to be latest editions adopted by and enforced by local authorities have jurisdiction.

1.3 RELATED REQUIREMENTS

.1 Section 26 05 31 - Splitter Boxes, Junction Boxes and Pullboxes.

.2 Section 26 24 13 - Switchboards and Panelboards.

.3 Section 26 28 00 - Circuit Breakers and Fuses

1.4 REFERENCE STANDARDS

.1 Ontario Electrical Safety Code (OESC).

.2 Ontario Building Code (OBC).

.3 CSA Z462, Workplace Electrical Safety.

.4 ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.5 CAN/CSA C22.2 No. 4, Enclosed and Dead-front Switches.

.6 NEMA FU l−07 Low Voltage Cartridge Fuses.

.7 NEMA KS l−06 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

.8 NFPA 130, National Fire Protection Association Standard for Fixed Guideway Transit and Passenger Rail System.

.9 UL98−07 Enclosed and Dead−Front Switches.

.10 UL248−00 Low Voltage Fuses.

.11 UL489−09 Molded Case Circuit Breakers and Circuit.

1.5 SUBMITTALS

.1 Product Data and Shop Drawings Package:

.1 Product Data:

.1 Submit manufacturer's Product data indicating:

.1 Technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists.

.2 Performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol. Include time–current curves of fuses.

.3 Include dimensional outline drawings; conduit entrance locations and requirements; voltage rating, continuous and short-circuit current ratings; horsepower rating; fuse type and rating; cable terminal sizes and temperature ratings.

.4 Maintenance Data: recommended maintenance procedures and intervals. Include spare parts data listing; source and current prices of replacement parts and supplies.

.5 Product transportation, storage, handling, and installation requirements.

.2 Shop Drawings:

.1 Submit Shop Drawings indicating:

.1 Complete, dimensioned general arrangement.

.2 Identification.

1.6 QUALITY ASSURANCE

.1 Manufacturers Qualifications: Company specializing in disconnect switch and fuses with at least ten years documented experience.

.2 All electrical work shall be carried by licensed electricians with experience and training in the equipment and systems (certified or manufacture approve) being installed in Ontario.

.3 Regulatory Requirements: Furnish Products listed and classified by CSA and ULc, as suitable for application, and shall be stamped accordingly.

Part 2 Products

2.1 GENERAL

.1 Disconnect switches to be CSA approved and bear CSA label.

.2 Disconnect switches shall comply with CSA C22.2 No. 4.

.3 Fuseholder assembles shall comply with CSA C22.2 No. 39.

.4 Disconnect switches to be 3- or 4-pole with solid neutral as applicable, rated 60 Hz, 240/600 Vac or up to 1000 Vdc as applicable, single throw, continuous heavy duty, load break, quick-make, quick-break, rated for name plate ampere value and motor loads.

.5 Shunt trip safety switch with shunt trip technology are to be operated electrically and remotely with a handle operation mechanism and visible blade indication. These switches can be used with emergency stop pushbuttons or other remote signaling means to quickly disconnect power from equipment. The switch can be in two-, three- and four-pole configurations for system voltages up to 600 Vac and 1000 Vdc with fusible and non-fusible protection options.

2.2 MATERIALS

.1 Steel sheet: ASTM A653, coating designation Z275; galvanized steel sheet.

.2 Stainless steel sheet: ASTM A240 Type 304.

.3 Switches shall be in accordance with NEMA, CSA, ULC/UL.

.4 UL – Underwriters' Laboratories:

.1 UL 98 Enclosed and Dead-Front Switches

.2 UL 198C High-Interrupting Capacity Fuses, Current Limiting Type

.3 UL 198E Class R Fuses.

.5 NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 600 V switches.

.6 Switch shall be horsepower (HP) rated.

2.3 FUSED AND UNFUSED DISCONNECT SWITCHES

.1 Quick make, quick break mechanism, with power and voltage ratings as specified.

.2 Copper blades, visible in the open position.

.3 An arc chute for each pole.

.4 External operating handle shall indicate open and closed positions and have lock open padlocking provisions.

.5 The disconnect must have visual knife blade position provided by a window or LED indicator lights except for 15A/30A, 1PH disconnect switch.

.6 Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.

.7 Fuse holders for the sizes and types of fuses specified.

.8 Solid neutral for each switch being installed in a circuit which includes a neutral conductor.

.9 Ground lugs for each ground conductor.

.10 All disconnect switches to be lockable, complete with locks and keys.

.11 Switch operating handle: Interlocked with switch cover, to prevent opening of cover when switch in ON position and to prevent operation of switch mechanism when door open.

.12 Enclosures: Shall be the NEMA types (Enclosures: NEMA 1 for indoor controlled environment, NEMA 12 for dusty indoor environment and NEMA 4X for outdoor environment, conforming to CAN/CSA C22.2 No. 94, or as shown on the project documentation and shall be finished with manufacturer’s standard gray baked enamel paint over pre-treated steel. Where the types of switch enclosures are not shown, they shall be the NEMA 4X stainless steel.

.13 Disconnect switch electrical interlock auxiliary contacts shall conform to CSA C22.1.

.14 External roof top exhaust fan disconnect switch to have (1NO+1NC) electrical auxiliary contacts. Auxiliary contacts to be late make, early break type.

2.4 FUSES

.1 Refer to Contract Drawings for disconnect switch type, rating and accessories.

.2 Only HRC fuses with interrupting rating of 200,000 A symmetrical and voltage rating of 600 V shall be used, unless otherwise indicated.

.3 Time delay fuses to carry 500% of their rated current for minimum of 10 s and marked "Time Delay".

.4 CSA designation HRCI J fuses for lighting and general loads without inrush.

.5 CSA designation HRCI J Time Delay fuses for motors, transformers and other loads with inrush, 600 A and lower.

.6 CSA designation HRC L Time Delay fuses for motors, transformers and other loads above 600 A with inrush.

.7 CSA designation HRC L fuses for lighting and general loads without inrush above 600 A.

.8 Shall be in accordance with NEMA FU 1.

.9 Fuses that are in controls circuits, requiring monitoring of fuse status must be selected and supplied with the spring-loaded indicator. When the fuse blows have the indicator pop out of the fuse to open or close the monitoring switch.

.10 Service Entrance: Class L fast acting or time delay type.

.11 Feeders: Class L, fast acting or time delay (over 600A) or Class J, fast acting or time delay for up to 600A.

.12 Motor Branch Circuits: Class RK1 or Class RK5, time delay.

.13 Other Branch Circuits: Class RK1 or Class RK5, time delay or Class J, fast acting, to suit application.

.14 Control Circuits: Class CC time delay.

Part 3 Execution

3.1 INSTALLATION

.1 Install fused and unfused disconnect switches and enclosures and as required by Code and in accordance with manufacturer's instructions.

.2 Install dual element fuses in accordance with manufacturer's instructions.

.3 Test disconnect switches in accordance with Section on, Commissioning.

3.2 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers are:

.1 Eaton – Cooper Bussmann;

.2 Siemens Electric Ltd.;

.3 Schneider Electric (Square D);

.4 Mersen (Ferraz Shawmut);

.5 Or approved equivalent.

END OF SECTION

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

CPANL LED

Lumen Switchable Panel

1' x 4', 2' x 2'and 2' x 4'

FEATURES & SPECIFICATIONS

INTENDED USE — The CPANL™ Series LED switchable lumen flat panel features an internal driver and deep drawn backplate. This reliable and rigid flat panel is visually comfortable and can be recessed, direct ceiling mounted, suspended or surface box mounted. Suitable for many applications such as schools, offices, retail, convenience stores, hospitals, healthcare facilities and other commercial spaces. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate. Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.**

CONSTRUCTION — This edge-lit platform was built to last with an aluminum frame for strength and durability, the seamless frame prevents light leak in the corners. The satin white lens provides excellent shielding and fully luminous appearance. CPANL's low-profile design provides increased installation flexibility especially in restricted plenum spaces. The back plate includes integral T-bar clips for installation into 9/16" or 15/16" T-grid ceilings. Fixture may be direct ceiling mounted with the DCMK bracket on a hard-ceiling see accessories section for more information. Fixture may be mounted and wired in continuous rows.

ELECTRICAL — Long-life LEDs, coupled with a high-efficiency driver, provide superior illumination for extended service life. 70% LED lumen maintenance at 60,000 hours (L70/60,000). 0-10V dimming driver, dims to 10% and contains non-isolated dimming leads. Switch set to max high lumen output at the factory. For optimal 0-10V dimming performance it is recommended that the luminaire remains at factory default high lumen setting.

LISTINGS — CSA certified to meet US and Canadian standards. Intended for indoor use only. Product is not to be stored in non-climate controlled spaces. Damp location listed. IC rated. IP5X Rated.

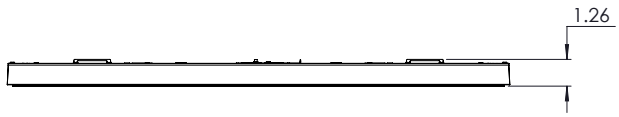
DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

Rated for NSF/ANSI Standard 2 - Light Fixture for Splash Zone and Non Food Zone.

WARRANTY — 5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at:
www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.
Specifications subject to change without notice.

Switchable Lumens



ORDERING INFORMATION

Catalog Number	UPC	Description	Nominal Lumens	Color Temperature	CRI	Voltage	Nominal Wattage	Pallet QTY
CPANL 1X4 ALO1 SWW7 M4	00194995124930	1x4 Fully Switchable Flat Panel	2400/3300/**4400**	35/**40**/50K	>80	MVOLT (120-277)	22/31/**41**	56
CPANL 2X2 ALO1 SWW7 M4	00194995124923	2x2 Fully Switchable Flat Panel	2400/3300/**4400**	35/**40**/50K	>80	MVOLT (120-277)	22/31/**41**	56
CPANL 2X4 ALO6 SWW7 M2	00194995124916	2x4 Fully Switchable Flat Panel	4000/5000/**6000**	35/**40**/50K	>80	MVOLT (120-277)	36/45/**55**	28

View Contractor Select versions, Click here or visit www.acuitybrands.com and search for CPANL

* Bolded lumen package designates default switch setting.

ACCESSORIES

Accessories: *Order as separate catalog number.*	
ILBLP CP10 HE SD A	IOTA emergency constant power battery pack field installation kit (Certified in CA Title 20 MAEDBS) [1]
ELA PSDMT	External mounting tray to secure emergency battery to building structure, not required, battery can be mounted to fixture
DCMK 14	Direct Ceiling Mount Kit for CPANL 1x4
DCMK 224	Direct Ceiling Mount Kit for CPANL 2x4 and 2x2
1X4SMKSH	Surface Mount Kit 1'x4', Shallow Depth
2X2SMKSH	Surface Mount Kit 2'x2', Shallow Depth
2X4SMKSH	Surface Mount Kit 2'x4', Shallow Depth
DGA14	Drywall grid adapter for 1x4 recessed fixture.
DGA22	Drywall grid adapter for 2x2 recessed fixture.
DGA24	Drywall grid adapter for 2x4 recessed fixture.
PAC 2DNF 36	Panel Air Craft Kit, 2 cables with Y splitter, No Power Feed, 36 inches [2]
PAC 2DF 36	Panel Air Craft Kit, 2 cables with Y splitter, with Power Feed, 36 inches [2]
PAC 2DNF 72	Panel Air Craft Kit, 2 cables with Y splitter, No Power Feed, 72 inches [2]
PAC 2DF 72	Panel Air Craft Kit, 2 cables with Y splitter, with Power Feed, 72 inches [2]
PAC 4DNF 36	Panel Air Craft Kit, 4 cables, No Power Feed, 36 inches [2]
PAC 4DF 36	Panel Air Craft Kit, 4 cables, with Power Feed, 36 inches [2]
PAC 4DNF 72	Panel Air Craft Kit, 4 cables, No Power Feed, 72 inches [2]
PAC 4DF 72	Panel Air Craft Kit, 4 cables, with Power Feed, 72 inches [2]

Emergency Battery Delivered Lumens

Use the formula below to determine the delivered lumens in emergency mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver (10W for PS1055)

LPW = Lumen per watt rating of the luminaire.

NOTES

1. See Power Sentry PS1055CP battery spec sheet here. Test switch must be remote mounted or installed in an adjacent ceiling tile.
2. See Suspension Kits section below for additional detail.

Switchable Table						
Size	**Nomenclature**	**Lumen Setting**	**CCT**	**Lumen**	**Wattage**	**Efficacy**
1x4	CPANL 1X4 ALO1 SWW7 M4	Low Lumen	3500K	2645	21.6	122
			4000K	2712	20.9	130
			5000K	2637	21.4	123
		Medium Lumen	3500K	3599	30.7	117
			4000K	3754	29.4	128
			5000K	3595	30.4	118
		High Lumen	3500K	4597	40.5	114
			4000K	**4881**	**38.7**	**126**
			5000K	4596	40.1	115
2x2	CPANL 2X2 ALO1 SWW7 M4	Low Lumen	3500K	2617	21.6	121
			4000K	2750	20.9	132
			5000K	2766	21.5	129
		Medium Lumen	3500K	3778	30.6	123
			4000K	3930	29.4	134
			5000K	3755	30.5	123
		High Lumen	3500K	4741	40.5	117
			4000K	**5031**	**38.8**	**130**
			5000K	4717	40.4	117
2x4	CPANL 2X4 ALO6 SWW7 M2	Low Lumen	3500K	4363	35.7	122
			4000K	4450	34.4	129
			5000K	4358	35.4	123
		Medium Lumen	3500K	5354	45.1	119
			4000K	5509	43.3	127
			5000K	5351	44.8	119
		High Lumen	3500K	6343	55.1	115
			4000K	**6579**	**52.7**	**125**
			5000K	6353	54.7	116

* Bolded lumen, color temperature and wattage designates default switch setting.

Emergency Battery Pack Options - Field Installable

Battery Model Number	Wattage	Runtime (Minutes)	Lumen Output* @ 120 Lumens/Watt	Other
ILB CP07 2H A	7W	120	840	Storm Shelter/ 2-hour Runtime
ILB CP10 A	10W	90	1200	
ILB CP10 HE AELR A	10W	90	1200	Title 20; Enabled with Self Testing, Automated Reporting (STAR)
ILBLP CP10 HE SD A	10W	90	1200	Title 20, Self Diagnostic
ILBLP CP15 HE SD A	15W	90	1800	Title 20, Self Diagnostic
ILB CP20 HE A	20W	90	2400	Title 20
ILB CP20 HE SD A	20W	90	2400	Title 20, Self Diagnostic

All the above are UL 924 Listed products that are certified for field install external/remote to the fixture.
*Minimum delivered lumen output to assist in product selection for increased fixture mounting height.
Delivered emergency illumination of CP10 models outperforms legacy 1400 lumen fluorescent emergency ballasts.
Please contact us at techsupport@iotaengineering.com for any Emergency Battery related questions.

+

Field Installed Emergency LED Driver

ILB CP10 HE AELR A

Compliance Just Got Easier!

Emergency Lighting with Self Testing Automated Reporting (STAR), enables self-testing and automated reporting to aid in life safety code compliance. Emergency lighting equipment enabled with STAR, automatically conducts the required monthly and annual tests, logs results within the units, and wirelessly communicates test data on demand to the CLARITY+ mobile app. **Leave the ladders, disruptions and written records behind with emergency lighting solutions with STAR!**

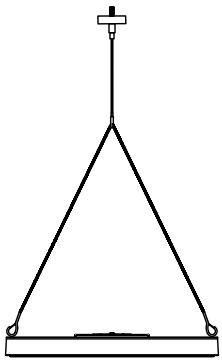
DOWNLOAD CLAIRTY™+

Available on the App Store

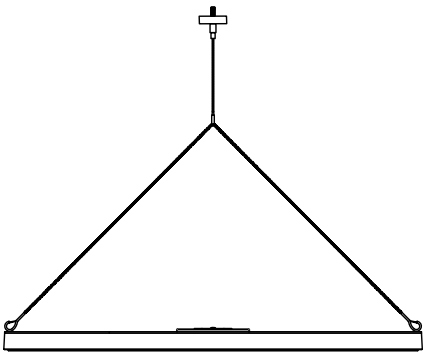
ANDROID APP ON Google play

Suspension Kits

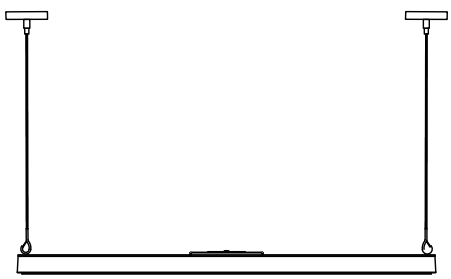
2 drops (1x4)



2 drops (2x2)



4 drops (2x4)



CPANL LED Flat Panel

CPANL compatible with Sensor Switch™
WSX-D and SPOD wall switches.

WSX-D

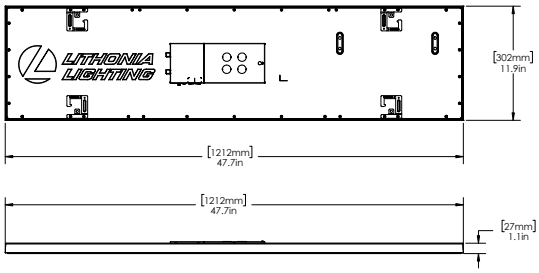
SPOD

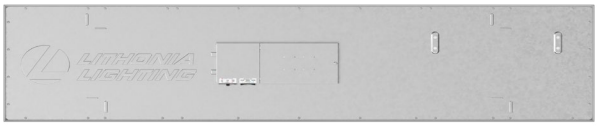
PHOTOMETRICS

See www.lithonia.com for photometry reports.

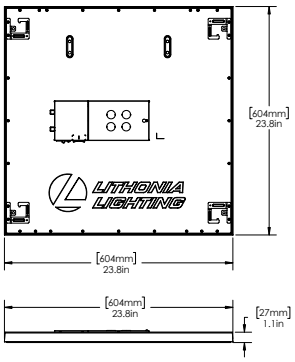
DIMENSIONS

Length: 11.9(30.2)
Width: 47.7 (121.12)
Depth: 1.1 (2.7)
Weight:
Unit: 9.3lbs
Unit Carton: 10.3lbs
Master Carton: 43.2lbs

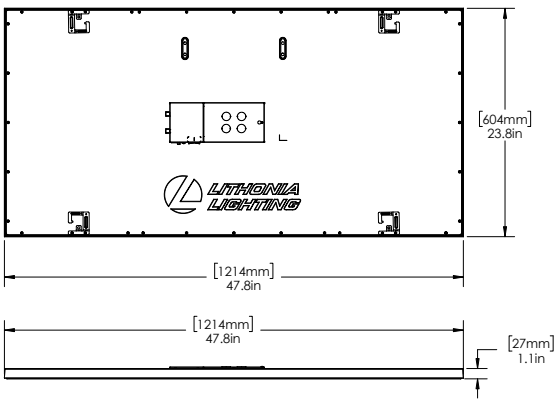


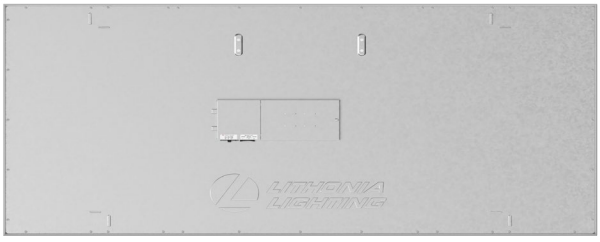


Length: 23.8 (60.4)
Width: 23.8 (60.4)
Depth: 1.1 (2.7)
Weight:
Unit: 9.0lbs
Unit Carton: 10.0lbs
Master Carton: 41.9lbs



Length: 47.8 (121.4)
Width: 23.8 (60.4)
Depth: 1.1 (2.7)
Weight:
Unit: 17.8lbs
Unit Carton: 19.7lbs
Master Carton: 43.3lbs



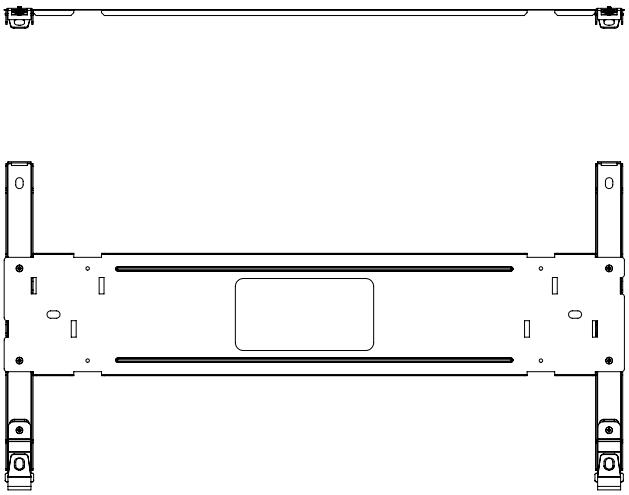


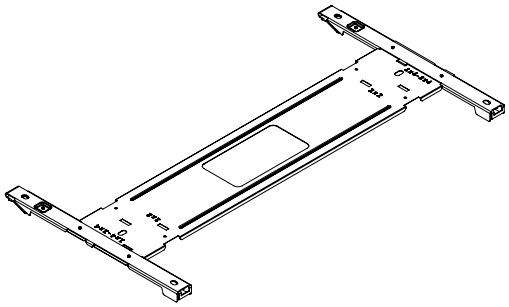
COMMERCIAL INDOOR: One Lithonia Way Conyers, GA 30012 Phone: 800-705-SERV (7378) www.acuitybrands.com

Rev. 11/08/23

DCMK - DIRECT CEILING MOUNT KITS (Sold as a separate accessory, see accessories section on page 1)

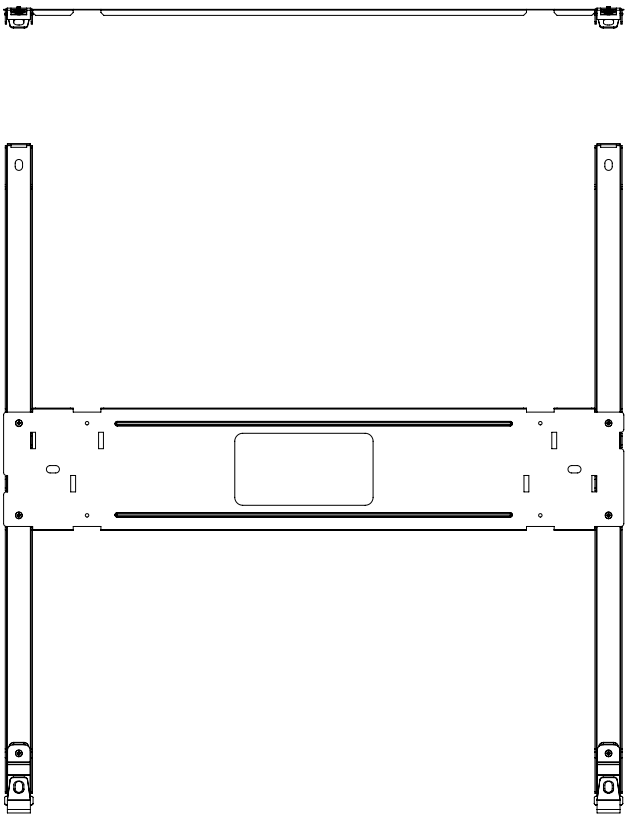
DCMK 14

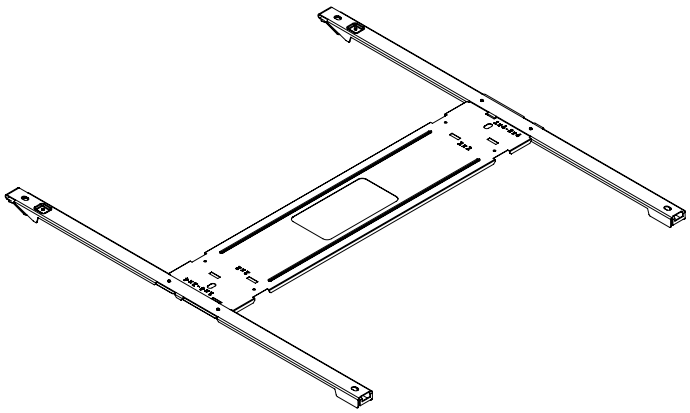




Specification DCMK 14	
Length	11-3/8 (29)
Width	21-1/2 (54.4)
Height	11/16 (1.8)
Bracket Weight	1.0 lbs

DCMK 224





Specification DCMK 224	
Length	23-14 (59)
Width	21-1/2 (54.4)
Height	11/16 (1.8)
Bracket Weight	1.4 lbs

OVERVIEW

The nCM xx RJB family of nLight ceiling/surface mount occupancy sensors provide a range of networked sensor solutions for applications with finished ceilings (e.g. ceiling tiles, sheetrock, plaster). nCM xx RJB family sensors utilize 100% digital Passive Infrared (PIR) detection and are available with several lens options, providing flexibility for multiple mounting height and coverage pattern requirements. Dual technology occupancy detection can also be added as an option for applications where occupants are stationary for long periods of time. nCM xx RJB family sensors are also available with an optional auxiliary low voltage relay for simple integration with a BMS system or other building system.

nCM xx RJB family sensors are powered via the nLight network bus and typically communicate with one or more nLight enabled luminaires (e.g. Lithonia VTLED Series) or nLight relay/dimming packs to enable control of fixtures individually or in groups. These configurations work standalone and do not require a connection to a larger nLight network.

FEATURES

- 100% digital PIR detection
- Optional dimming photocell (ADCX option)
- Optional auxiliary low voltage relay (AR option) for dry contact output – relay only tracks occupancy by default, ignoring switch and photocell commands
- LED status indicator
- Adjustable settings (e.g. occupancy time delays, photocell set-points) via push-button or SensorView software application
- Broadcasts occupancy and photocell information over a local nLight channel
- Remotely upgradeable firmware

Buy American Act
Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations.
Please refer to www.acuitybrands.com/buy-american for additional information.

Warranty
Five-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

A+ Capable

This item is an A+ capable component, which has been designed and tested to provide out-of-the-box luminaire compatibility with simple commissioning, when included as part of an A+ Certified™ Solution.

To learn more about A+, visit www.acuitybrands.com/aplus.

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.
*See ordering tree for details

nLIGHT

nCM xx RJB
nCM PDT xx RJB

nCM 9 RJB
nCM PDT 9 RJB

nCM 10 RJB
nCM PDT 10 RJB

nCM 6 RJB

Design Select options indicated by this color background.

ORDERING INFORMATION

nCM xx RJB				Example: nCM PDT 9 ADCX RJB
Series / Detection	**Coverage Type**	**Options (See Below)**	**RJ45 Port Location**	**Buy America(n)[2]**
nCM PIR Detection nCM PDT Dual Tech (PIR/ Microphonics)	9 Small Motion 360° 10 Large Motion 360 ° 6 High Mount 360° (not available with PDT version)		RJB Rear RJ45 (CAT5e patch cable & RJ45 splitter included)	blank Standard BAA Buy America(n) Act Compliant

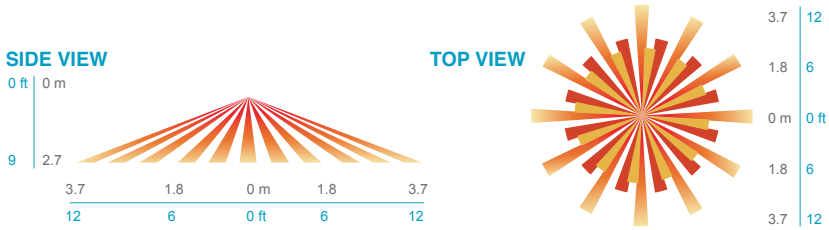
nCM xx RJB Options				
Photocell	**Auxiliary Relay**	**Preset Type[1]**	**Time Delay**	**Temp/ Humidity**
[blank] Standard (No photocell) ADCX Automatic Dimming Control (of remote dimming output)	[blank] None AR Low Voltage Aux. Relay	[blank] Single Time Delay 2P Dual Time Delay	[blank] Standard 15M 15 Minutes 20M 20 Minutes 30M 30 Minutes	[blank] Standard LT Low Temp / High Humidity

NOTES:
1. Not available with **AR** or **ADCX** options.
2. Not available with AR, 2P, Time Delay, or LT options

COVERAGE PATTERNS*

SMALL MOTION 360° (Model # nCM 9/nCM PDT 9[1])

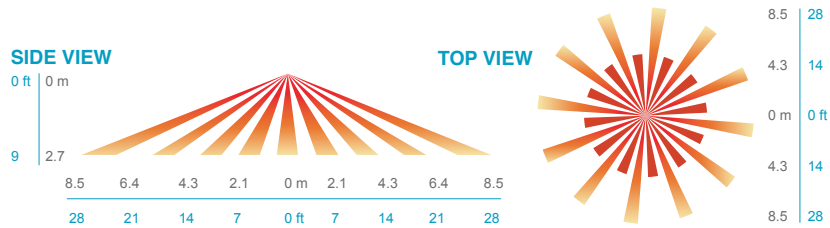
- Best choice for small motion (e.g. hand movements) detection
- 360° conical shaped pattern
- Provides 12 ft (3.66 m) radial coverage (~500 ft²) when mounted to standard 9 ft (2.74 m) ceiling
- 8 to 15 ft (2.44 to 4.57 m) mounting heights provide 10 to 20 ft (3.05 to 6.10 m) radial coverage



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

LARGE MOTION 360° (Model # nCM 10/nCM PDT 10[1])

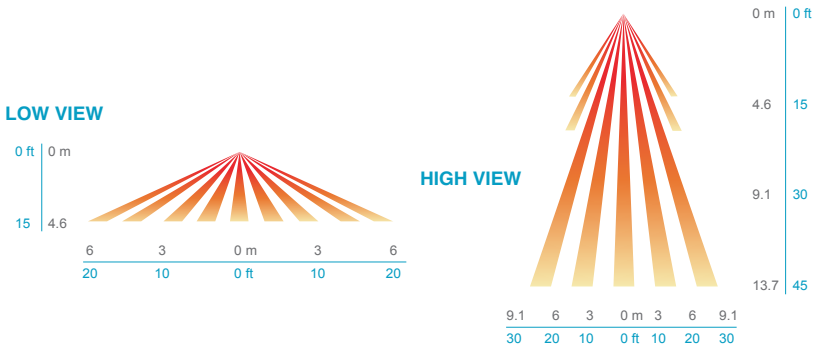
- Best choice for large motion detection (e.g. walking)
- 360° conical shaped pattern
- Provides ~24 ft (7.32 m) radial coverage (~2000 ft²) when mounted at 9 ft (2.74 m)
- 7 to 15 ft (2.13 to 4.57 m) mounting heights provide 16 to 36 ft (4.88 to 10.97 m) radial coverage
- Detection range improves when walking across beams compared to into beams



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

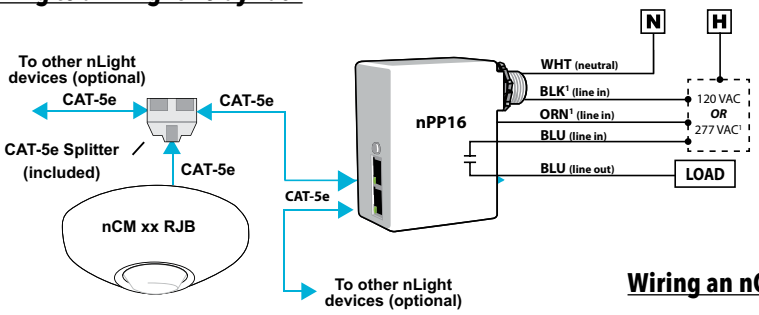
HIGH MOUNT 360° (Model # nCM 6)

- Best choice for 15 to 45 ft (4.57 to 13.72 m) mounting heights
- 15 to 20 ft (4.57 to 6.10 m) radial coverage overlaps area lit by a typical high bay fixture
- Excellent detection of large motion (e.g. walking) up to 35 ft (10.76 m)
- Excellent detection of extra large motion (e.g. forklifts) up to a 45 ft (13.72 m)

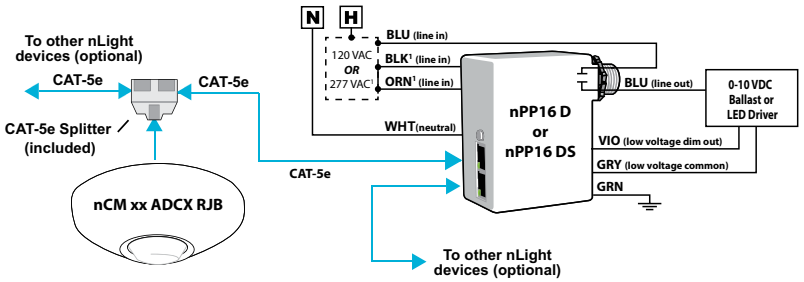


* Coverage pattern shown is derived from NEMA WD7 testing

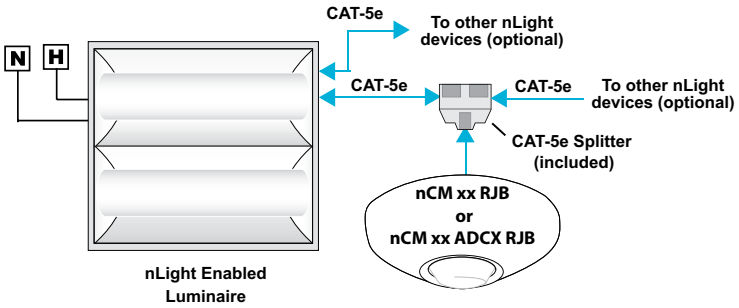
Wiring to an nLight Relay Pack



Wiring an nCM xx ADCX RJB to an nLight Dimming Pack



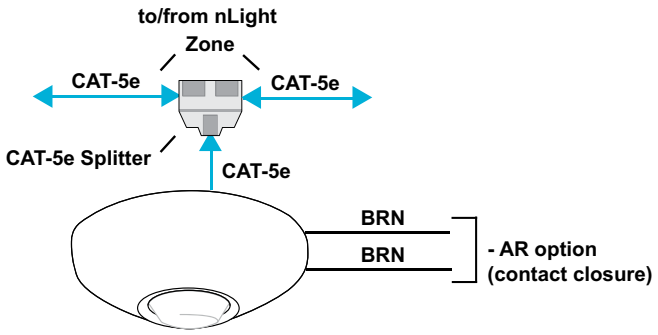
Wiring to an nLight Enabled Luminaire



TYPICAL APPLICATIONS

The following instructions are for mounting sensor directly to a ceiling tile or sheetrock surface.[1] Sensor's mounting holes also align with standard round fixture or single gang handy box (screws not provided).

1. Using template included with unit, mark spots on ceiling tile/sheetrock for cable hole and mounting anchors/screws
2. Drill 1/2" hole through ceiling surface at location indicated on template
3. Insert provided anchors into ceiling surface at locations indicated on template
4. Remove provided RJ-45 splitter from sensor's attached CAT5e cable and then thread cable (and low voltage wires if **-AR** option included) through hole from underside
5. Mount sensor to anchors using two screws provided
6. Attach provided RJ45 splitter device (model **CAT5 Y**) above ceiling to cable from sensor (see diagram on right)
7. Interconnect CAT-5e cables to/from rest of nLight zone to RJ45 splitter[2]
8. Once power is received via CAT-5e connection, all devices in zone will automatically begin functioning together according to each device's defaults
9. Install decorative sensor lid by rotating clockwise
10. Refer to included instruction card for default settings and directions on push-button programming.



Note:

1. Recommended mounting 4' or more away from HVAC vents.
2. T568B pin/pair assignment is recommended for all CAT-5e cables. Sensor power is provided via a CAT-5e connection to an nLight power pack/supply, nLight enabled digital luminaire, or nLight Bridge.

SPECIFICATIONS

Electrical	**Input Ratings**	15-24VDC, 3mA, Class 2 (nLight network power)
	Output Ratings	24 VAC/VDC, 1A - Resistive (AR option)
	Relay Type	Latching (AR option)
	Standards/ Ratings	Energy Management Equipment, UL916 (E167435)
Mechanical	**Dimensions**	4.55"W x 1.55"D (116mm x 40mm)
	Mounting	Single-Gang or Octagonal Box, Surface Mount
	Color	White
	Finish	Matte
	Connection Type	RJ-45 nLight Network Ports (2 ports via included RJ-45 splitter) Low-Voltage Leads (AR option)
Environmental	**Warrantied Operating Temperature**	Standard: 14°F to 185°F (-10°C to 85°C) PDT option: 14°F to 140°F (-10°C to 60°C) LT option: -4°F to 185°F (-20°C to 85°C) PDT LT options: -4°F to 140°F (-20°C to 60°C)
	Relative Humidity	Up to 90%, Non-Condensing
	Standards/ Ratings	RoHS
General	**Standards/ Ratings**	System Component to aid in compliance with Title 24, ASHRAE 90.1, IECC

OVERVIEW

The nCM xx RJB family of nLight ceiling/surface mount occupancy sensors provide a range of networked sensor solutions for applications with finished ceilings (e.g. ceiling tiles, sheetrock, plaster). nCM xx RJB family sensors utilize 100% digital Passive Infrared (PIR) detection and are available with several lens options, providing flexibility for multiple mounting height and coverage pattern requirements. Dual technology occupancy detection can also be added as an option for applications where occupants are stationary for long periods of time. nCM xx RJB family sensors are also available with an optional auxiliary low voltage relay for simple integration with a BMS system or other building system.

nCM xx RJB family sensors are powered via the nLight network bus and typically communicate with one or more nLight enabled luminaires (e.g. Lithonia VTLED Series) or nLight relay/dimming packs to enable control of fixtures individually or in groups. These configurations work standalone and do not require a connection to a larger nLight network.

FEATURES

- 100% digital PIR detection
- Optional dimming photocell (ADCX option)
- Optional auxiliary low voltage relay (AR option) for dry contact output – relay only tracks occupancy by default, ignoring switch and photocell commands
- LED status indicator
- Adjustable settings (e.g. occupancy time delays, photocell set-points) via push-button or SensorView software application
- Broadcasts occupancy and photocell information over a local nLight channel
- Remotely upgradeable firmware

Buy American Act
Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations.
Please refer to www.acuitybrands.com/buy-american for additional information.

Warranty
Five-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

A+ Capable

This item is an A+ capable component, which has been designed and tested to provide out-of-the-box luminaire compatibility with simple commissioning, when included as part of an A+ Certified™ Solution.

To learn more about A+, visit www.acuitybrands.com/aplus.

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.
*See ordering tree for details

nCM xx RJB
nCM PDT xx RJB

nCM 9 RJB
nCM PDT 9 RJB

nCM 10 RJB
nCM PDT 10 RJB

nCM 6 RJB

Design Select options indicated by this color background.

ORDERING INFORMATION

nCM xx RJB				Example: nCM PDT 9 ADCX RJB
Series / Detection	**Coverage Type**	**Options (See Below)**	**RJ45 Port Location**	**Buy America(n)[2]**
nCM PIR Detection nCM PDT Dual Tech (PIR/ Microphonics)	9 Small Motion 360° 10 Large Motion 360 ° 6 High Mount 360° (not available with PDT version)		RJB Rear RJ45 (CAT5e patch cable & RJ45 splitter included)	blank Standard BAA Buy America(n) Act Compliant

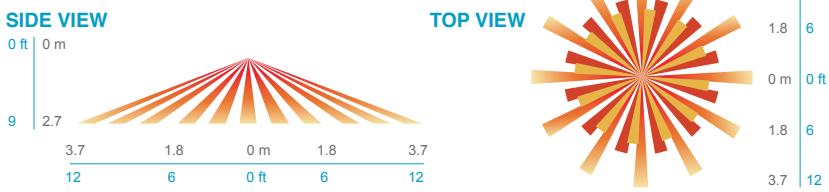
nCM xx RJB Options				
Photocell	**Auxiliary Relay**	**Preset Type[1]**	**Time Delay**	**Temp/ Humidity**
[blank] Standard (No photocell) ADCX Automatic Dimming Control (of remote dimming output)	[blank] None AR Low Voltage Aux. Relay	[blank] Single Time Delay 2P Dual Time Delay	[blank] Standard 15M 15 Minutes 20M 20 Minutes 30M 30 Minutes	[blank] Standard LT Low Temp / High Humidity

NOTES:
1. Not available with **AR** or **ADCX** options.
2. Not available with AR, 2P, Time Delay, or LT options

COVERAGE PATTERNS*

SMALL MOTION 360° (Model # nCM 9/nCM PDT 9[1])

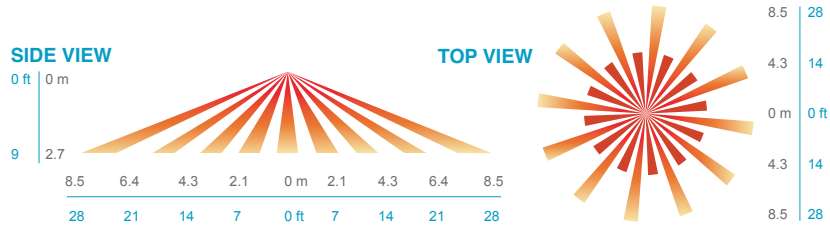
- Best choice for small motion (e.g. hand movements) detection
- 360° conical shaped pattern
- Provides 12 ft (3.66 m) radial coverage (~500 ft²) when mounted to standard 9 ft (2.74 m) ceiling
- 8 to 15 ft (2.44 to 4.57 m) mounting heights provide 10 to 20 ft (3.05 to 6.10 m) radial coverage



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

LARGE MOTION 360° (Model # nCM 10/nCM PDT 10[1])

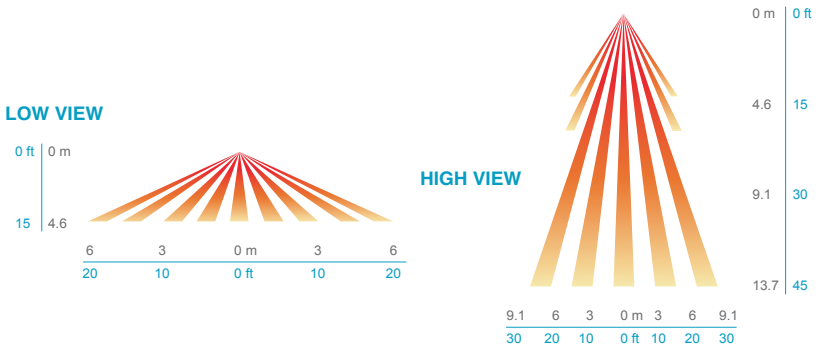
- Best choice for large motion detection (e.g. walking)
- 360° conical shaped pattern
- Provides ~24 ft (7.32 m) radial coverage (~2000 ft²) when mounted at 9 ft (2.74 m)
- 7 to 15 ft (2.13 to 4.57 m) mounting heights provide 16 to 36 ft (4.88 to 10.97 m) radial coverage
- Detection range improves when walking across beams compared to into beams



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

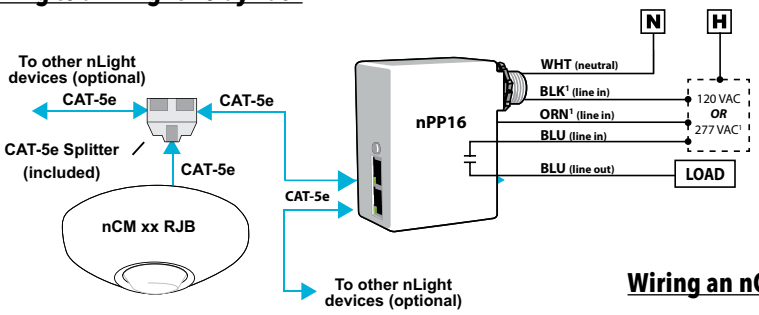
HIGH MOUNT 360° (Model # nCM 6)

- Best choice for 15 to 45 ft (4.57 to 13.72 m) mounting heights
- 15 to 20 ft (4.57 to 6.10 m) radial coverage overlaps area lit by a typical high bay fixture
- Excellent detection of large motion (e.g. walking) up to 35 ft (10.76 m)
- Excellent detection of extra large motion (e.g. forklifts) up to a 45 ft (13.72 m)

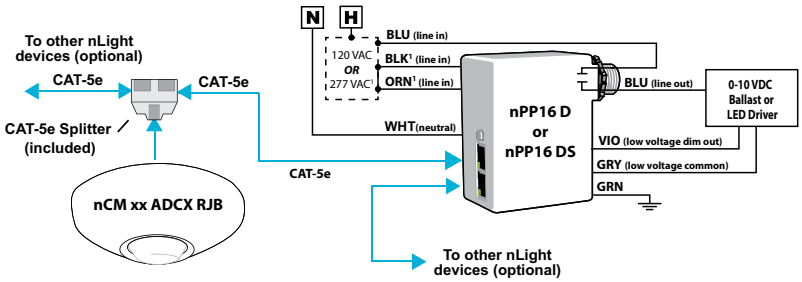


* Coverage pattern shown is derived from NEMA WD7 testing

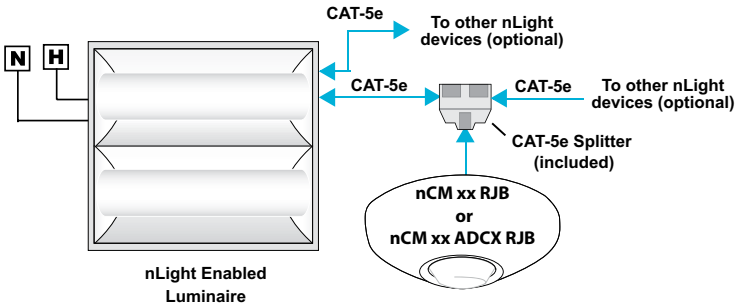
Wiring to an nLight Relay Pack



Wiring an nCM xx ADCX RJB to an nLight Dimming Pack



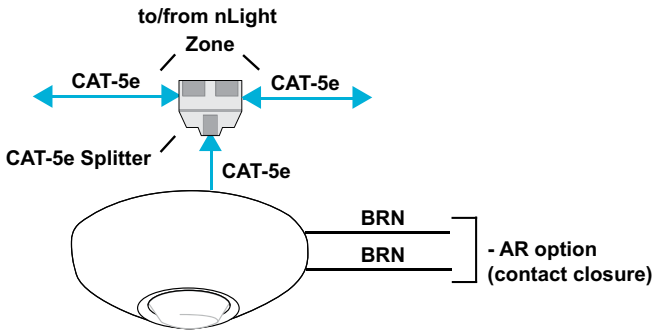
Wiring to an nLight Enabled Luminaire



TYPICAL APPLICATIONS

The following instructions are for mounting sensor directly to a ceiling tile or sheetrock surface.[1] Sensor's mounting holes also align with standard round fixture or single gang handy box (screws not provided).

1. Using template included with unit, mark spots on ceiling tile/sheetrock for cable hole and mounting anchors/screws
2. Drill 1/2" hole through ceiling surface at location indicated on template
3. Insert provided anchors into ceiling surface at locations indicated on template
4. Remove provided RJ-45 splitter from sensor's attached CAT5e cable and then thread cable (and low voltage wires if **-AR** option included) through hole from underside
5. Mount sensor to anchors using two screws provided
6. Attach provided RJ45 splitter device (model **CAT5 Y**) above ceiling to cable from sensor (see diagram on right)
7. Interconnect CAT-5e cables to/from rest of nLight zone to RJ45 splitter[2]
8. Once power is received via CAT-5e connection, all devices in zone will automatically begin functioning together according to each device's defaults
9. Install decorative sensor lid by rotating clockwise
10. Refer to included instruction card for default settings and directions on push-button programming.



Note:

1. Recommended mounting 4' or more away from HVAC vents.
2. T568B pin/pair assignment is recommended for all CAT-5e cables. Sensor power is provided via a CAT-5e connection to an nLight power pack/supply, nLight enabled digital luminaire, or nLight Bridge.

SPECIFICATIONS

Electrical	**Input Ratings**	15-24VDC, 3mA, Class 2 (nLight network power)
	Output Ratings	24 VAC/VDC, 1A - Resistive (AR option)
	Relay Type	Latching (AR option)
	Standards/ Ratings	Energy Management Equipment, UL916 (E167435)
Mechanical	**Dimensions**	4.55"W x 1.55"D (116mm x 40mm)
	Mounting	Single-Gang or Octagonal Box, Surface Mount
	Color	White
	Finish	Matte
	Connection Type	RJ-45 nLight Network Ports (2 ports via included RJ-45 splitter) Low-Voltage Leads (AR option)
Environmental	**Warrantied Operating Temperature**	Standard: 14°F to 185°F (-10°C to 85°C) PDT option: 14°F to 140°F (-10°C to 60°C) LT option: -4°F to 185°F (-20°C to 85°C) PDT LT options: -4°F to 140°F (-20°C to 60°C)
	Relative Humidity	Up to 90%, Non-Condensing
	Standards/ Ratings	RoHS
General	**Standards/ Ratings**	System Component to aid in compliance with Title 24, ASHRAE 90.1, IECC

OVERVIEW

The nPODMA Series WallPods are single gang nLight-enabled decorator wall switches that enable toggle/raise/lower/scene control of lighting zones. Equipped with soft-click push-buttons, and a green LED indicator for each button, these devices allow field replaceable and custom engraved button options. nPODMA WallPods communicate with other nLight devices, via CAT-5e cable, through RJ-45 connectors and can be daisy-chained to work with nLight power packs and/or nLight-enabled fixtures to provide switch control operations.

The scene control option presents a convenient method of selecting a custom lighting control scene for spaces in which installed, or requesting a global profile scene be run across several remote zones. By default, scene control wall switches are configured as on/off toggle switches and are to be customized programmatically through the SensorView software.

*In order to utilize a blink warning, system gateway and additional programming is required.

FEATURES

- Communicates with nLight network
- Remotely configurable/upgradeable
- Soft-click push-button control
- Sets lights to one of two or four preset levels with single button push (nPODMA xL versions only)
- Scene controllers run locally stored scenes or global scenes (stored on gateway)
  - Capable of Programming 4 Different Scene Types
    - Local "Profile" Scene – Modifies the operational configuration of up to 80 devices in the local zone. Stopping scene will revert devices to default settings.
    - Local "Preset" Scene – Modifies on/off/dim levels for up to 16 local switch groups. Exit scene through additional "preset" scene or WallPod control.
    - Global "Profile" Scene – Modifies the operational configuration of any devices on the system. Stopping scene will revert devices to default settings. Scene is stored on the system Gateway.
    - Global "Preset" Scene – Modifies on/off/dim levels for up to 128 global switch groups. Exit scene through additional "preset" scene or WallPod control.
- Easy-to-install screwless wall plate design offers a clean, uninterrupted aesthetic for a more refined look in the space.
- A full range of color options provides a variety of choices for your building designs with the assurance that the housing and the wall plate match.
- 1, 2, or 4 channel on/off
- 1, 2, or 4 channel raise/lower
- "Dynamic" options for custom button names when pairing with Acuity Brands nTUNE fixtures

CUSTOM BUTTON ENGRAVING

- Standard Button labeling is shown on back
- Custom lettering for units can be specified and ordered at: nGrave Form
- To ensure color uniformity, ordering templates facilitate specifying all buttons on a unit as custom lettered. Replacing single buttons not recommended
- Buttons may ship separately and require field installations

A+ Capable

This item is an A+ capable component, which has been designed and tested to provide out-of-the-box luminaire compatibility with simple commissioning, when included as part of an A+ Certified™ Solution.

To learn more about A+, visit www.acuitybrands.com/aplus.

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.
*See ordering tree for details

nPODMA

Wallpod: On/Off & On/Off+Raise/Lower

Buy American Act
Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Warranty
Five-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application.
Specifications subject to change without notice.

Design Select options indicated by this color background.

ORDERING INFORMATION

nPODMA — Example: nPODMA DX WH

Series	Poles & Scenes	Dimming Control	Dynamic	Color	Temp/Humidity	Buy America(n)[6][7]
nPODMA	[blank] None 2P Two channels 4P Four channels 2L[1] Two levels 2L AB[1] High/low step control 4L[2] Four levels with raise/lower 1SB[1] 1 Scene control (2 buttons) 2S 2 Scene control (2 buttons) 2SB[1] 2 Scene control (4 buttons) 4S 4 Scene control (4 buttons) 4SB[1] 4 Scene control (8 buttons)	[blank] Standard DX On/off + raise/lower control	[blank] Standard CCT[3] Correlated color temperature GRSC[5] Grayscale COLOR[5] Color control EDUTW[4] Tuneable White	WH White IV Ivory GY Gray AL Lt Almond BK Black RD Red	[blank] Normal LT Low temp	[blank] Standard BAA Buy America(n) Act Compliant

ACCESSORIES

Series	# of Gangs	Mounting	Color		Packaging
WS xPODA Wall Plates (Standard) SSW[10] Sealed Cover	1 GNG Single Gang	[blank] Standard	WH White IV Ivory GY[9] Gray AL[9] Lt Almond	BK[9] Black RD Red VP[9] Variety Pack	[blank] Single Unit[11] M5[9] 5 Pack M6[8,9] 6 Pack

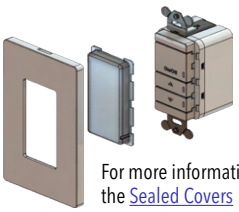
All nPODMA switches are shipped with wall plates and mounting flanges (WS XPODA), and mounting flanges (WS XPODA), however, the following order information is available to acquire replacement wall plates. Also compatible with the WALLP Series.

Notes
1. Not available with DX option.
2. Only available with DX option.
3. Only available with 2P DX version.
4. Only available with 4S and 4S DX versions.
5. Only available with 2P DX and 4S DX versions.
6. Only available in WH, IV, or GY.
7. Not available with LT option.
8. Only available for Variety Packs.
9. Not available for SSW Series.
10. Ships with custom screwless wall plate.
11. Single units only available with SSW series.

WALL SWITCH CLEANING

It will occasionally be necessary to clean the wall switches. All nPODMA switches may be wiped down with a soft cloth or paper towel dampened with glass cleaner, vinegar and water, hydrogen peroxide, or a mild abrasive. Spray a limited amount on the cloth or paper towel prior to applying. Do not spray cleaner on the switches directly, and do not wipe the switches down with a towel saturated (drips when wrung out) with cleaner.

If the ability to clean the switches using chemical spray disinfectants is desired, we recommend the use of the Sealed Screwless Wall Plate (SSW). The Sealed Screwless Wall Plate is a cover for the standard wall plate, designed with an IP54 rating. It consists of a transparent silicone rubber layer that covers the wall switch to prevent liquids from entering the wall switch while maintaining a tactile button feel. The Sealed Screwless Wall Plate is the ideal solution to help protect a wall switch from fluid entering the device while enabling the use of disinfectants recommended by the EPA for use against SARS-CoV-2, the coronavirus that causes COVID-19, which often require spraying or saturating the surface.



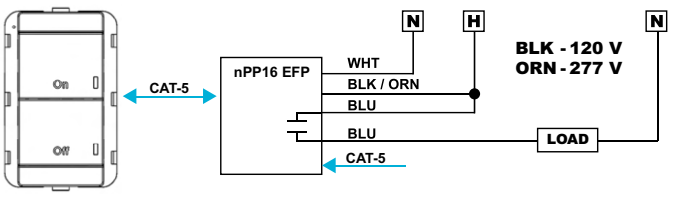
For more information on the Sealed Covers

WIRING

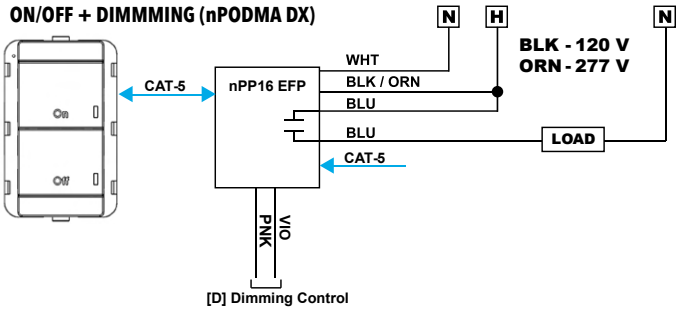
TYPICAL WIRING

Power to WallPod device is provided via the CAT-5e connection to an nLight enabled fixture, nLight power pack (e.g. **nPP16**), power supply (**nPS80**), or Bridge (**nBRG 8**).

ON/OFF

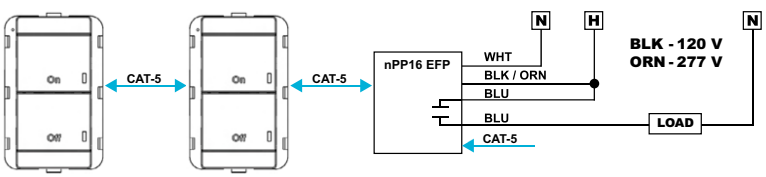


ON/OFF + DIMMMING (nPODMA DX)

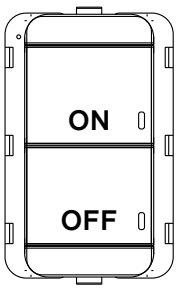


3-WAY CONFIGURATION WIRING

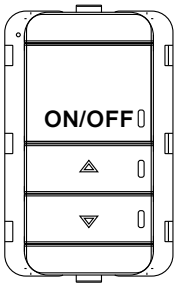
WallPods and/or nLight wall switch sensors can be configured together to create zones with multiple switching locations.



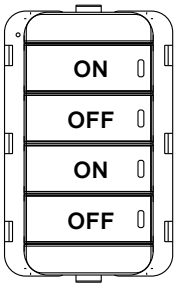
DEFAULT LABELING



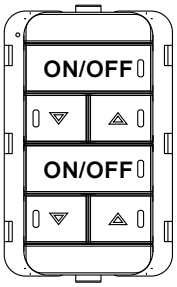
nPODMA



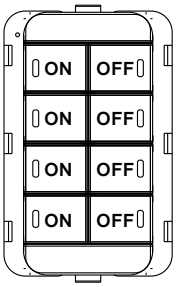
nPODMA DX



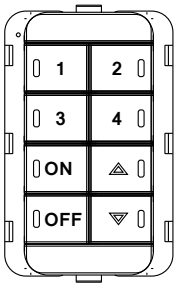
nPODMA 2P



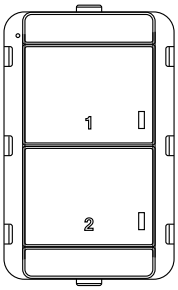
nPODMA 2P DX



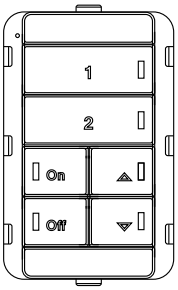
nPODMA 4P



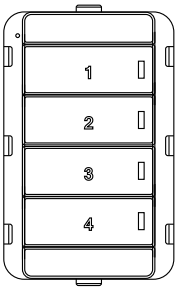
nPODMA 4P DX



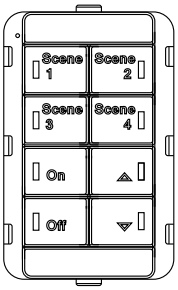
nPODMA 2S



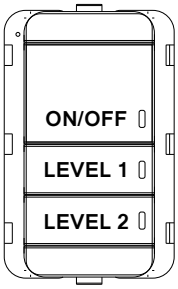
nPODMA 2S DX



nPODMA 4S



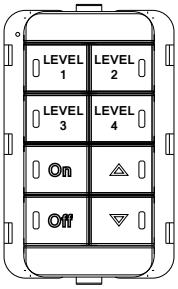
nPODMA 4S DX



LEVEL 1 100%

LEVEL 2 50%

nPODMA 2L



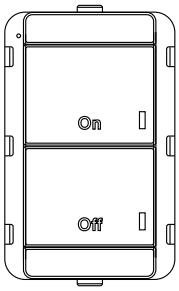
LEVEL 1 100%

LEVEL 2 75%

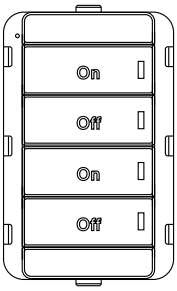
LEVEL 3 50%

LEVEL 4 25%

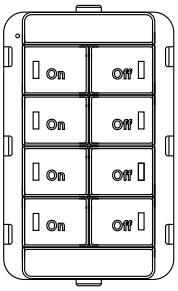
nPODMA 4L DX



nPODMA 1SB

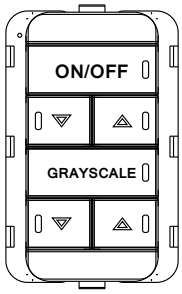


nPODMA 2SB

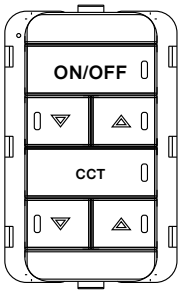


nPODMA 4SB

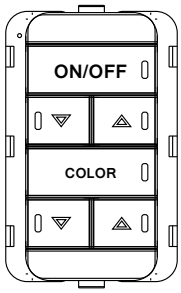
Dynamic wallpods below are paired with Acuity Brands nTUNE fixtures for out-of-box operation. Reference fixture cut sheets for additional details.



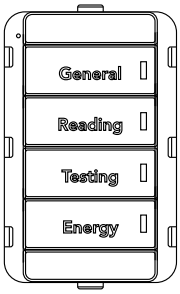
nPODMA 2P DX GRSC



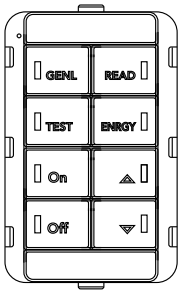
nPODMA 2P DX CCT



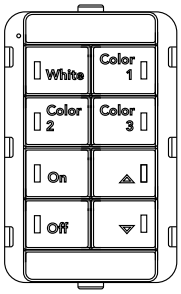
nPODMA 2P DX COLOR



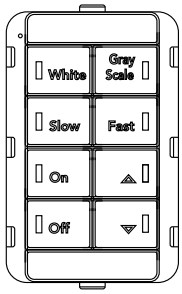
nPODMA 4S EDUTW



nPODMA 4S DX EDUTW



nPODMA 4S DX COLOR

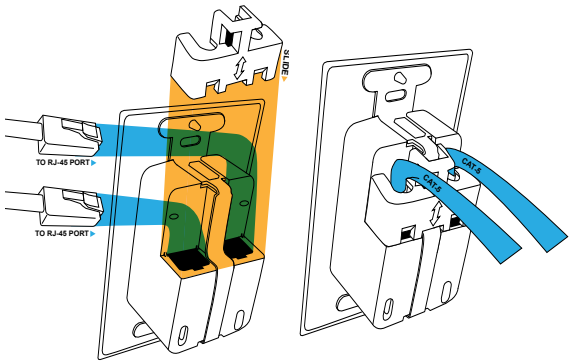


nPODMA 4S DX GRSC

INSTALLATION

- Ensure CAT-5e cable(s) an effectively fed through the gang box
  - Push the CAT5e cables through the back of the gang box
- Remove the wall plate from the device by pulling the sides out to expand the wall plate and release it from the mounting flanges.
- Access RJ-45 port(s) on the WallPod by sliding the plastic guard up
- Insert the CAT-5e cable(s) to the RJ-45 port(s)
- Slide the guard back onto metal strap
- Connect the unit to the gang box
  - The unit will connect to the gang box by screws, one at the top and one at the bottom
  - To ensure correct wall plate installation, drive the screws until the mounting flanges contact the wall surface. If the screws are overdriven, the mounting flanges will disengage, preventing wall plate installation. If this happens, reattach the mounting flange(s) and install to correct position. (The flanges may be reattached by inserting the two tabs in the side of the unit and pushing the part inward to engage the three snaps.)
- Reattach the wall plate
  - Expand the wall plate horizontally
  - Place the wall plate onto the unit
  - Contract the horizontally expanded wall plate onto the unit such that the side flange features seat inside the wall plate

Attention! Only use non-booted CAT5e cables.



PROGRAMMING

- Refer to instruction card IN-11.3 for directions on programming the switch via the upper-most left push-button. All buttons are factory set to the matching switch channel (button 1 - channel 1, button 2 - channel 2, etc). For nPODMA 4P DX, channels to be controlled are selected first, then the control button (on/off or raise/lower).
- For 2L and 4L variants, the preset dim level of a button can be changed by first adjusting the light level with either the unit's raise/lower buttons (nPODM 4L DX) or via another raise/lower WallPod broadcasting on the same switch channel (necessary with a nPODM 2L). Once lights are at desired level, hold a LEVEL button for 8 seconds until the LED flashes. Levels can also be set via SensorView.

SPECIFICATIONS

Electrical	**Input Ratings**	15-24VDC, 5mA, Class 2 (nLight network power)
	Standards/Ratings	Energy Management Equipment, UL916 (E167435)
Mechanical	**Dimensions**	2.74"H x 1.68"W x 1.63"D (70mm x 43mm x 41mm) - does not include ground strap
	Mounting	Single-Gang Box or Low Voltage Ring
	Connection Type	RJ-45 nLight Network Ports (2)
Environmental	**Warrantied Operating Temperature**	32°F to 140°F (0°C to 60°C) LT Option: -4°F to 140°F (-20°C to 60°C)
	Relative Humidity	Up to 90%, Non-Condensing
	Standards/ Ratings	RoHS
	Security	Complies with California Civil Code Title 1.81.26, Security of Connected Devices, approved under Senate Bill No. 327 (2018)

OVERVIEW

The nLight nPP16 EFP family of power packs is the workhorse of an nLight system, delivering robust system performance and design versatility for commercial and industrial lighting control applications. The nPP16 EFP family is capable of switching loads via an internal latching relay designed with robust protection from the harsh switching requirements of T5 fluorescent and LED loads. These power packs also provide nLight system bus power - up to 40mA from each of its two RJ-45 ports - by transforming Class 1 line voltage (120/277 VAC or 347 VAC) to Class 2 low voltage (15 VDC). This power is typically utilized by other nLight devices within the power pack's local control zone; however, remaining power is also made available over the network for Bridges and devices in other zones to utilize.

FEATURES

- Communicates w/ nLight Network
- Self-Contained Relay Switches Line Voltage Load
- Supplies 40mA of Bus Power / RJ-45 port
- Optional out-of-box vacancy and partial-on modes
- Remotely Configurable/Upgradeable
- Push-Button Programmable
- Configurable Relay Logic
- Extended Chase Nipple
- Plenum rated
- Includes fuse integrated to relay wirelead for protection from load faults
- Meets NEMA410 ratings for LED/electronic ballast inrush

Buy American Act
Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Warranty
Five-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application. Specifications subject to change without notice.

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.
*See ordering tree for details

nLIGHT

nPP16 EFP Power/Relay Pack

Model #: nPP16 (D) EFP

Design Select options indicated by this color background.

ORDERING INFORMATION

Series	Dimming	Fault Protection	Default Mode	Voltage	Temp/humidity	Buy America(n)[2]
nPP16 Power/Relay Pack	[blank] None D 0-10VDC Dimming output (via chase nipple) DS 0-10VDC Dimming output (via side slot)	EFP External Fault Protection	[blank] Auto On (Switch Ch. 1) SW2 Auto On (Switch Ch. 2) SW3 Auto On (Switch Ch. 3) SW4 Auto On (Switch Ch. 4) SA Manual On (Switch Ch. 1) SA2 Manual On (Switch Ch. 2) PA70 Auto On to 70% (Partial On)[1] PA Auto On to 50% (Partial On)[1]	[blank] 120/277VAC 230 220-240VAC 347 120/347VAC	[blank] Standard LT Low temp	[blank] Standard BAA Buy American(n) Act Compliant

ACCESSORIES	
NPP FUSE J10	Replacement Fuse

Notes:
1. Requires D or DS option
2. Not available with 230, 347, or LT options

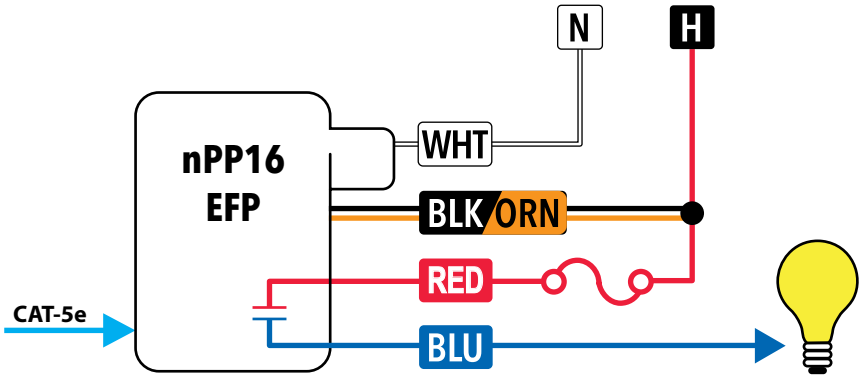
SPECIFICATIONS

Electrical	**Input Ratings**	120/277VAC, 50/60 Hz 220-240VAC, 50/60Hz (with 230 option) 120/347VAC, 50/60 Hz (with 347 option)
	Output Ratings	120/277VAC, 50/60 Hz 220-240VAC, 50/60Hz (with 230 version) 120/347VAC, 50/60 Hz (with 347 version) 16A - Tungsten, Standard Ballast, Electronic Ballast, General Purpose 120VAC, 50/60 Hz, 1/2 HP -Motor SCCR: 5KA 100mA, 0-10VDC Dimming Sink Current
	Relay Type	Latching
	Low Voltage Output Ratings	15VDC, 40mA per RJ-45 Port (80mA total)
	Class Rating	0-10V Dimming can be wired Class 1 or 2
	Standards/ Ratings	Energy Management Equipment, UL916 (E167435)
Mechanical	**Dimensions**	3.38"H x 2.53"W x 1.83"D (86mm x 64mm x 47mm) - does not include ½" chase nipple
	Mounting	1/2" Knockout (7/8" hole)
	Color	White
	Connection Type	RJ-45 nLight Network Ports (2) Non-Dimming Model: Line Voltage Leads Dimming Model: Line and Low Voltage Leads
Environmental	**Warrantied Operating Temperature**	Standard: 14°F to 122°F (-10°C to 50°C) Standard: 14°F to 113°F (-10°C to 45°C) if enclosed within a junction box LT option: -4°F to 122°F (-20°C to 50°C)
	Relative Humidity	Up to 90%, Non-Condensing
	Standards/ Ratings	RoHS, Plenum UL2043
General	**Standards/ Ratings**	System Component to aid in compliance with Title 24, ASHRAE 90.1, IECC

WIRING

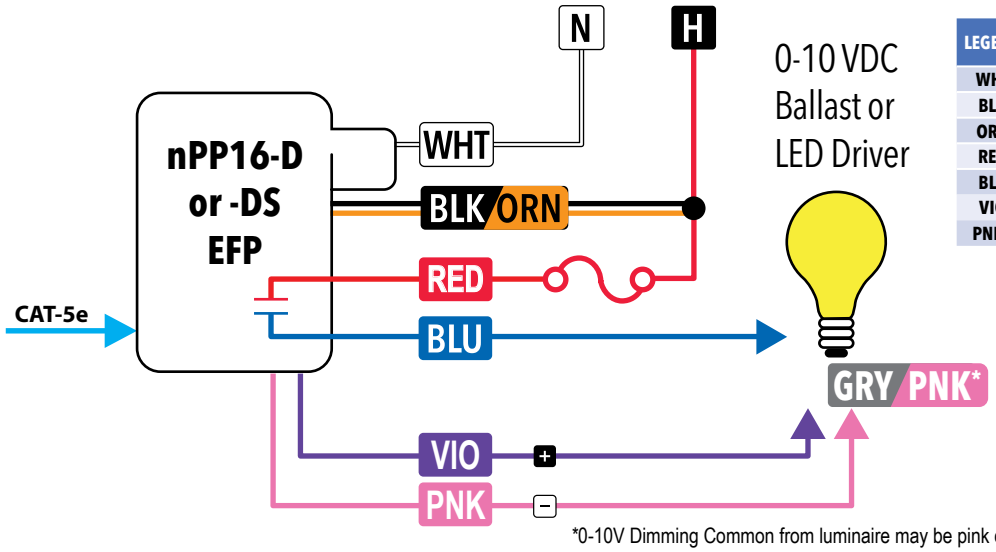
T568B pin/pair assignment is recommended for all CAT-5e cables. For Supply Connections, use 14 AWG or larger wires rated for at least 90° C.

Diagram for non-dimming units



LEGEND	Base (120/277VAC)	230 (220/240VAC)	347 (120/347VAC)
WHT	Neutral		
BLK	120VAC	N/A	120VAC
ORN	277VAC	220-240VAC	347VAC
RED	120/277VAC	220-240VAC	120/347VAC
BLU	Load (Switched Out)		

Diagram for units with a dimming option (-D or -DS suffix)



LEGEND	Base (120/277VAC)	230 (220/240VAC)	347 (120/347VAC)
WHT	Neutral		
BLK	120VAC	N/A	120VAC
ORN	277VAC	220-240VAC	347VAC
RED	120/277VAC	220-240VAC	120/347VAC
BLU	Load (Switched Out)		
VIO	0-10V Dim (+)		
PNK*	0-10V Com (-)		

NOTE: If there is a GREEN wire present, connect to earth ground.

*0-10V Dimming Common from luminaire may be pink or as otherwise indicated per section 410.69 of the 2020 NEC.

OVERVIEW

The nWSXA series nLight wall switch occupancy sensor provides a simple control solution for a small room, in particular one utilizing nLight enabled digital luminaires. Capable of detecting small motion up to 20 ft (6.10 m), this sensor is perfect for private offices, private rest rooms, copy rooms, closets or any small enclosed space. Available as Passive Infrared (PIR), or PIR/Microphonics Dual Technology (PDT), this stylish sensor can be programmed locally, via the front push button(s), or remotely via the nLight software solutions. The nWSXA includes an integrated photocell (inhibit only – disabled by default).

FEATURES

- 100% digital PIR detection, vandal resistant lens standard, includes screwless wall plate
- Push-button programmable, adjustable time delays, multiple operating modes
- Multiple nWSXA sensors or WallPods can be used in 3 way(or greater) configurations w/o traveler wires
- Photocell standard (inhibit only – disabled by default)
- Broadcasts occupancy, photocell, and switch information over a local and/or global nLight channel
- Remotely firmware upgradeable

CONTROL MODES

A control zone with an nWSXA can operate in several modes:

1. Auto On / Auto Off (i.e. Fully Automatic)
2. Manual On (initial state) to Override On (with expiration timer)
3. Auto On (initial state) to Override On (with expiration timer)
4. Manual On / Automatic Off (i.e. Semi-Automatic)
5. Manual On (initial state) to Fully Automatic
6. Predictive Off Switch (returns zone to auto-on unless person remained in room after an off switch press)

*See MLO operation chart on page 2.

Buy American Act
Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

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Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.
*See ordering tree for details

nWSXA

Low Voltage Wall Switch Sensor

nWSXA DX

Design Select options indicated by this color background.

ORDERING INFORMATION

nWSXA — Example: nWSXA LV DX WH

Series	Occupancy Detection	Voltage	Dimming	Color		Temp/Humidity	Buy America(n)[1 2]
nWSXA Passive Infrared	[blank] PIR Detection	LV Low Voltage	[blank] None	WH White	AL Lt. Almond	[blank] Standard	[blank] Standard
	PDT Dual Tech - PIR/ Microphonics		DX Raise/Lower dim control	IV Ivory	BK Black	LT Low temp	BAA Buy America(n) Act Compliant
				GY Gray	RD Red		

ACCESSORIES

Series	# of Gangs	Mounting	Color		Packaging
WS xPODA Wall Plates (Standard)	1 GNG Single Gang	[blank] Standard	WH White	BK[4] Black	[blank] Single Unit[7]
SSW[5] Sealed Covers		OCC[6] Occ. Wall Switch	IV Ivory	RD Red	M5[4] 5 Pack
			GY[4] Gray	VP[4] Variety Pack	M6[3] 6 Pack
			AL[4] Lt. Almond		

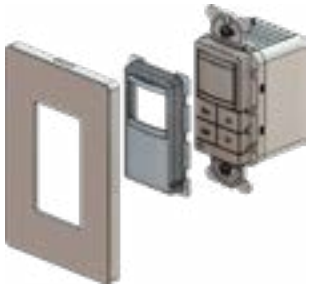
Notes:
1. Only available in WH.
2. Not available with LT option.
3. Only available for Variety Pack.
4. Not available for SSW Series.
5. Ships with custom screwless wall plate.
6. Only available with SSW series.
7. Single units only available with SSW series.

All nWSXA switches are shipped with wall plates and mounting flanges (WS XPODA), however, the following order information is available to acquire replacement wall plates. Also compatible with the WALLP Series.

WALL SWITCH CLEANING

It will occasionally be necessary to clean the wall switches. All nWSXA switches may be wiped down with a soft cloth or paper towel dampened with glass cleaner, vinegar and water, hydrogen peroxide, or a mild abrasive. Spray a limited amount on the cloth or paper towel prior to applying. Do not spray cleaner on the switches directly, and do not wipe the switches down with a towel saturated (drips when wrung out) with cleaner.

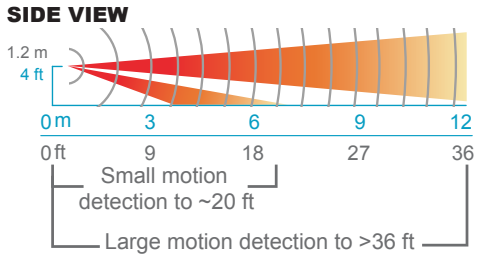
If the ability to clean the switches using chemical spray disinfectants is desired, we recommend the use of the Sealed Screwless Wall Plate (SSW). The Sealed Screwless Wall Plate is a cover for the standard wall plate, designed with an IP54 rating. It consists of a transparent silicone rubber layer that covers the wall switch to prevent liquids from entering the wall switch while maintaining a tactile button feel. The Sealed Screwless Wall Plate is the ideal solution to help protect a wall switch from fluid entering the device while enabling the use of disinfectants recommended by the EPA for use against SARS-CoV-2, the coronavirus that causes COVID-19, which often require spraying or saturating the surface.

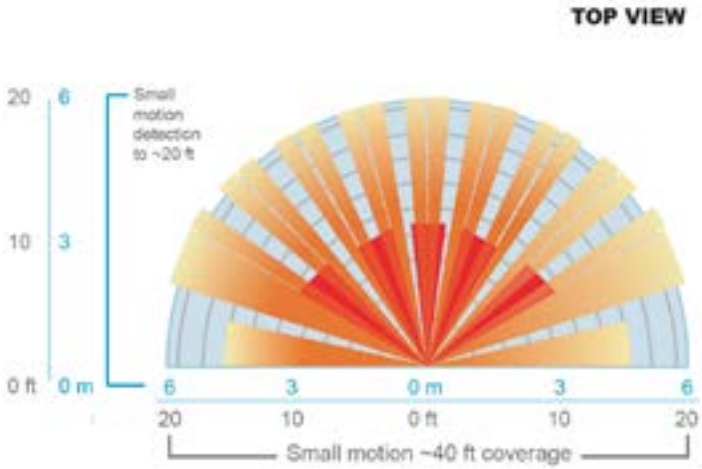


For more information on the Sealed Screwless Wall Plates

COVERAGE PATTERN*

- Small Motion (e.g. hand movements) detection up to 20 ft (6.10 m)
- Large motion (e.g. walking) detection greater than 36 ft (10.97 m)
- Wall to Wall Coverage
- Passive Dual Technology (Microphonics) provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is utilized to prevent non-occupant noises from keeping the lights on.



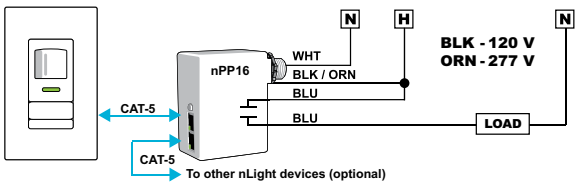


* Coverage pattern shown is derived from NEMA WD7 testing

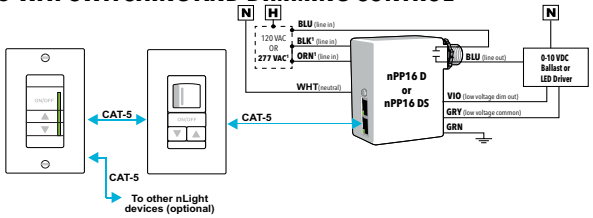
TYPICAL WIRING DIAGRAMS

Sensor power is provided via the CAT-5e connection to an nLight power pack/supply, nLight enabled digital luminaire, or nLight Bridge. T568B pin/pair assignments is recommended for CAT-5e cables.

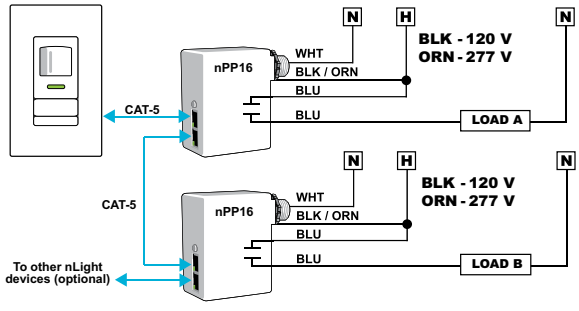
SINGLE LOAD SWITCHING



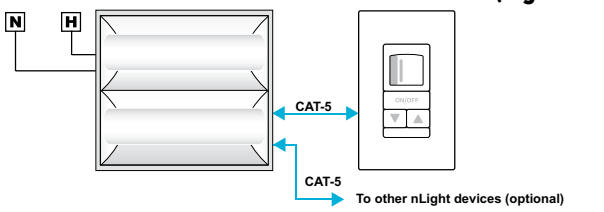
3-WAY SWITCHING AND DIMMING CONTROL



BI-LEVEL SWITCHING USING MULTI-LEVEL OPERATING MODE (MLO)



WIRING to nLIGHT ENABLED DIGITAL LUMINAIRE (e.g. RTLED)



NOTES:

- nLight enabled fixture must have **nIO LEDG/nIO EZ PH** for standalone operation
- Luminaires with **nIO LEDG ER/nIO EZ PH ER** require bus power from another device
- Provides on/off and continuous raise/lower dimming operation by default. For bi-level operation only program **nWSXA** for Multi-Level Operating Mode (**MLO**)

MLO OPERATIONAL MODES

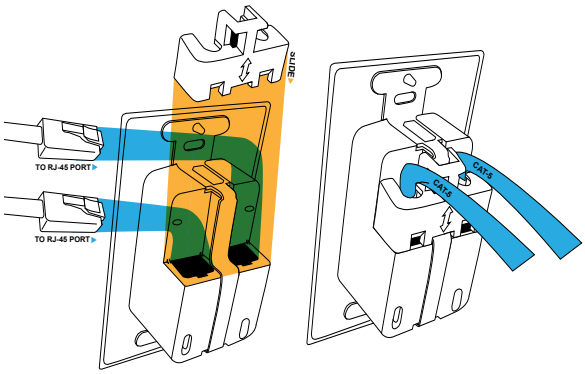
Additionally, an **nWSXA** can be set to function in Multi-Level Operating Mode (**MLO**) which enables the user to select from multiple on/off lighting states using just the unit's single on/off button. This mode is designed specifically for bi-level applications and eliminates user confusion created when wall stations have multiple buttons. Several different transition sequences are available in order to comply with energy codes or user preference. Depending on the sequence selected and initial lighting state, every subsequent button push steps through states according to below table. **MLO** sequences are also available that enable high/low or low/high step operation via any nLight dimming output.

	2 State (Bi-Level) Sequence		2 State - Alternating Sequence		3 State Sequence	
Button Press #	Load A	Load B	Load A	Load B	Load A	Load B
1	On	Off	On	Off	On	Off
2	On	On	Off	On	Off	On
3	Off	Off	Off	Off	On	On
4					Off	Off

INSTALLATION

- Mount WallPod using holes that align with standard single gang switch box or low voltage ring
- Access RJ-45 ports by sliding plastic guard up
- Insert CAT-5e cable(s), T568B wiring convention recommended
- Slide guard back onto metal strap
- Interconnect unit with other nLight devices in lighting zone using CAT-5e cables
- Once power is received via CAT-5e connection, all devices in zone will automatically begin functioning together according to respective device's defaults

Attention! Only use non-booted CAT5e cables.



SPECIFICATIONS

Electrical	**Input Ratings**	15-24VDC, 3mA, Class 2 (nLight network power)
Mechanical	**Dimensions**	2.74"H x 1.68"W x 1.63"D (70mm x 43mm x 41mm) - does not include ground strap
	Mounting	Single-Gang Box or Low Voltage Ring
	Connection Type	RJ-45 nLight Network Ports (2)
Environmental	**Warrantied Operating Temperature**	32°F to 140°F (0°C to 60°C) LT Option: -4°F to 140°F (-20°C to 60°C)
	Relative Humidity	Up to 90%, Non-Condensing
	Standards/ Ratings	Energy Management Equipment, UL916 (E167435) RoHS

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

EARM Running Man LED Sign

FEATURES & SPECIFICATIONS

INTENDED USE — Ideal for applications requiring durable, attractive and quick installation of an extruded aluminum running man sign.

CONSTRUCTION — Lightweight extruded aluminum housing comes fully assembled with two screws for fast installation. Field selectable direction, comes fully packaged with right arrow, left arrow, and pictogram only inserts.

OPTICS — Ultra bright LEDs mounted on printed circuit boards. Low energy consumption. LED lamp operates in normal (AC input) and emergency (DC input) modes. Uniform illumination without shadows or hot spots.

The typical life of the LED lamp is 10 years.

ELECTRICAL — Input voltage capability 120V, 50 or 60Hz.

Battery: Sealed, maintenance-free nickel-cadmium battery delivers a minimum of 90 minutes of illumination.

Self-diagnostics: Performs monthly 30 second, bi-monthly 30 minute and annual 90 minute testing with multi-status diagnostic functions.

Automatic solid-state charger initiates battery charging, maximizes battery life and automatically recharges after battery discharge.

DC Input leads for use with 6V/12V/24V. DC Input provided by an external power supply or the remote leads of a battery backup unit, to keep sign illuminated in the absence of AC power.

INSTALLATION — Universal (top-, end-, or back-) mounting. Easily removed mounting knockouts. J-box pattern on back panel. Housing face frame can be removed with two small screws.

Ships standard with additional pictogram inserts.

LISTINGS — CSA certified to US and Canadian standards. CSA listed for damp location 10°- 40°C (50°F to 104°F). Meets CSA C22.2 No. 141.15. Meets CSA C860. Meets UL924, NFPA 101 (current Life Safety Code), NFPA 70- NEC, FCC Title 47, Part 15, Subpart B and OSHA illumination standards.

WARRANTY — 5-year limited warranty. (Battery is prorated.) This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.
Specifications subject to change without notice.

Specifications

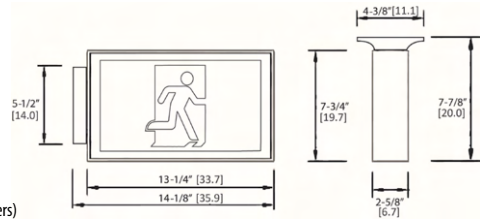
Length: 13.25 (33.66)

Depth: 2-5/8 (6.67)

Height: 7-7/8 (20)

Weight: 2.6 lbs (1.18 kgs)

All dimensions are inches (centimeters) unless otherwise specified.



ORDERING INFORMATION For shortest lead times, configure product using **bolded options.** **Example**: EARM W 1 EL

EARM					
Family	**Housing color**	**Input voltage**	**Number of Faces**	**Operation**	**Options**
EARM	**W** Ivory white B Black	**(blank)** 120V, 50/60Hz	**1** Single face 2 Double face	**(blank)** AC only EL Nickel-cadmium battery	SD Self-diagnostics [1]

Accessories: *Order as separate catalog number.*	
ELA WG1	Wireguard (back mount only) [2]

Notes

1. Only available with EL operation.
2. See spec sheet ELA-WG for specifications and additional wireguards.

EARM Running Man LED Sign

SPECIFICATIONS

Electrical Primary Circuit				
	Typical LED life[1]	Supply Voltage	Max Amps	Max Watts
White LED	10 years	120	0.04	4.4

BATTERY				
Nickel Cadmium				
Voltage	Typical shelf life[2]	Typical life[3]	Maintenance[3]	Temperature range[4]
9.6	3 years	7-9 years	none	50°F - 104°F (10°C - 40°C)

Notes

1. Based on continuous operation. The typical life of the exit LED lamp is 10 years.
2. At 77°F (25°C).
3. All life safety equipment, including emergency lighting for path of egress must be maintained, serviced and tested in accordance with all National Fire Protection Association (NFPA) and local codes. Failure to perform the required maintenance, service, or testing could jeopardize the safety of occupants and will void all warranties.
4. Temperature range where unit will provide capacity for 90 minutes. Higher and lower temperatures affect life and capacity.

EMERGENCY: One Lithonia Way Conyers, GA 30012 Phone: 800-705-SERV (7378) techsupport-emergency@acuitybrands.com www.lithonia.com
 Rev. 07/28/23

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

star SELF-TESTING AUTOMATED REPORTING

QUANTUM®

Contemporary Commercial LED Emergency Light

ELM2L
Aimable Optics

ELM2LF
Fixed Optics

LITHIUM IRON PHOSPHATE

Nickel Cadmium

FEATURES & SPECIFICATIONS

INTENDED USE — Provides a minimum of 90 minutes illumination for the rated wattage upon loss of AC power to meet and exceed code required emergency lighting. Ideal for applications requiring attractive LED unit equipment with quick installation and unparalleled performance for lower mounting heights. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate. Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.**

CONSTRUCTION — The housing is a standard white (black optional) thermoplastic with a compact and low-profile contemporary design. It is 5VA flame rated, impact-resistant, scratch-resistant and corrosion proof. The UV-stable resin resists discoloration from natural and man-made light sources. There is a low-profile, integrated and back-lit test switch with an easily visible multi-color LED status indicator. The back-plate contains a universal j-box mounting pattern to facilitate ease of installation on a wide variety of j-boxes and the front housing allows tool-less access for ease of maintenance.

ELM2LF: Fixed lamp head arrangement for ease of installation and maximum path of egress aiming coverage with no aiming required for wall mount applications.

ELM2L: Unique track and swivel arrangement permits full range of direction for lamp head adjustment.

OPTICS — Both the ELM2L and ELM2LF feature two, high performance LEDs with acrylic lens' rated at 1.2 watts each and delivering a total of 220 lumens in a linear pattern (LP220L). The typical life of an LED is 10 years. The LED light sources typically never need to be replaced under normal conditions for normal off applications.

CCT: 5000K.

ELECTRICAL — Orderable in multiple voltages (see ordering tree for specific voltages).

Current-limiting charger maximizes battery life and minimizes energy consumption and provides low operating costs. Small battery chargers Certified in the CA Title 20 Appliance Efficiency Database.

Short-circuit protection — current-limiting charger circuitry protects printed circuit board from shorts.

Regulated charge voltage maintains constant-charge voltage over a wide range of line voltages.

Prevents over/undercharging that shortens battery life and reduces capacity. Filtered charger input minimizes charge voltage ripple and extends battery life.

BATTERY: Sealed, maintenance-free nickel-cadmium or Lithium Iron Phosphate.

Lithium Iron Phosphate battery powers both on board LEDs and up to 2.4W additional LED remote lamp heads simultaneously or offers extended run-time up to 3 hours.

Automatic 24-hour recharge after a 90-minute discharge.

Advanced electrical design provides constant light output throughout the entire discharge period.

Brownout protection is automatically switched to emergency mode when supply voltage drops below approximately 80 percent nominal of 120, 220, 277 or 347. Other input voltages may vary.

AC/LVD reset allows battery connection before AC power is applied and prevents battery damage from deep discharge.

SELF-DIAGNOSTICS and REMOTE TEST (SDRT and AELR option):
Self-Diagnostics: Continuously monitors AC functionality. Test switch and remote tester (RTKIT accessory) provide manual activation of 30-second diagnostic testing for on-demand visual inspection. Standard derangement monitoring will indicate disconnected battery, charger failure and displays green flashing indicator light while in emergency mode. Single multi-chromatic LED indicator to display two-state charging, test activation and three-state self-diagnostics.

Self-diagnostic testing: Five minutes every 30 days and 90 minutes annually. Diagnostic evaluation of lamps, AC to DC transfer, battery charging and condition of microprocessor. Automatic test is easily postponed for eight hours by activating manual test switch or use of remote tester (RTKIT accessory).

AELR option: STAR (Self-testing Automated Reporting) radio transmits monthly and annual test results and diagnostics information for automated reporting requirements.
For more information visit AcuityBrands.com/STAR

INSTALLATION — Wall mount and ceiling mount standard for ELM2L. Wall mount only for ELM2LF. Blind-mate connector ensures easy installation and safe maintenance. 7/8" entrance provision at top of unit for standard 1/2" conduit entry. Tool-less removal of front cover from back-plate for ease of installation and maintenance.

LISTINGS — UL damp location listed standard and wet location listed when used with the WPVS accessory, all at 50-104°F (10-40°C). Meets or exceeds all applicable requirements for UL 924, NFPA 101 (current Life Safety Code), NFPA 70 (NEC), NOM (Norma Oficial Mexicana), California Energy Commission Title 20 section 1605.3 (W)(4), FCC Title 47, Part 15, Subpart B and OSHA. List and labeled to comply with Canadian Standards C22.2 No. 141-10.

BUY AMERICAN ACT — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations.
Please refer to www.acuitybrands.com/buy-american for additional information.

WARRANTY — 5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

NOTE: Actual performance may differ as a result of end-user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.
Specifications subject to change without notice.

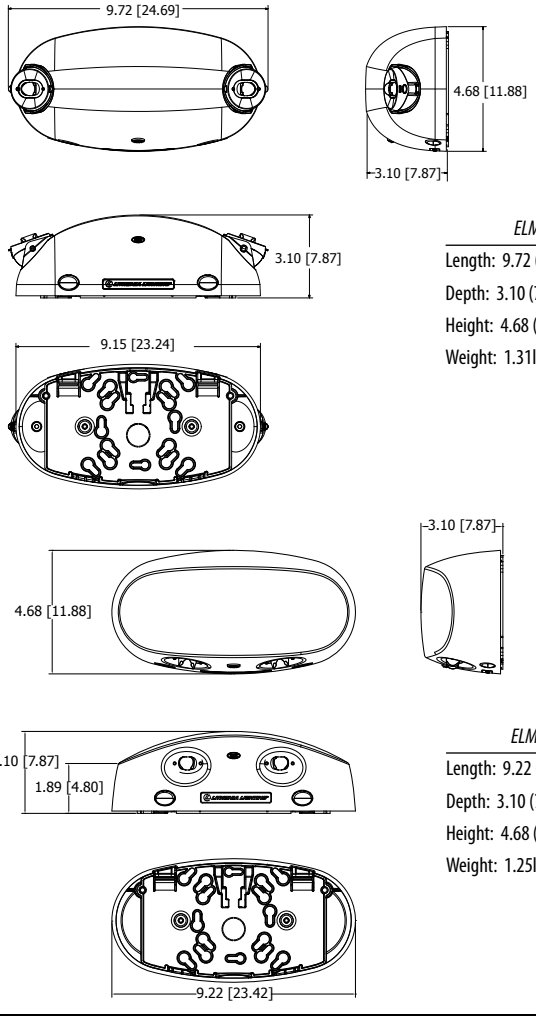
† Small Battery Chargers Certified in the CA Title 20 Appliance Efficiency Database.

BC CERTIFIED IN TITLE 20 † FC NOM c UL us LISTED BAA

MOUNTING AND SPECIFICATIONS

All dimensions are inches (centimeters) unless otherwise indicated.

LED



ELM2L Specifications

Length: 9.72 (24.69)
Depth: 3.10 (7.87)
Height: 4.68 (11.88)
Weight: 1.31lbs (0.59kg)

ELM2LF Specifications

Length: 9.22 (23.42)
Depth: 3.10 (7.87)
Height: 4.68 (11.88)
Weight: 1.25lbs (0.57kg)

ELM2L_ELM2LF Quantum® Contemporary Commercial LED Emergency Light

Looking for Contractor Select readily available configurations? Click here to visit Contractor Select™ spec sheet or go to www.contractorselect.com

NICKEL CADMIUM BATTERY MODELS

ORDERING INFORMATION For shortest lead times, configure product using **bolded options.**

Example: ELM2LF

Series[1]	Lamp type	Housing color	Voltage	Battery type	Automatic Testing	Options
ELM2L Aimable optics **ELM2LF** Fixed optics	**(blank)** LP220L 220 lumen, 2.4 watt, linear pattern, two lamps	**(blank)** White B Black	**(blank)** 120/277 VAC/60Hz 120/347 120/347 VAC/60Hz SVOLT 220-240/50-60 Hz UVOLT 120 - 347 VAC, 50/60hz	**(blank)** Nicad	**(blank)** None SDRT Self Diagnostics, Remote Test[2]	**(blank)** None WPVS Wet protective vandal shield[3] BAA Buy America(n) Act Compliant

Notes
1 ELM2L and ELM2LF with Nicad battery type not available with remote capacity.
2 SDRT only available with UVOLT.
3 WPVS breaks out and ships separately and color will match (ex: WPVS SML B). Must be ordered when using for wet location applications. Decreases delivered lumens up to 20%. See spec sheet WPVS for more information.

LITHIUM IRON PHOSPHATE BATTERY MODELS

ORDERING INFORMATION For shortest lead times, configure product using **bolded options.**

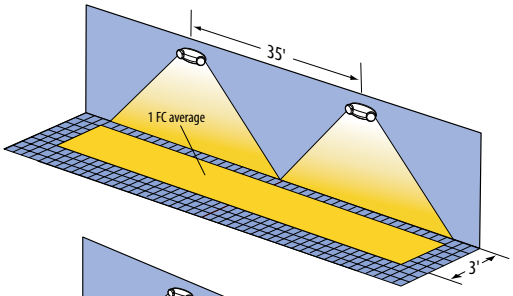
Example: ELM2LF UVOLT LTP

Series[1]	Lamp type	Housing color	Voltage	Battery type	Automatic Testing	Options
ELM2L Aimable Optics **ELM2LF** Fixed Optics	**(blank)** LP220L 220 lumen, 2.4 Watt, Linear Pattern, two lamps	**(blank)** White B Black	UVOLT 120 - 347 VAC, 50/60hz	**LTP** Lithium Iron Phosphate[1]	**(blank)** None SDRT Self-diagnostics, remote test[1] AELR Automatic Emergency Lighting Reporting[2]	**(blank)** None WPVS Wet protective vandal shield[3] BAA Buy America(n) Act Compliant

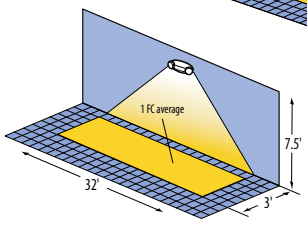
Notes
1 Extended run-time or remote capacity is standard. New ELMRE and ELMRW style remotes are compatible with both SDRT and non-SDRT versions (see page 3).
2 SDRT option required. AELR transmits monthly and annual test results and diagnostics information for automated reporting requirements. Only available with LTP battery type.
3 WPVS breaks out and ships separately and color will match (ex: WPVS SML B). Must be ordered when using for wet location applications. Decreases delivered lumens up to 20%. See spec sheet WPVS for more information.

SPACING GUIDELINES

*Note: To see complete photometric report or download the .ies file for this product, visit Lithonia Lighting ELM2L or ELM2LF home page.



Example of multiple ELM2L luminaires illuminating a 3' path of egress.



Example of single ELM2L illuminating a 3' path of egress.
* Application image examples are using LP220L lamp.

Maximum Spacing Guidelines — ELM2LF

Mounting Height	Illumination Level	Single Luminaire Coverage		Multiple Luminaire Spacing		Application Notes
		3' Path of Egress	6' Path of Egress	3' Path of Egress	6' Path of Egress	
7.5'	1FC Avg[1]	32'	20'	35'	28'	100' Corridor, 8' wide, and 12' high with 80/50/20 reflectances
10'	1FC Avg[1]	20'	NA	27'	24'	

Notes:
1. Also meets the additional illumination requirements of NFPA 101: 1FC minimum and max/min ratio of 40:1.

Maximum Spacing Guidelines — ELM2L

Mounting Height	Illumination Level	Single Luminaire Coverage		Multiple Luminaire Spacing		Application Notes
		3' Path of Egress	6' Path of Egress	3' Path of Egress	6' Path of Egress	
7.5'	1FC Avg[1]	32'	24'	35'	28'	100' Corridor, 8' wide, and 12' high with 80/50/20 reflectances
10'	1FC Avg[1]	20'	14'	27'	23'	

Notes:
1. Also meets the additional illumination requirements of NFPA 101: 1FC minimum and max/min ratio of 40:1.

Other Accessories: *Order as separate catalog number.*

WPVS SML W	Wet protective vandal shield (must be used for wet location applications)
WPVS SML B	Wet protective vandal shield, black (must be used for wet location applications)
ELA WG1	Wireguard, 15" W x 13-1/2" H x 6" D (see spec sheet ELA-WG)
RTKIT	Remote test kit, up to 40' away (includes goggles, laser and battery)


ELM2L mounted inside the WPVS (white)


ELM2LF mounted inside WPVS (white)

EMERGENCY: One Lithonia Way, Conyers, GA 30012 Phone: 1-800-705-SERV (7378) techsupport-emergency@acuitybrands.com www.lithonia.com

INDOOR/ DAMP LOCATION REMOTES

ELMRE Compatible Remotes [1,2,3]

LTP Compatible Remote Accessories: *Order as separate catalog number.*	
ELMRE LP220L SGL	Single LED Indoor remote head, white, 110 lumens
ELMRE LP220L T	Twin LED Indoor remote heads, white, 110 lumens

ELMRE LP220L SGL

ELMRE LP220L T

Notes
1 Compatible with SDRT and non-SDRT versions.
2 Order the WPVS accessory for wet location listing and vandal protection.
3 See spec sheet ELMRE. Also available in black.

BATTERY CAPACITY AND LOADNG - ELMRE REMOTES		
Battery Option	**Total Capacity**	**Maximum # of Remote Lamp heads**
LTP	4.8W	2- ELMRE LP220L SGL M12
		1 - ELMRE LP220L T M12

* In addition to the lamp heads on the product.

OUTDOOR / WET LOCATION REMOTES

ELMRW Compatible Remotes

LTP Compatible Remote Accessories: *Order as separate catalog number.*	
ELMRW LP220L DDBTXD SGL	Single LED Wet Location remote head, dark bronze, 110 lumens
ELMRW LP220L DDBTXD T	Twin LED Wet Location remote heads, dark bronze, 220 lumens

ELMRW LP220L DDBTXD SGL

ELMRW LP220L DDBTXD T

BATTERY CAPACITY AND LOADING		
Battery Option	**Total Capacity**	**Maximum# Remote lamp heads***
LTP	4.8W	2- ELMRW LP220L SGL
		1 - ELMRW LP220L T

* These are in addition to the lamp heads on the product.

SPECIFICATIONS

ELECTRICAL			
Primary Circuit			
Type	**Volts**	**Input amps**	**Watts**
Nicad	120	0.018	1.09
	347	0.012	1.34
Lithium Iron Phosphate	120	0.022	1.35
	347	0.014	1.64

LTP EXTENDED RUN-TIMES	
Products	**Total Run-time with no remotes**
ELM2L LTP	3 hours
ELM2LF LTP	3 hours

BATTERY			
UVOLT Nicad (6V), All Other Nicad (3.6V)			
Typical Shelf life[1]	**Typical life**[1]	**Maintenance**[2]	**Temperature Range**[3,4]
3 years	6-8 years	none	50°-104°F (10-40°C)
Lithium Iron Phosphate (9.6V)			
Typical Shelf life[1]	**Typical life**[1]	**Maintenance**[2]	**Temperature Range**[3,4]
1 years	6-8 years	none	50°-104°F (10-40°C)

Notes
1 At 77°F (25°C) ambient temperature, charge/discharge cycles and prolonged full discharge may reduce useful life.
2 All life safety equipment, including emergency lighting for path of egress must be tested in accordance with all National Fire Protection Association (NFPA) and local codes. Failure to perform the required testing could jeopardize the safety of occupants and will void all warranties.
3 Temperature range where unit will provide capacity for 90 minutes. Higher and lower temperatures affect life and capacity.
4 Battery life is negatively impacted by many variables including temperature, charging rates, number of cycles and deep discharges due to long periods of time without AC power.

EMERGENCY: One Lithonia Way, Conyers, GA 30012 Phone: 1-800-705-SERV (7378) techsupport-emergency@acuitybrands.com www.lithonia.com

gotham® | EVO®

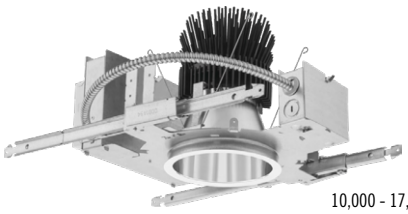
Multiple Layers of Light

Luminaire Type:

Catalog Number:

General Illumination Round Downlight 6"

250 - 8,000 lumens



10,000 - 17,500 lumens

Feature Set

- Bounding Ray™ optical design
- Unitized optics mechanically attach the light engine to the lower reflector for complete optical alignment.
- 45° cutoff to source and source image
- Fully serviceable and upgradeable lensed LED light engine
- 70% lumen maintenance at 60,000 hours
- 2.5 MacAdam Ellipse; 85 CRI typical, 90+ CRI optional
- Fixtures are wet location, covered ceiling
- Available with 10% dimming, 1% dimming, or dim to dark
- Batwing distribution with feathered edges provides even illumination on horizontal and vertical surfaces
- ENERGY STAR® certified product*
- UGR of zero for fixtures aimed at nadir with a cut-off equal to or less than 60deg per CIE 117-1995 Discomfort Glare in Interior Lighting. UGR FAQ

Distribution

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.

*See ordering tree for details

Superior Performance

Nominal Lumens	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10,000	12,000	15,000	17,500
Delivered Lumens	297	519	776	994	1471	2006	2537	3077	3542	4027	4533	5256	6371	8247	10637	12332	15776	17801
Wattage	3.4	6.2	8.2	9.6	14.7	19.7	24.7	29.5	33.8	39.0	47.3	48.7	57.6	74.9	97.1	115.0	150.9	175.3
Lumens per Watt	87.4	83.7	94.6	103.5	100.1	101.8	102.7	104.3	104.8	103.3	95.8	107.9	110.6	110.1	109.5	107.2	104.5	101.5

*Based on 3500K AR LSS MWD 80CRI

Coordinated Apertures | Multiple Layers of Light

General Illumination Layer | EVO

High Center Beam Layer | Incito

EVO + Incito — Multiple Layers of Light

Core

Healthcare

Special Applications

OVERVIEW

COMPLIMENTARY PRODUCTS

GOTHAM ARCHITECTURAL DOWNLIGHTING | 1400 Lester Road Conyers, GA 30012 | P 800-705-SERV (7378) | gothamlighting.com

ORDERING INFORMATION

Design Select options indicated by this color background.

Luminaire Type:

Catalog Number:

EXAMPLE: EV06 35/150 AR MWD LSS MVOLT EZ1

Series	Color Temperature	Nominal Lumen Values	Reflector & Flange Color	Trim Style	Finish
EV06	27/ 2700 K 30/ 3000 K 35/ 3500 K 40/ 4000 K 50/ 5000 K	02 250 lumens 05 500 lumens 07 750 lumens 10 1000 lumens 15 1500 lumens 20 2000 lumens 25 2500 lumens 30 3000 lumens 35 3500 lumens 40 4000 lumens 45 4500 lumens 50 5000 lumens 60 6000 lumens 80 8000 lumens 100 10000 lumens 120 12000 lumens 150 15000 lumens 175 17500 lumens	AR Clear PR Pewter WTR Wheat GR Gold WR[1] White BR[1] Black WRAMF[1] White Anti-microbial TRALTBD[1,2] RAL paint for pricing only TCPC[1] Custom paint color	(blank) Self-flanged FL Flangeless	LSS Semi-specular LD Matte-diffuse LS Specular

Distribution	Voltage	Driver[5]	
VND Very Narrow (0.5 s/mh) ND Narrow (0.7 s/mh) MD Medium (0.9 s/mh) MWD Medium Wide (1.0 s/mh) WD Wide (1.2 s/mh)	MVOLT 120 277 347[3,4]	GZ10 0-10V driver dims to 10% GZ1 0-10V driver dims to 1% EZ10 eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1%. EDAB eldoLED SOLOdrive DALI. Logarithmic dimming to <1%.	EDXB eldoLED POWERdrive DMX with RDM (remote device management). Square Law dimming to <1%. Includes termination resistor. Refer to DMXR Manual. Minimum 1000 lumens/Maximum 15000 lumens. ECOD[6] Lutron Ecosystem digital Hi-Lume 1% soft-on, fade to black. Max: 4000LM.

Control Interface	Emergency Options	Options
NLT[7] nLight® dimming pack controls NLTER[3,7,8] nLight® dimming pack controls emergency circuit NLTAIR2[9,10] nLight® AIR enabled NLTAIRER2[3,8,10] nLight® AIR enabled emergency NLTAIREM2[3,9] nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit with battery pack options.	EL Emergency battery pack, 10W, with integral test switch ELR Emergency battery pack, 10W, with remote test switch ELSD Emergency battery pack, 10W, with self-diagnostics, integral test switch ELRSD Emergency battery pack, 10W, with self-diagnostics, remote test switch E10WCP Emergency battery pack, 10W Constant Power, CA Title 20 compliant with integral test switch E10WCPR Emergency battery pack, 10W Constant Power, CA Title 20 compliant with remote test switch BGTD Bodine generator transfer device. Specify 120V or 277V.	SF Single fuse. Specify 120V or 277V. TRW[11] White painted flange TRBL[12] Black painted flange FRALTBD[2] Flange ring only RAL color for pricing only FCPC Flange custom paint color N80[13] nLight® Lumen Compensation GTD generator transfer device. Specify 120V or 277V 90CRI High CRI (90+) CP[14] Chicago Plenum. Specify 120V or 277V for 5000lm and above. HAO[15] HAO High Ambient Option (40°C) RRL_ RELOC®-ready luminaire connectors enable a simple and consistent factory installed option across all ABL luminaire brands. Available only with RRLA, RRLB, RRLAE, and RRLC12S. Refer to RRL spec sheet on www.acuitybrands.com for RELOC® product specifications. Above ceiling access required.

ACCESSORIES – order as separate catalog numbers (shipped separately)

SCA6	Sloped ceiling adapter. Degree of slope must be specified (5D, 10D, 15D, 20D, 25D, 30D). Ex: SCA6 10D. Refer to TECH-190.
CTA EV06	6" Aperture ceiling thickness adapter, for up to 8,000LM (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YK	4"-8" Aperture ceiling thickness adapter for use with EDXB or CP up to 8,000LM, or nTune options (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YKHL	6" Aperture ceiling thickness adapter, for 10,000LM and up (extends mounting frame to accommodate ceiling thickness up to 5"). For use with CWW/DWW trims, EDXB, CP or nTune options.
ISD BC	0-10V wallbox dimmer. Refer to ISD-BC.

ORDERING NOTES

1. Not available with finishes.
2. Replace with applicable RAL number and finish when ready to order. See RAL BROCHURE for available color options. Not available with emergency battery pack options.
3. Not available with emergency battery pack options.
4. Supplied with factory installed step down transformer.
5. Refer to TECH-240 for compatible dimmers.
6. Not available with nLight®.
7. Specify voltage.
8. ER for use with generator supply power. Will require an emergency hot feed and normal hot feed.
9. Not available DALI or DMX drivers. Not available with CP or N80 options. Not recommended for metal ceiling installations.
10. When combined with the EZ1, EZ10, or EZB option, normal luminaires (non-emergency) can be used as a normal power sensing device for nearby nLight AIR devices and luminaires with EM emergency options.
11. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with WR (white reflector) or FL (flangeless) option.
12. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with BR (black reflector) or FL (flangeless) option.
13. Fixture begins at 80% light level. Must be specified with NLT or NLTER. Only available with EZ10 and EZ1 drivers.
14. 12,000LM max with EL or nLight® options. 5,000LM max with Lutron drivers combined with EL. Not available with ELR, HAO, or EXAB, or any nLight® AIR dimming options.
15. Only available 5000LM - 15,000LM with eldoLED drivers.

SPECIFICATIONS

Optical Assembly
Optical design is a Bounding Ray™ design with 45° cutoff to source and source image. Top-down flash characteristic for superior glare control.
Unitized optics shall have mechanical attachment of the light engine to the lower reflector for complete optical alignment.

Electrical
The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
Sound Rated A+. Driver shall be >80% efficient at full load across all input voltages.
Input wires shall be 18AWG, 300V minimum, solid copper.

Controls
Luminaire shall be equipped with interface for nLight wired or wireless network with integral power supply as per specification.

Dimming
The luminaire shall be capable of continuous dimming without perceivable stroboscopic flicker as measured by flicker index (ANSI/IES RP-16-10) over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output with a smooth shut off function to step to 0%.
eldoLED LED drivers shall conform to IEEE P1789 standards. Alternatively, manufacturers must demonstrate conformance with product literature and testing which demonstrates this performance. Systems that do not meet IEEE P1789 will not be considered.
Driver is inaudible in 24dB environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Construction
Fully serviceable and upgradeable lensed LED light engine, both the driver and light engine are suitable for field maintenance and are serviceable from above or below the ceiling.
Luminaire housing shall be constructed of 16-gauge galvanized steel and have preinstalled telescopic mounting bars with maximum 32" and minimum 15" extension and 4" vertical adjustment.
Luminaires shall be suitable for installation in ceilings up to 1½" thick. (specify ceiling thickness adapter to extend frame to accommodate ceiling thickness up to 5").
Tool-less adjustments shall be possible after installation.
The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
25°C ambient temperature standard (1/2" clearance on all sides from non-combustible materials in non-IC applications, unless marked spacing noted otherwise). For use in insulated ceilings, a 3" clearance on all sides from insulation is required (unless marked spacing noted otherwise). 40°C high ambient optional.

Listings
Fixtures are CSA certified to meet US and Canadian Standards: All fixtures manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL, wet location covered ceiling. Luminaire configurations are Energy Star certified through testing in EPA–recognized laboratories, with the results reviewed by an independent, accredited certification organization. Visit www.energystar.gov for specific configurations listed. *Not all configurations are Energy Star listed.

BUY AMERICAN ACT
This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Photometrics
LEDs tested to LM-80 standards. Measured by IESNA Standard LM-79-08 in an accredited lab. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.
Color appearance from luminaire to luminaire of the same type and in all configurations, shall be consistent both initially and at 60,000 hours and operate within a tolerance of <2.5 MacAdam ellipse as defined by a point at the intersection of the CCT line and the black body locus line in CIE chromaticity space.

Warranty
5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note:
Actual performance may differ as a result of end user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.

A+ Capable Luminaire
This item is an A+ capable luminaire, which has been designed and tested to provided consistent color appearance and out-of-the-box control capability with simple commissioning when used with Acuity Brands controls products.
All configurations of this luminaire are calibrated and tested meet the Acuity Brands' specification for chromatic consistency - including color rendering, color fidelity and color temperature tolerance around standard CIE chromaticity coordinates.
To learn more about A+, visit www.acuitybrands.com/aplus.

Tables of Use

Marked Spacing in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
500-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

EVO - eldoLED Driver Default Dimming Curve			
Nomenclature	Min Dimming	Driver Dim Curve	Control Dim Curve
EZ10	10%	Linear	Linear/Logarithmic
EZ1	1%	Linear	Linear/Logarithmic
EXA1	1%	Linear	Linear/Logarithmic
EZB	<1%	Logarithmic	Linear
EDAB	<1%	Logarithmic	Linear
EXAB	<1%	Logarithmic	Linear
EDXB	<1%	Square	Linear

Marked Spacing in Inches 40°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
5000	24	12	5
6000			
8000	48	24	9
10000			
12000			
15000	72	36	9

Marked Spacing Chicago Plenum Open Frame in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

Marked Spacing Chicago Plenum Enclosure in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-6000	None	None	None
8000	36	18	6
10000	48	24	3
12000			

Driver		Control Provided (note: 347V/UVOLT versions provided with 347 option selected)			
Nomenclature	Description	NLT	NLTER	NLTAIR2	NLTAIRER2
GZ10	0-10V driver dims to 10%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
GZ1	0-10V driver dims to 1%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ10	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ1	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZB	eldoLED 0-10V SOLOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2

How to Estimate Delivered Lumens in Emergency Mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver. P = 10W for PS1055CP

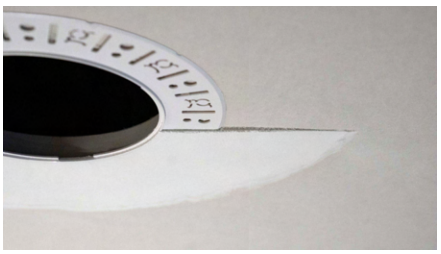
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

Flangeless

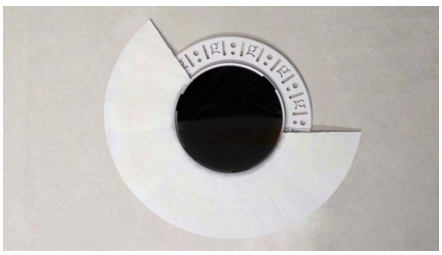
Flangeless Installation

Gotham's flangeless option utilizes a micro-thin polymer mud ring that minimizes the amount of drywall compound required to finish the ceiling. The end result is a virtually undetectable flangeless downlight installation.

The polymer mud ring is installed independent of the of the recessed frame, therefore floating with the ceiling. This innovation minimizes any surface cracks during reflector installation, ceiling movement and any future service to the recessed frame, wiring, electronics, etc.



Partially finished mud ring, showing cross-section detail.



An EVO downlight requires only approximately 3" of plaster to finish.

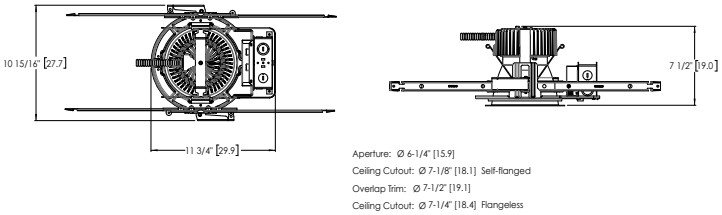
EVO with flangeless trim

DIMENSIONAL DATA

*Dimensions in inches [centimeters]

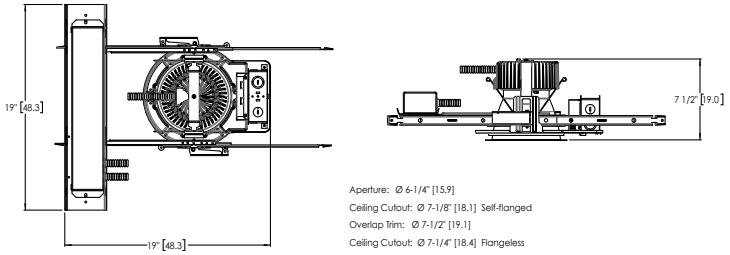
Aperture: 6 1/4" [15.9)]	Ceiling Opening: 7 1/8" [18.1] self-flanged
Overlap Trim: 7 1/2" [19.1]	7 1/4" [18.4] flangeless

250LM-5000LM Standard



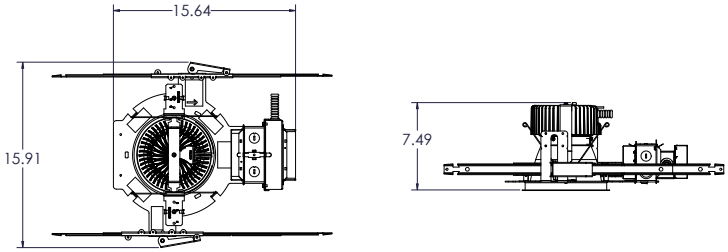
Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

250LM-5000LM Battery Pack

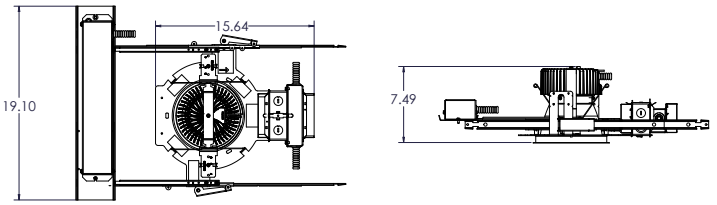


Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

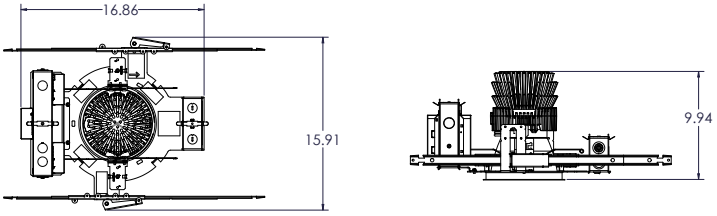
6000LM-8000LM Standard



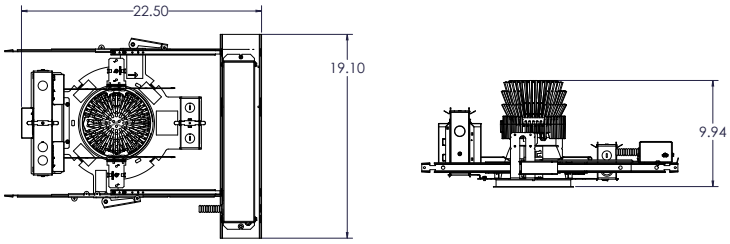
6000LM-8000LM Battery Pack



10,000LM-17,500LM Standard



10,000LM-17,500LM Battery Pack

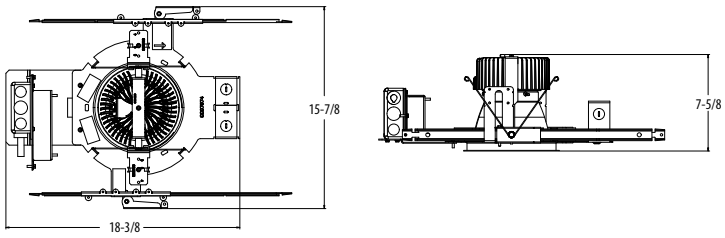


gotham®

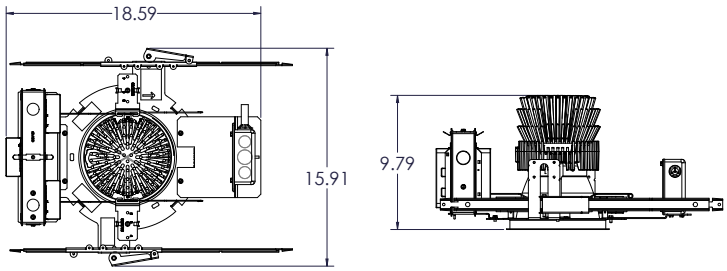
DIMENSIONAL DATA

*Dimensions in inches [centimeters]

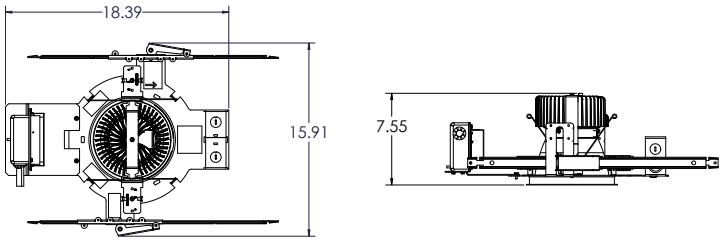
250LM-4500LM CP



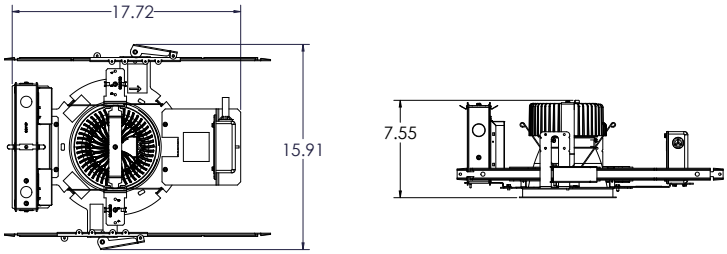
10000LM - 17,500LM Lumen Open Frame CP



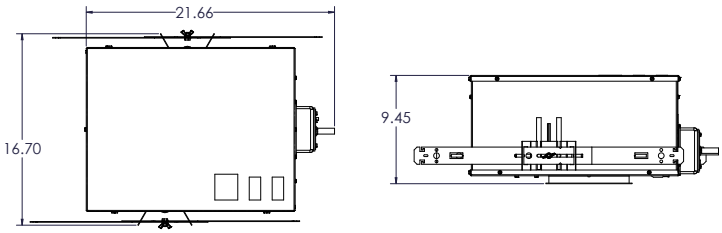
5000LM ECO/SOLO Drive Open Frame CP



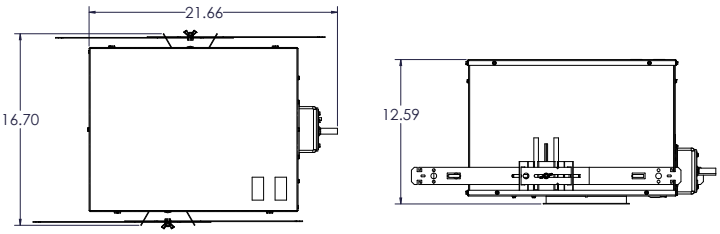
5000LM (Lutron & POWER Drive Only), 6000LM & 8000LM Open Frame CP



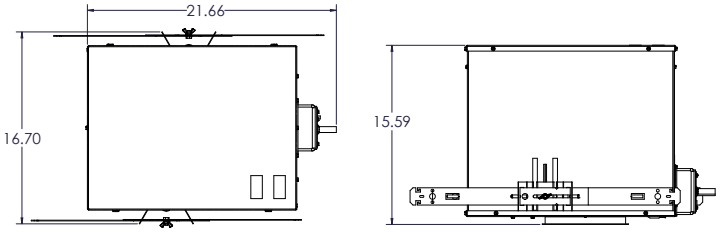
250LM - 6000LM CP Enclosed with Battery Pack and/or nLight™ Only



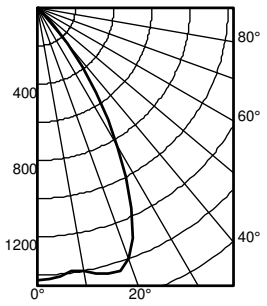
8,000LM CP Enclosed with Battery Pack and/or nLight™ Only



10,000LM-12,000LM CP Enclosed with Battery Pack and/or nLight™ Only



EV06 35/15 AR MWD LS INPUT WATTS: 14.7, DELIVERED LUMENS: 1471LM, LPW= 100, 1.03 S/MH, TEST NO. LTL27783P1505



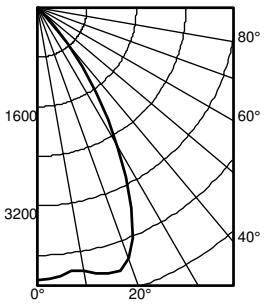
	Ave	Lumens
0	1431	
5	1410	134
15	1442	405
25	1161	523
35	540	332
45	78	72
55	3	4
65	1	1
75	0	1
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	1061.4	72.2
0° - 40°	1393.5	94.7
0° - 60°	1469.5	99.9
0° - 90°	1470.9	100.0
90° - 180°	0.0	0.0
0° - 180°	1470.9	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	47.3	5.7	23.7	8.9	4.7
10.0	25.4	7.7	12.7	12.1	2.5
12.0	15.9	9.8	7.9	15.3	1.6
14.0	10.8	11.8	5.4	18.6	1.1
16.0	7.9	13.9	3.9	21.8	0.8

EV06 35/45 AR MWD LS INPUT WATTS: 47.3, DELIVERED LUMENS: 4532.7LM, LPW= 95.8, 1.03 S/MH, TEST NO. LTL27783P1649



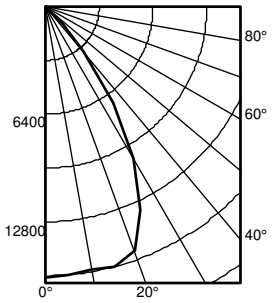
	Ave	Lumens
0	4411	
5	4346	413
15	4443	1247
25	3578	1610
35	1665	1024
45	242	222
55	8	12
65	2	3
75	1	2
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	3270.7	72.2
0° - 40°	4294.2	94.7
0° - 60°	4528.3	99.9
0° - 90°	4532.7	100.0
90° - 180°	0.0	0.0
0° - 180°	4532.7	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	145.8	5.7	72.9	8.9	14.6
10.0	78.4	7.7	39.2	12.1	7.8
12.0	48.9	9.8	24.4	15.3	4.9
14.0	33.4	11.8	16.7	18.6	3.3
16.0	24.2	13.9	12.1	21.8	2.4

EV06 35/175 AR MWD LS INPUT WATTS: 175.3, DELIVERED LUMENS: 17801LM, LPW=101.5, 1.06 S/MH, TEST NO. ISF 34035P268



	Ave	Lumens
0	16146	
5	15998	1521
15	16006	4479
25	13362	6001
35	7018	4289
45	1470	1299
55	100	156
65	37	38
75	13	14
85	2	2
90	0	

Zone	Lumens	% Lamp
0° - 30°	12002.3	67.4
0° - 40°	16291.0	91.5
0° - 60°	17746.3	99.7
0° - 90°	17801.0	100.0
90° - 120°	0.0	0.0
90° - 130°	0.0	0.0
90° - 150°	0.0	0.0
90° - 180°	0.0	0.0
0° - 180°	17801.0	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	108	106	104	104	103	101
2	103	98	95	101	97	94	98	95	92
3	95	90	86	94	89	86	91	87	84
4	89	83	79	88	82	78	85	81	77
5	83	77	72	82	76	72	80	75	71
6	77	71	67	77	71	67	75	70	66
7	73	66	62	72	66	62	71	65	61
8	68	62	58	67	62	57	66	61	57
9	64	58	54	63	58	54	62	57	53
10	60	54	50	60	54	50	59	54	50

		50% beam - 55.7°		10% beam - 79.8°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	533.7	5.8	266.9	9.2	53.4
10.0	287.0	7.9	143.5	12.5	28.7
12.0	178.9	10.0	89.4	15.9	17.9
14.0	122.1	12.1	61.0	19.2	12.2
16.0	88.6	14.3	44.3	22.6	8.9

Lumen Output Multiplier		
CRI	CCT	Multplier
80	2700K	0.96
	300K	1.00
	3500K	1.00
	4000K	1.01
	5000K	1.07
90	2700K	0.80
	300K	0.83
	3500K	0.85
	4000K	0.87
	5000K	0.91

Reflector Finish Multiplier	
Reflector Finish	Multiplier
LS - Specular	1
LSS - Semi Specular	0.956
WR - White	0.87
LD - Matte Diffuse	0.85
BR - Black	0.73

Distributions		
Nomenclature	Beam Angle	Field Angle
VND	30	64
ND	44	69
MD	54	82
MWD	67	89
WD	71	92

NLIGHT AIR

NLIGHT

nLight® AIR is the ideal solution for retrofit or new construction spaces where adding communication wiring is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each EVO Luminaire ordered with the NLTAIR option. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.

nLight® AIR Control Accessories *Order as separate catalog number. Visit nLight AIR.*	
Wall Switches	**Model Number**
On/Off single pole	rPODB (color) G2
On/Off two pole	rPODB 2P (color) G2
On/Off & raise/lower single pole	rPODB DX (color) G2
On/Off & raise/lower two pole	rPODB 2P DX (color) G2

nLight® AIR Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	rCMS 9 / rCMS PDT 9
Large motion 360°, ceiling	rCMS 10 / rCMS PDT 10

UL924 Sequence of Operation

The below information applies to all nLight AIR devices with an EM option.

- EM devices will remain at their high-end trim and ignore wireless lighting control commands, unless a normal-power-sensed (NPS) broadcast is received at least every 8 seconds.
- Using the CL**AIR**ITY+ mobile app, EM devices must be associated with a group that includes a normal power sensing device to receive NPS broadcasts.
- Only non-emergency rPP20, rLSXR, rSBOR, rSDGR, and nLight AIR luminaires with version 3.4 or later firmware can provide normal power sensing for EM devices. See specification sheets for control devices and luminaires for more information on options that support normal power sensing.

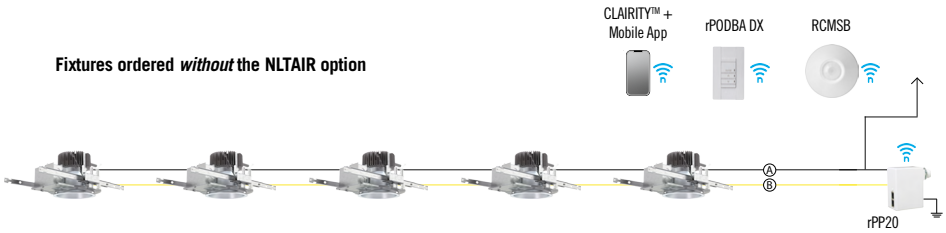
nLight® The nLight® solution is a digital networked lighting control system that provides both energy savings and increased user configurability by cost effectively integrating time-based, daylight-based, sensor-based and manual lighting control schemes.

nLight® Wired Control Accessories *Order as separate catalog number. Visit nLight.*	
Wall Switches	**Model Number**
On/Off single pole	nPODM (color)
On/Off two pole	nPODM 2P (color)
On/Off & raise/lower single pole	nPOD DX (color)
On/Off & raise/lower two pole	nPODM 2P DX (color)
Graphic touchscreen	nPOD GFX (color)
Photocell Controls	
Dimming	nCM ADCX

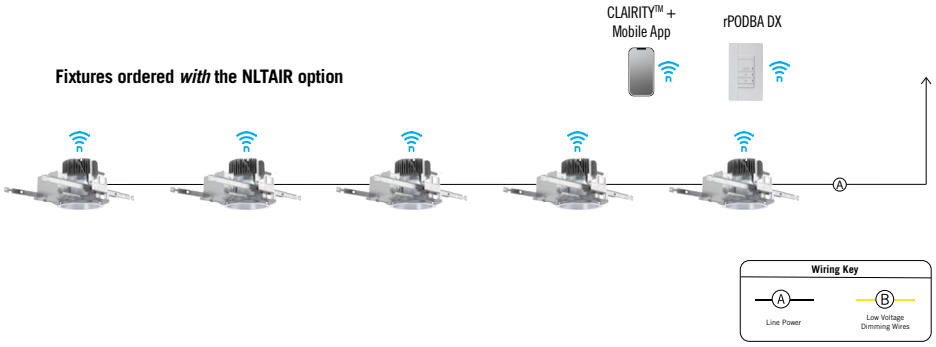
nLight® Wired Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	nCM 9 / nCM PDT 9
Large motion 360°, ceiling	nCM 10 / nCM PDT 10
Wide View	nWV 16 / nWV PDT 16
Wall switch with raise/lower	nWSX LV DX / nWSX PDT LV DX
Cat-5 Cables (plenum rated)	
10', CAT5	CAT5 10FT J1
15', CAT5	CAT5 15FT J1

Possibilites for nLight® AIR

Fixtures ordered *without* the NLTAIR option

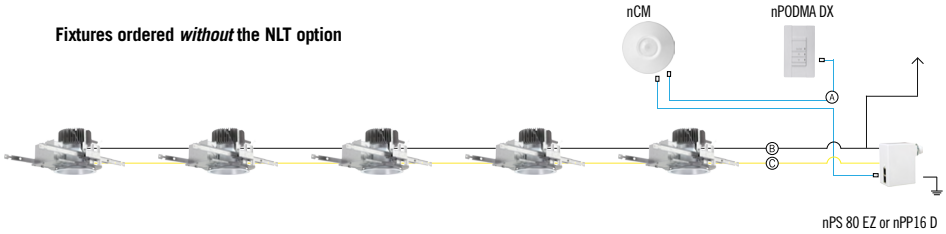


Fixtures ordered *with* the NLTAIR option

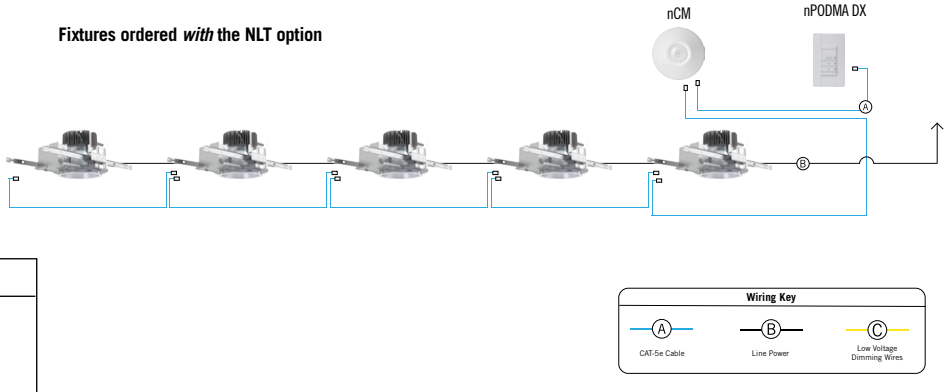


Possibilites for nLight® wired

Fixtures ordered *without* the NLT option



Fixtures ordered *with* the NLT option



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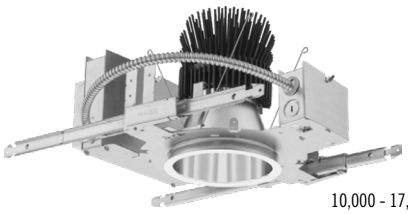
Multiple Layers of Light

Luminaire Type:

Catalog Number:

General Illumination Round Downlight 6"

250 - 8,000 lumens



10,000 - 17,500 lumens

Feature Set

- Bounding Ray™ optical design
- Unitized optics mechanically attach the light engine to the lower reflector for complete optical alignment.
- 45° cutoff to source and source image
- Fully serviceable and upgradeable lensed LED light engine
- 70% lumen maintenance at 60,000 hours
- 2.5 MacAdam Ellipse; 85 CRI typical, 90+ CRI optional
- Fixtures are wet location, covered ceiling
- Available with 10% dimming, 1% dimming, or dim to dark
- Batwing distribution with feathered edges provides even illumination on horizontal and vertical surfaces
- ENERGY STAR® certified product*
- UGR of zero for fixtures aimed at nadir with a cut-off equal to or less than 60deg per CIE 117-1995 Discomfort Glare in Interior Lighting. UGR FAQ

Distribution

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.

*See ordering tree for details

Superior Performance

Nominal Lumens	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10,000	12,000	15,000	17,500
Delivered Lumens	297	519	776	994	1471	2006	2537	3077	3542	4027	4533	5256	6371	8247	10637	12332	15776	17801
Wattage	3.4	6.2	8.2	9.6	14.7	19.7	24.7	29.5	33.8	39.0	47.3	48.7	57.6	74.9	97.1	115.0	150.9	175.3
Lumens per Watt	87.4	83.7	94.6	103.5	100.1	101.8	102.7	104.3	104.8	103.3	95.8	107.9	110.6	110.1	109.5	107.2	104.5	101.5

*Based on 3500K AR LSS MWD 80CRI

Coordinated Apertures | Multiple Layers of Light

General Illumination Layer | EVO

High Center Beam Layer | Incito

EVO + Incito — Multiple Layers of Light

Core

Healthcare

Special Applications

OVERVIEW

COMPLIMENTARY PRODUCTS

GOTHAM ARCHITECTURAL DOWNLIGHTING | 1400 Lester Road Conyers, GA 30012 | P 800-705-SERV (7378) | gothamlighting.com

ORDERING INFORMATION

Design Select options indicated by this color background.

Luminaire Type:

Catalog Number:

EXAMPLE: EV06 35/150 AR MWD LSS MVOLT EZ1

Series	Color Temperature	Nominal Lumen Values	Reflector & Flange Color	Trim Style	Finish
EV06	27/ 2700 K 30/ 3000 K 35/ 3500 K 40/ 4000 K 50/ 5000 K	02 250 lumens 05 500 lumens 07 750 lumens 10 1000 lumens 15 1500 lumens 20 2000 lumens 25 2500 lumens 30 3000 lumens 35 3500 lumens 40 4000 lumens 45 4500 lumens 50 5000 lumens 60 6000 lumens 80 8000 lumens 100 10000 lumens 120 12000 lumens 150 15000 lumens 175 17500 lumens	AR Clear PR Pewter WTR Wheat GR Gold WR[1] White BR[1] Black WRAMF[1] White Anti-microbial TRALTBD[1,2] RAL paint for pricing only TCPC[1] Custom paint color	(blank) Self-flanged FL Flangeless	LSS Semi-specular LD Matte-diffuse LS Specular

Distribution	Voltage	Driver[5]	
VND Very Narrow (0.5 s/mh) ND Narrow (0.7 s/mh) MD Medium (0.9 s/mh) MWD Medium Wide (1.0 s/mh) WD Wide (1.2 s/mh)	MVOLT 120 277 347[3,4]	GZ10 0-10V driver dims to 10% GZ1 0-10V driver dims to 1% EZ10 eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1%. EDAB eldoLED SOLOdrive DALI. Logarithmic dimming to <1%.	EDXB eldoLED POWERdrive DMX with RDM (remote device management). Square Law dimming to <1%. Includes termination resistor. Refer to DMXR Manual. Minimum 1000 lumens/Maximum 15000 lumens. ECOD[6] Lutron Ecosystem digital Hi-Lume 1% soft-on, fade to black. Max: 4000LM.

Control Interface	Emergency Options	Options
NLT[7] nLight® dimming pack controls NLTER[3,7,8] nLight® dimming pack controls emergency circuit NLTAIR2[9,10] nLight® AIR enabled NLTAIRER2[3,8,10] nLight® AIR enabled emergency NLTAIREM2[3,9] nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit with battery pack options.	EL Emergency battery pack, 10W, with integral test switch ELR Emergency battery pack, 10W, with remote test switch ELSD Emergency battery pack, 10W, with self-diagnostics, integral test switch ELRSD Emergency battery pack, 10W, with self-diagnostics, remote test switch E10WCP Emergency battery pack, 10W Constant Power, CA Title 20 compliant with integral test switch E10WCPR Emergency battery pack, 10W Constant Power, CA Title 20 compliant with remote test switch BGTD Bodine generator transfer device. Specify 120V or 277V.	SF Single fuse. Specify 120V or 277V. TRW[11] White painted flange TRBL[12] Black painted flange FRALTBD[2] Flange ring only RAL color for pricing only FCPC Flange custom paint color N80[13] nLight® Lumen Compensation GTD generator transfer device. Specify 120V or 277V 90CRI High CRI (90+) CP[14] Chicago Plenum. Specify 120V or 277V for 5000lm and above. HAO[15] HAO High Ambient Option (40°C) RRL_ RELOC®-ready luminaire connectors enable a simple and consistent factory installed option across all ABL luminaire brands. Available only with RRLA, RRLB, RRLAE, and RRLC12S. Refer to RRL spec sheet on www.acuitybrands.com for RELOC® product specifications. Above ceiling access required.

ACCESSORIES – order as separate catalog numbers (shipped separately)

SCA6	Sloped ceiling adapter. Degree of slope must be specified (5D, 10D, 15D, 20D, 25D, 30D). Ex: SCA6 10D. Refer to TECH-190.
CTA EV06	6" Aperture ceiling thickness adapter, for up to 8,000LM (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YK	4"-8" Aperture ceiling thickness adapter for use with EDXB or CP up to 8,000LM, or nTune options (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YKHL	6" Aperture ceiling thickness adapter, for 10,000LM and up (extends mounting frame to accommodate ceiling thickness up to 5"). For use with CWW/DWW trims, EDXB, CP or nTune options.
ISD BC	0-10V wallbox dimmer. Refer to ISD-BC.

ORDERING NOTES

1. Not available with finishes.
2. Replace with applicable RAL number and finish when ready to order. See RAL BROCHURE for available color options. Not available with emergency battery pack options.
3. Not available with emergency battery pack options.
4. Supplied with factory installed step down transformer.
5. Refer to TECH-240 for compatible dimmers.
6. Not available with nLight®.
7. Specify voltage.
8. ER for use with generator supply power. Will require an emergency hot feed and normal hot feed.
9. Not available DALI or DMX drivers. Not available with CP or N80 options. Not recommended for metal ceiling installations.
10. When combined with the EZ1, EZ10, or EZB option, normal luminaires (non-emergency) can be used as a normal power sensing device for nearby nLight AIR devices and luminaires with EM emergency options.
11. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with WR (white reflector) or FL (flangeless) option.
12. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with BR (black reflector) or FL (flangeless) option.
13. Fixture begins at 80% light level. Must be specified with NLT or NLTER. Only available with EZ10 and EZ1 drivers.
14. 12,000LM max with EL or nLight® options. 5,000LM max with Lutron drivers combined with EL. Not available with ELR, HAO, or EXAB, or any nLight® AIR dimming options.
15. Only available 5000LM - 15,000LM with eldoLED drivers.

SPECIFICATIONS

Optical Assembly
Optical design is a Bounding Ray™ design with 45° cutoff to source and source image. Top-down flash characteristic for superior glare control.
Unitized optics shall have mechanical attachment of the light engine to the lower reflector for complete optical alignment.

Electrical
The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
Sound Rated A+. Driver shall be >80% efficient at full load across all input voltages.
Input wires shall be 18AWG, 300V minimum, solid copper.

Controls
Luminaire shall be equipped with interface for nLight wired or wireless network with integral power supply as per specification.

Dimming
The luminaire shall be capable of continuous dimming without perceivable stroboscopic flicker as measured by flicker index (ANSI/IES RP-16-10) over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output with a smooth shut off function to step to 0%.
eldoLED LED drivers shall conform to IEEE P1789 standards. Alternatively, manufacturers must demonstrate conformance with product literature and testing which demonstrates this performance. Systems that do not meet IEEE P1789 will not be considered.
Driver is inaudible in 24dB environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Construction
Fully serviceable and upgradeable lensed LED light engine, both the driver and light engine are suitable for field maintenance and are serviceable from above or below the ceiling.
Luminaire housing shall be constructed of 16-gauge galvanized steel and have preinstalled telescopic mounting bars with maximum 32" and minimum 15" extension and 4" vertical adjustment.
Luminaires shall be suitable for installation in ceilings up to 1½" thick. (specify ceiling thickness adapter to extend frame to accommodate ceiling thickness up to 5").
Tool-less adjustments shall be possible after installation.
The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
25°C ambient temperature standard (1/2" clearance on all sides from non-combustible materials in non-IC applications, unless marked spacing noted otherwise). For use in insulated ceilings, a 3" clearance on all sides from insulation is required (unless marked spacing noted otherwise). 40°C high ambient optional.

Listings
Fixtures are CSA certified to meet US and Canadian Standards: All fixtures manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL, wet location covered ceiling. Luminaire configurations are Energy Star certified through testing in EPA–recognized laboratories, with the results reviewed by an independent, accredited certification organization. Visit www.energystar.gov for specific configurations listed. *Not all configurations are Energy Star listed.

BUY AMERICAN ACT
This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Photometrics
LEDs tested to LM-80 standards. Measured by IESNA Standard LM-79-08 in an accredited lab. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.
Color appearance from luminaire to luminaire of the same type and in all configurations, shall be consistent both initially and at 60,000 hours and operate within a tolerance of <2.5 MacAdam ellipse as defined by a point at the intersection of the CCT line and the black body locus line in CIE chromaticity space.

Warranty
5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note:
Actual performance may differ as a result of end user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.

A+ Capable Luminaire
This item is an A+ capable luminaire, which has been designed and tested to provided consistent color appearance and out-of-the-box control capability with simple commissioning when used with Acuity Brands controls products.
All configurations of this luminaire are calibrated and tested meet the Acuity Brands' specification for chromatic consistency - including color rendering, color fidelity and color temperature tolerance around standard CIE chromaticity coordinates.
To learn more about A+, visit www.acuitybrands.com/aplus.

Tables of Use

Marked Spacing in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
500-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

EVO - eldoLED Driver Default Dimming Curve			
Nomenclature	Min Dimming	Driver Dim Curve	Control Dim Curve
EZ10	10%	Linear	Linear/Logarithmic
EZ1	1%	Linear	Linear/Logarithmic
EXA1	1%	Linear	Linear/Logarithmic
EZB	<1%	Logarithmic	Linear
EDAB	<1%	Logarithmic	Linear
EXAB	<1%	Logarithmic	Linear
EDXB	<1%	Square	Linear

Marked Spacing in Inches 40°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
5000	24	12	5
6000			
8000	48	24	9
10000			
12000			
15000	72	36	9

Marked Spacing Chicago Plenum Open Frame in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

Marked Spacing Chicago Plenum Enclosure in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-6000	None	None	None
8000	36	18	6
10000	48	24	3
12000			

Driver		Control Provided (note: 347V/UVOLT versions provided with 347 option selected)			
Nomenclature	Description	NLT	NLTER	NLTAIR2	NLTAIRER2
GZ10	0-10V driver dims to 10%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
GZ1	0-10V driver dims to 1%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ10	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ1	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZB	eldoLED 0-10V SOLOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2

How to Estimate Delivered Lumens in Emergency Mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver. P = 10W for PS1055CP

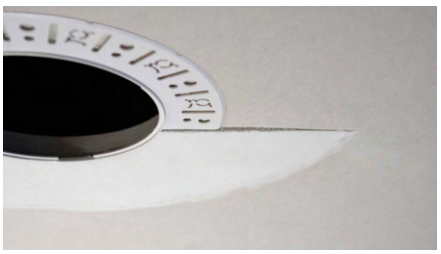
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

Flangeless

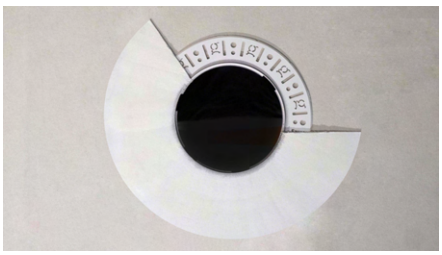
Flangeless Installation

Gotham's flangeless option utilizes a micro-thin polymer mud ring that minimizes the amount of drywall compound required to finish the ceiling. The end result is a virtually undetectable flangeless downlight installation.

The polymer mud ring is installed independent of the of the recessed frame, therefore floating with the ceiling. This innovation minimizes any surface cracks during reflector installation, ceiling movement and any future service to the recessed frame, wiring, electronics, etc.



Partially finished mud ring, showing cross-section detail.



An EVO downlight requires only approximately 3" of plaster to finish.

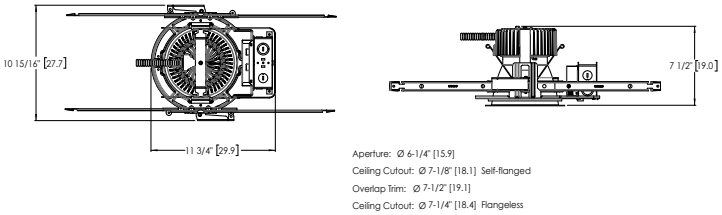
EVO with flangeless trim

DIMENSIONAL DATA

*Dimensions in inches [centimeters]

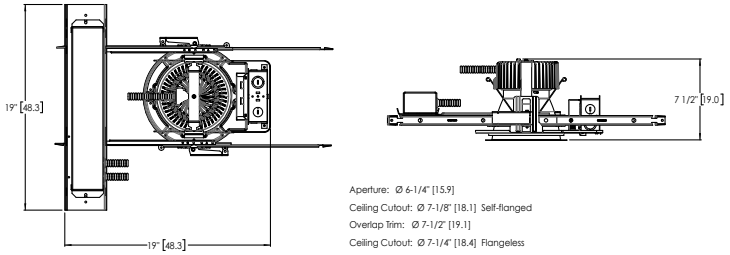
Aperture: 6 1/4" [15.9)]	Ceiling Opening: 7 1/8" [18.1] self-flanged
Overlap Trim: 7 1/2" [19.1]	7 1/4" [18.4] flangeless

250LM-5000LM Standard



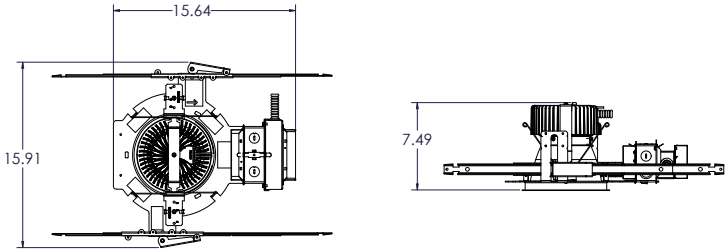
Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

250LM-5000LM Battery Pack

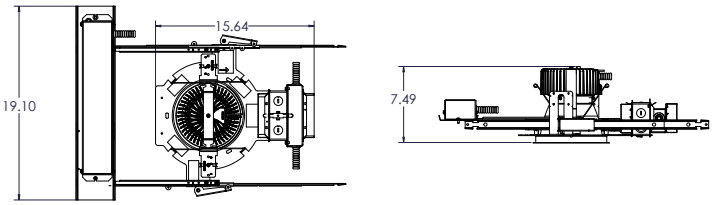


Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

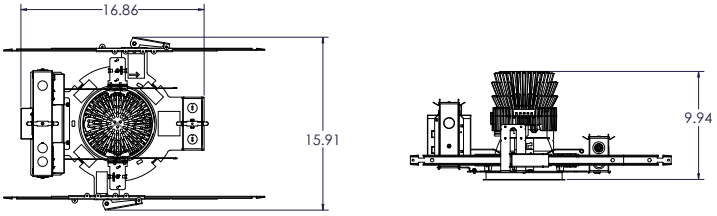
6000LM-8000LM Standard



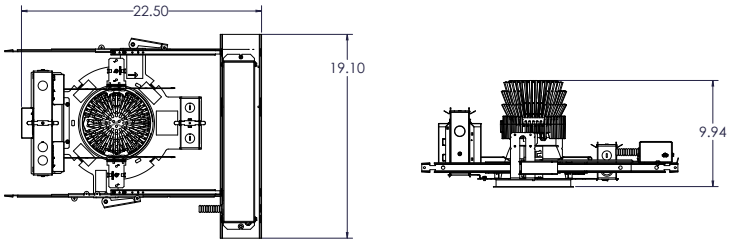
6000LM-8000LM Battery Pack



10,000LM-17,500LM Standard



10,000LM-17,500LM Battery Pack

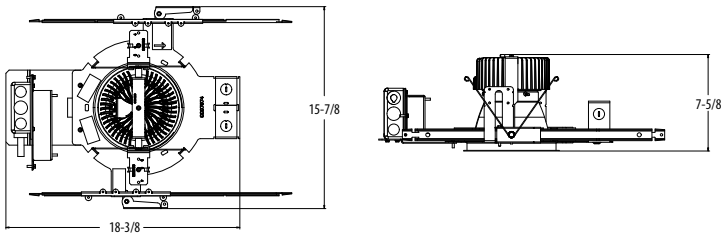


gotham®

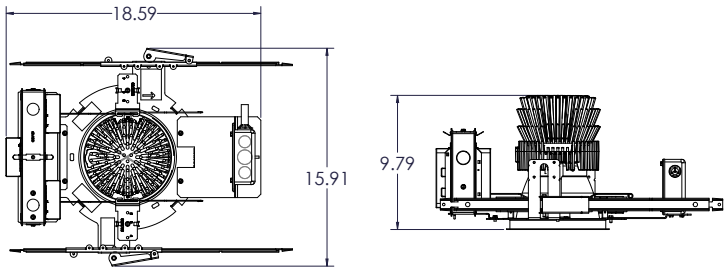
DIMENSIONAL DATA

*Dimensions in inches [centimeters]

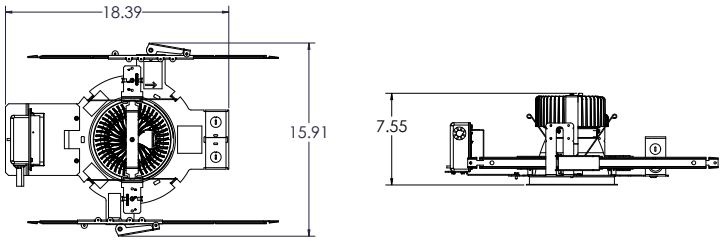
250LM-4500LM CP



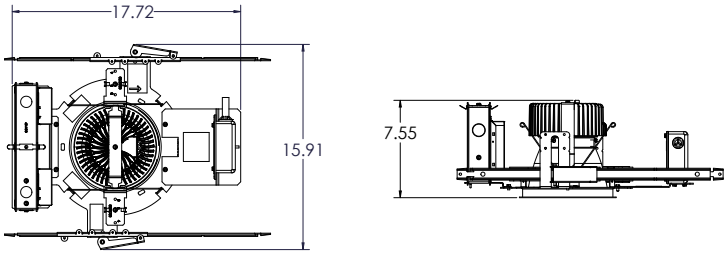
10000LM - 17,500LM Lumen Open Frame CP



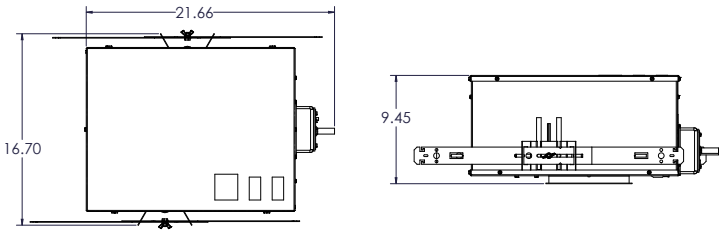
5000LM ECO/SOLO Drive Open Frame CP



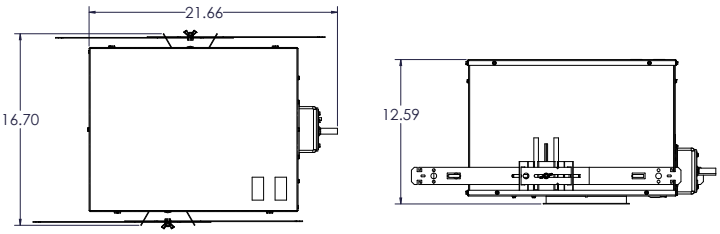
5000LM (Lutron & POWER Drive Only), 6000LM & 8000LM Open Frame CP



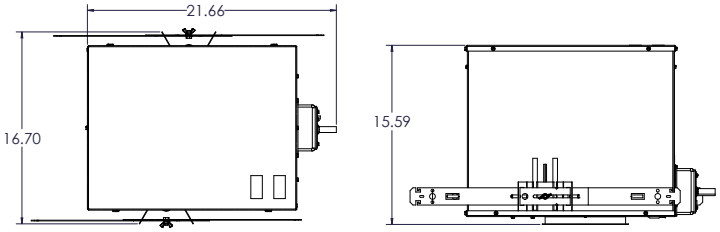
250LM - 6000LM CP Enclosed with Battery Pack and/or nLight™ Only



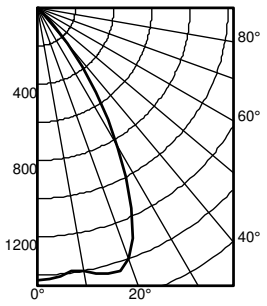
8,000LM CP Enclosed with Battery Pack and/or nLight™ Only



10,000LM-12,000LM CP Enclosed with Battery Pack and/or nLight™ Only



EV06 35/15 AR MWD LS INPUT WATTS: 14.7, DELIVERED LUMENS: 1471LM, LPW= 100, 1.03 S/MH, TEST NO. LTL27783P1505



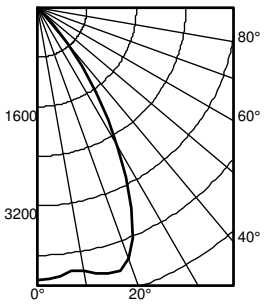
	Ave	Lumens
0	1431	
5	1410	134
15	1442	405
25	1161	523
35	540	332
45	78	72
55	3	4
65	1	1
75	0	1
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	1061.4	72.2
0° - 40°	1393.5	94.7
0° - 60°	1469.5	99.9
0° - 90°	1470.9	100.0
90° - 180°	0.0	0.0
0° - 180°	1470.9	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	47.3	5.7	23.7	8.9	4.7
10.0	25.4	7.7	12.7	12.1	2.5
12.0	15.9	9.8	7.9	15.3	1.6
14.0	10.8	11.8	5.4	18.6	1.1
16.0	7.9	13.9	3.9	21.8	0.8

EV06 35/45 AR MWD LS INPUT WATTS: 47.3, DELIVERED LUMENS: 4532.7LM, LPW= 95.8, 1.03 S/MH, TEST NO. LTL27783P1649



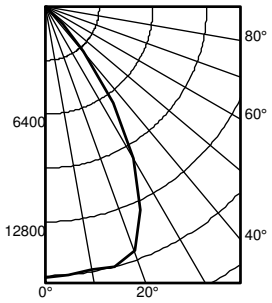
	Ave	Lumens
0	4411	
5	4346	413
15	4443	1247
25	3578	1610
35	1665	1024
45	242	222
55	8	12
65	2	3
75	1	2
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	3270.7	72.2
0° - 40°	4294.2	94.7
0° - 60°	4528.3	99.9
0° - 90°	4532.7	100.0
90° - 180°	0.0	0.0
0° - 180°	4532.7	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	145.8	5.7	72.9	8.9	14.6
10.0	78.4	7.7	39.2	12.1	7.8
12.0	48.9	9.8	24.4	15.3	4.9
14.0	33.4	11.8	16.7	18.6	3.3
16.0	24.2	13.9	12.1	21.8	2.4

EV06 35/175 AR MWD LS INPUT WATTS: 175.3, DELIVERED LUMENS: 17801LM, LPW=101.5, 1.06 S/MH, TEST NO. ISF 34035P268



	Ave	Lumens
0	16146	
5	15998	1521
15	16006	4479
25	13362	6001
35	7018	4289
45	1470	1299
55	100	156
65	37	38
75	13	14
85	2	2
90	0	

Zone	Lumens	% Lamp
0° - 30°	12002.3	67.4
0° - 40°	16291.0	91.5
0° - 60°	17746.3	99.7
0° - 90°	17801.0	100.0
90° - 120°	0.0	0.0
90° - 130°	0.0	0.0
90° - 150°	0.0	0.0
90° - 180°	0.0	0.0
0° - 180°	17801.0	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	108	106	104	104	103	101
2	103	98	95	101	97	94	98	95	92
3	95	90	86	94	89	86	91	87	84
4	89	83	79	88	82	78	85	81	77
5	83	77	72	82	76	72	80	75	71
6	77	71	67	77	71	67	75	70	66
7	73	66	62	72	66	62	71	65	61
8	68	62	58	67	62	57	66	61	57
9	64	58	54	63	58	54	62	57	53
10	60	54	50	60	54	50	59	54	50

		50% beam - 55.7°		10% beam - 79.8°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	533.7	5.8	266.9	9.2	53.4
10.0	287.0	7.9	143.5	12.5	28.7
12.0	178.9	10.0	89.4	15.9	17.9
14.0	122.1	12.1	61.0	19.2	12.2
16.0	88.6	14.3	44.3	22.6	8.9

Lumen Output Multiplier		
CRI	CCT	Multplier
80	2700K	0.96
	300K	1.00
	3500K	1.00
	4000K	1.01
	5000K	1.07
90	2700K	0.80
	300K	0.83
	3500K	0.85
	4000K	0.87
	5000K	0.91

Reflector Finish Multiplier	
Reflector Finish	Multiplier
LS - Specular	1
LSS - Semi Specular	0.956
WR - White	0.87
LD - Matte Diffuse	0.85
BR - Black	0.73

Distributions		
Nomenclature	Beam Angle	Field Angle
VND	30	64
ND	44	69
MD	54	82
MWD	67	89
WD	71	92

NLIGHT AIR

NLIGHT

nLight® AIR is the ideal solution for retrofit or new construction spaces where adding communication wiring is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each EVO Luminaire ordered with the NLTAIR option. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.

nLight® AIR Control Accessories *Order as separate catalog number. Visit nLight AIR.*	
Wall Switches	**Model Number**
On/Off single pole	rPODB (color) G2
On/Off two pole	rPODB 2P (color) G2
On/Off & raise/lower single pole	rPODB DX (color) G2
On/Off & raise/lower two pole	rPODB 2P DX (color) G2

nLight® AIR Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	rCMS 9 / rCMS PDT 9
Large motion 360°, ceiling	rCMS 10 / rCMS PDT 10

UL924 Sequence of Operation

The below information applies to all nLight AIR devices with an EM option.

- EM devices will remain at their high-end trim and ignore wireless lighting control commands, unless a normal-power-sensed (NPS) broadcast is received at least every 8 seconds.
- Using the CL**AIR**ITY+ mobile app, EM devices must be associated with a group that includes a normal power sensing device to receive NPS broadcasts.
- Only non-emergency rPP20, rLSXR, rSBOR, rSDGR, and nLight AIR luminaires with version 3.4 or later firmware can provide normal power sensing for EM devices. See specification sheets for control devices and luminaires for more information on options that support normal power sensing.

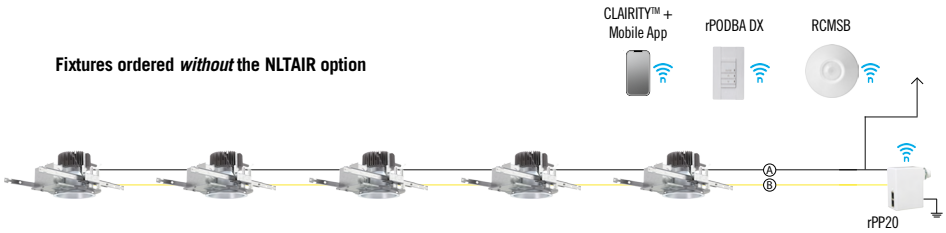
nLight® The nLight® solution is a digital networked lighting control system that provides both energy savings and increased user configurability by cost effectively integrating time-based, daylight-based, sensor-based and manual lighting control schemes.

nLight® Wired Control Accessories *Order as separate catalog number. Visit nLight.*	
Wall Switches	**Model Number**
On/Off single pole	nPODM (color)
On/Off two pole	nPODM 2P (color)
On/Off & raise/lower single pole	nPOD DX (color)
On/Off & raise/lower two pole	nPODM 2P DX (color)
Graphic touchscreen	nPOD GFX (color)
Photocell Controls	
Dimming	nCM ADCX

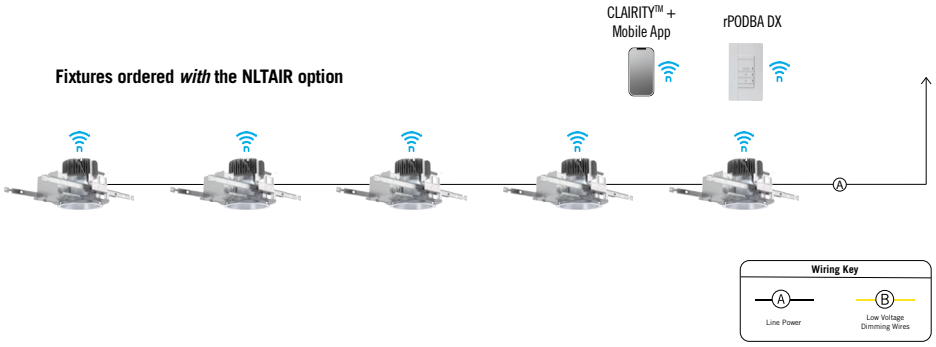
nLight® Wired Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	nCM 9 / nCM PDT 9
Large motion 360°, ceiling	nCM 10 / nCM PDT 10
Wide View	nWV 16 / nWV PDT 16
Wall switch with raise/lower	nWSX LV DX / nWSX PDT LV DX
Cat-5 Cables (plenum rated)	
10', CAT5	CAT5 10FT J1
15', CAT5	CAT5 15FT J1

Possibilites for nLight® AIR

Fixtures ordered *without* the NLTAIR option

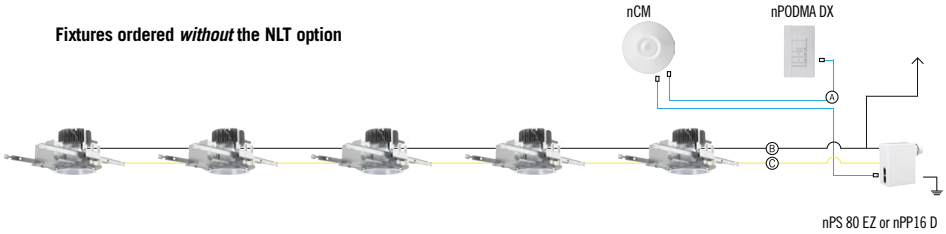


Fixtures ordered *with* the NLTAIR option

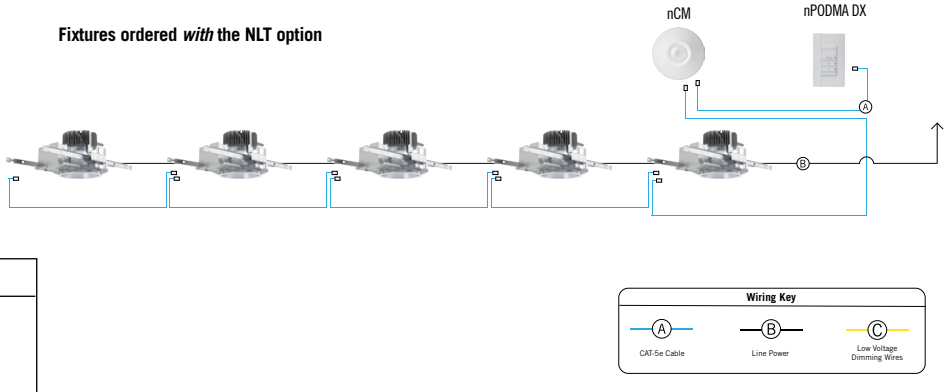


Possibilites for nLight® wired

Fixtures ordered *without* the NLT option



Fixtures ordered *with* the NLT option



gotham® | EVO®

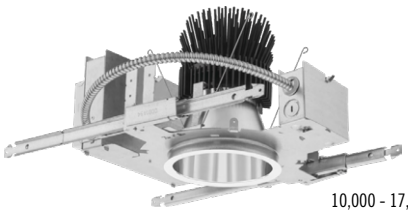
Multiple Layers of Light

Luminaire Type:

Catalog Number:

General Illumination Round Downlight 6"

250 - 8,000 lumens



10,000 - 17,500 lumens

Feature Set

- Bounding Ray™ optical design
- Unitized optics mechanically attach the light engine to the lower reflector for complete optical alignment.
- 45° cutoff to source and source image
- Fully serviceable and upgradeable lensed LED light engine
- 70% lumen maintenance at 60,000 hours
- 2.5 MacAdam Ellipse; 85 CRI typical, 90+ CRI optional
- Fixtures are wet location, covered ceiling
- Available with 10% dimming, 1% dimming, or dim to dark
- Batwing distribution with feathered edges provides even illumination on horizontal and vertical surfaces
- ENERGY STAR® certified product*
- UGR of zero for fixtures aimed at nadir with a cut-off equal to or less than 60deg per CIE 117-1995 Discomfort Glare in Interior Lighting. UGR FAQ

Distribution

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.

*See ordering tree for details

Superior Performance

Nominal Lumens	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10,000	12,000	15,000	17,500
Delivered Lumens	297	519	776	994	1471	2006	2537	3077	3542	4027	4533	5256	6371	8247	10637	12332	15776	17801
Wattage	3.4	6.2	8.2	9.6	14.7	19.7	24.7	29.5	33.8	39.0	47.3	48.7	57.6	74.9	97.1	115.0	150.9	175.3
Lumens per Watt	87.4	83.7	94.6	103.5	100.1	101.8	102.7	104.3	104.8	103.3	95.8	107.9	110.6	110.1	109.5	107.2	104.5	101.5

*Based on 3500K AR LSS MWD 80CRI

Coordinated Apertures | Multiple Layers of Light

General Illumination Layer | EVO

High Center Beam Layer | Incito

EVO + Incito — Multiple Layers of Light

Core

Healthcare

Special Applications

OVERVIEW

COMPLIMENTARY PRODUCTS

GOTHAM ARCHITECTURAL DOWNLIGHTING | 1400 Lester Road Conyers, GA 30012 | P 800-705-SERV (7378) | gothamlighting.com

ORDERING INFORMATION

Design Select options indicated by this color background.

Luminaire Type:

Catalog Number:

EXAMPLE: EV06 35/150 AR MWD LSS MVOLT EZ1

Series	Color Temperature	Nominal Lumen Values	Reflector & Flange Color	Trim Style	Finish
EV06	27/ 2700 K 30/ 3000 K 35/ 3500 K 40/ 4000 K 50/ 5000 K	02 250 lumens 05 500 lumens 07 750 lumens 10 1000 lumens 15 1500 lumens 20 2000 lumens 25 2500 lumens 30 3000 lumens 35 3500 lumens 40 4000 lumens 45 4500 lumens 50 5000 lumens 60 6000 lumens 80 8000 lumens 100 10000 lumens 120 12000 lumens 150 15000 lumens 175 17500 lumens	AR Clear PR Pewter WTR Wheat GR Gold WR[1] White BR[1] Black WRAMF[1] White Anti-microbial TRALTBD[1,2] RAL paint for pricing only TCPC[1] Custom paint color	(blank) Self-flanged FL Flangeless	LSS Semi-specular LD Matte-diffuse LS Specular

Distribution	Voltage	Driver[5]	
VND Very Narrow (0.5 s/mh) ND Narrow (0.7 s/mh) MD Medium (0.9 s/mh) MWD Medium Wide (1.0 s/mh) WD Wide (1.2 s/mh)	MVOLT 120 277 347[3,4]	GZ10 0-10V driver dims to 10% GZ1 0-10V driver dims to 1% EZ10 eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1%. EDAB eldoLED SOLOdrive DALI. Logarithmic dimming to <1%.	EDXB eldoLED POWERdrive DMX with RDM (remote device management). Square Law dimming to <1%. Includes termination resistor. Refer to DMXR Manual. Minimum 1000 lumens/Maximum 15000 lumens. ECOD[6] Lutron Ecosystem digital Hi-Lume 1% soft-on, fade to black. Max: 4000LM.

Control Interface	Emergency Options	Options
NLT[7] nLight® dimming pack controls NLTER[3,7,8] nLight® dimming pack controls emergency circuit NLTAIR2[9,10] nLight® AIR enabled NLTAIRER2[3,8,10] nLight® AIR enabled emergency NLTAIREM2[3,9] nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit with battery pack options.	EL Emergency battery pack, 10W, with integral test switch ELR Emergency battery pack, 10W, with remote test switch ELSD Emergency battery pack, 10W, with self-diagnostics, integral test switch ELRSD Emergency battery pack, 10W, with self-diagnostics, remote test switch E10WCP Emergency battery pack, 10W Constant Power, CA Title 20 compliant with integral test switch E10WCPR Emergency battery pack, 10W Constant Power, CA Title 20 compliant with remote test switch BGTD Bodine generator transfer device. Specify 120V or 277V.	SF Single fuse. Specify 120V or 277V. TRW[11] White painted flange TRBL[12] Black painted flange FRALTBD[2] Flange ring only RAL color for pricing only FCPC Flange custom paint color N80[13] nLight® Lumen Compensation GTD generator transfer device. Specify 120V or 277V 90CRI High CRI (90+) CP[14] Chicago Plenum. Specify 120V or 277V for 5000lm and above. HAO[15] HAO High Ambient Option (40°C) RRL_ RELOC®-ready luminaire connectors enable a simple and consistent factory installed option across all ABL luminaire brands. Available only with RRLA, RRLB, RRLAE, and RRLC12S. Refer to RRL spec sheet on www.acuitybrands.com for RELOC® product specifications. Above ceiling access required.

ACCESSORIES – order as separate catalog numbers (shipped separately)

SCA6	Sloped ceiling adapter. Degree of slope must be specified (5D, 10D, 15D, 20D, 25D, 30D). Ex: SCA6 10D. Refer to TECH-190.
CTA EV06	6" Aperture ceiling thickness adapter, for up to 8,000LM (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YK	4"-8" Aperture ceiling thickness adapter for use with EDXB or CP up to 8,000LM, or nTune options (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YKHL	6" Aperture ceiling thickness adapter, for 10,000LM and up (extends mounting frame to accommodate ceiling thickness up to 5"). For use with CWW/DWW trims, EDXB, CP or nTune options.
ISD BC	0-10V wallbox dimmer. Refer to ISD-BC.

ORDERING NOTES

1. Not available with finishes.
2. Replace with applicable RAL number and finish when ready to order. See RAL BROCHURE for available color options. Not available with emergency battery pack options.
3. Not available with emergency battery pack options.
4. Supplied with factory installed step down transformer.
5. Refer to TECH-240 for compatible dimmers.
6. Not available with nLight®.
7. Specify voltage.
8. ER for use with generator supply power. Will require an emergency hot feed and normal hot feed.
9. Not available DALI or DMX drivers. Not available with CP or N80 options. Not recommended for metal ceiling installations.
10. When combined with the EZ1, EZ10, or EZB option, normal luminaires (non-emergency) can be used as a normal power sensing device for nearby nLight AIR devices and luminaires with EM emergency options.
11. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with WR (white reflector) or FL (flangeless) option.
12. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with BR (black reflector) or FL (flangeless) option.
13. Fixture begins at 80% light level. Must be specified with NLT or NLTER. Only available with EZ10 and EZ1 drivers.
14. 12,000LM max with EL or nLight® options. 5,000LM max with Lutron drivers combined with EL. Not available with ELR, HAO, or EXAB, or any nLight® AIR dimming options.
15. Only available 5000LM - 15,000LM with eldoLED drivers.

SPECIFICATIONS

Optical Assembly
Optical design is a Bounding Ray™ design with 45° cutoff to source and source image. Top-down flash characteristic for superior glare control.
Unitized optics shall have mechanical attachment of the light engine to the lower reflector for complete optical alignment.

Electrical
The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
Sound Rated A+. Driver shall be >80% efficient at full load across all input voltages.
Input wires shall be 18AWG, 300V minimum, solid copper.

Controls
Luminaire shall be equipped with interface for nLight wired or wireless network with integral power supply as per specification.

Dimming
The luminaire shall be capable of continuous dimming without perceivable stroboscopic flicker as measured by flicker index (ANSI/IES RP-16-10) over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output with a smooth shut off function to step to 0%.
eldoLED LED drivers shall conform to IEEE P1789 standards. Alternatively, manufacturers must demonstrate conformance with product literature and testing which demonstrates this performance. Systems that do not meet IEEE P1789 will not be considered.
Driver is inaudible in 24dB environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Construction
Fully serviceable and upgradeable lensed LED light engine, both the driver and light engine are suitable for field maintenance and are serviceable from above or below the ceiling.
Luminaire housing shall be constructed of 16-gauge galvanized steel and have preinstalled telescopic mounting bars with maximum 32" and minimum 15" extension and 4" vertical adjustment.
Luminaires shall be suitable for installation in ceilings up to 1½" thick. (specify ceiling thickness adapter to extend frame to accommodate ceiling thickness up to 5").
Tool-less adjustments shall be possible after installation.
The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
25°C ambient temperature standard (1/2" clearance on all sides from non-combustible materials in non-IC applications, unless marked spacing noted otherwise). For use in insulated ceilings, a 3" clearance on all sides from insulation is required (unless marked spacing noted otherwise). 40°C high ambient optional.

Listings
Fixtures are CSA certified to meet US and Canadian Standards: All fixtures manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL, wet location covered ceiling. Luminaire configurations are Energy Star certified through testing in EPA–recognized laboratories, with the results reviewed by an independent, accredited certification organization. Visit www.energystar.gov for specific configurations listed. *Not all configurations are Energy Star listed.

BUY AMERICAN ACT
This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Photometrics
LEDs tested to LM-80 standards. Measured by IESNA Standard LM-79-08 in an accredited lab. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.
Color appearance from luminaire to luminaire of the same type and in all configurations, shall be consistent both initially and at 60,000 hours and operate within a tolerance of <2.5 MacAdam ellipse as defined by a point at the intersection of the CCT line and the black body locus line in CIE chromaticity space.

Warranty
5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note:
Actual performance may differ as a result of end user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.

A+ Capable Luminaire
This item is an A+ capable luminaire, which has been designed and tested to provided consistent color appearance and out-of-the-box control capability with simple commissioning when used with Acuity Brands controls products.
All configurations of this luminaire are calibrated and tested meet the Acuity Brands' specification for chromatic consistency - including color rendering, color fidelity and color temperature tolerance around standard CIE chromaticity coordinates.
To learn more about A+, visit www.acuitybrands.com/aplus.

Tables of Use

Marked Spacing in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
500-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

EVO - eldoLED Driver Default Dimming Curve			
Nomenclature	Min Dimming	Driver Dim Curve	Control Dim Curve
EZ10	10%	Linear	Linear/Logarithmic
EZ1	1%	Linear	Linear/Logarithmic
EXA1	1%	Linear	Linear/Logarithmic
EZB	<1%	Logarithmic	Linear
EDAB	<1%	Logarithmic	Linear
EXAB	<1%	Logarithmic	Linear
EDXB	<1%	Square	Linear

Marked Spacing in Inches 40°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
5000	24	12	5
6000			
8000	48	24	9
10000			
12000			
15000	72	36	9

Marked Spacing Chicago Plenum Open Frame in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

Marked Spacing Chicago Plenum Enclosure in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-6000	None	None	None
8000	36	18	6
10000	48	24	3
12000			

Driver		Control Provided (note: 347V/UVOLT versions provided with 347 option selected)			
Nomenclature	Description	NLT	NLTER	NLTAIR2	NLTAIRER2
GZ10	0-10V driver dims to 10%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
GZ1	0-10V driver dims to 1%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ10	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ1	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZB	eldoLED 0-10V SOLOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2

How to Estimate Delivered Lumens in Emergency Mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver. P = 10W for PS1055CP

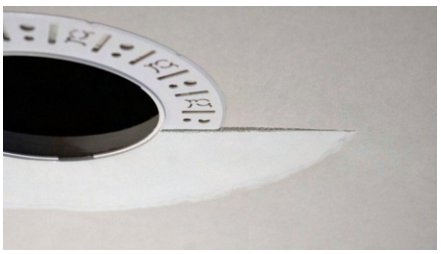
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

Flangeless

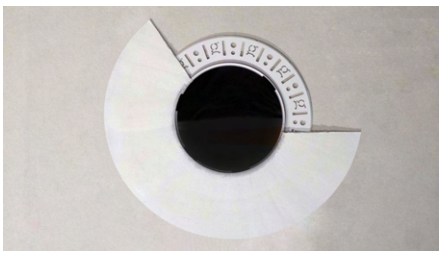
Flangeless Installation

Gotham's flangeless option utilizes a micro-thin polymer mud ring that minimizes the amount of drywall compound required to finish the ceiling. The end result is a virtually undetectable flangeless downlight installation.

The polymer mud ring is installed independent of the of the recessed frame, therefore floating with the ceiling. This innovation minimizes any surface cracks during reflector installation, ceiling movement and any future service to the recessed frame, wiring, electronics, etc.



Partially finished mud ring, showing cross-section detail.



An EVO downlight requires only approximately 3" of plaster to finish.

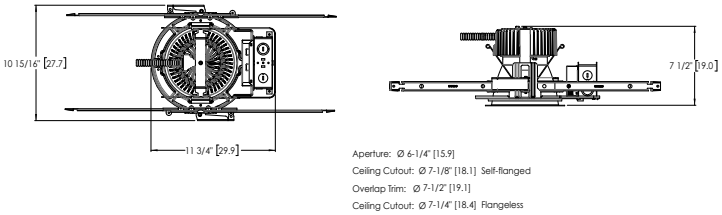
EVO with flangeless trim

DIMENSIONAL DATA

*Dimensions in inches [centimeters]

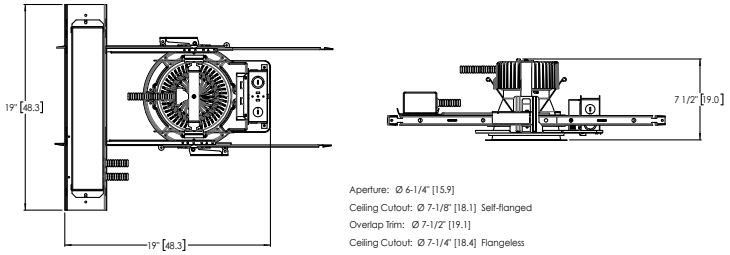
Aperture: 6 1/4" [15.9)]	Ceiling Opening: 7 1/8" [18.1] self-flanged
Overlap Trim: 7 1/2" [19.1]	7 1/4" [18.4] flangeless

250LM-5000LM Standard



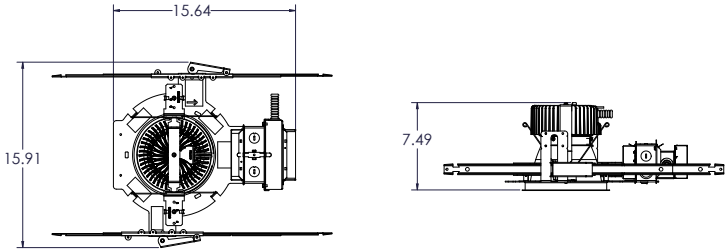
Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

250LM-5000LM Battery Pack

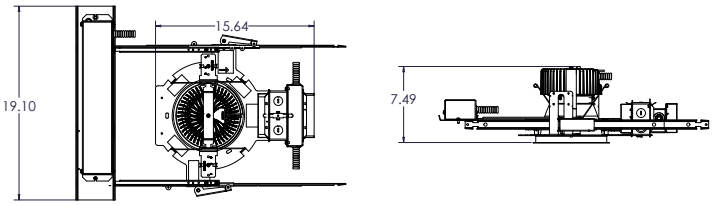


Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

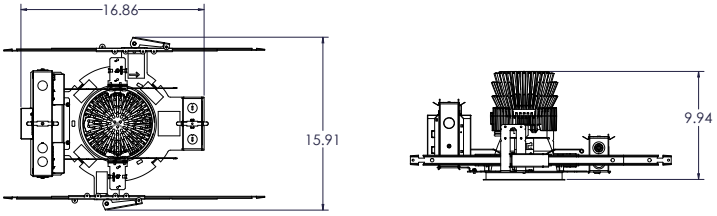
6000LM-8000LM Standard



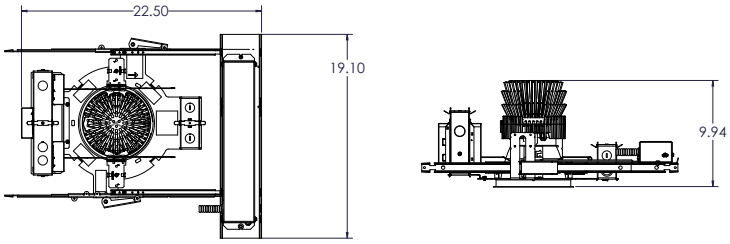
6000LM-8000LM Battery Pack



10,000LM-17,500LM Standard



10,000LM-17,500LM Battery Pack



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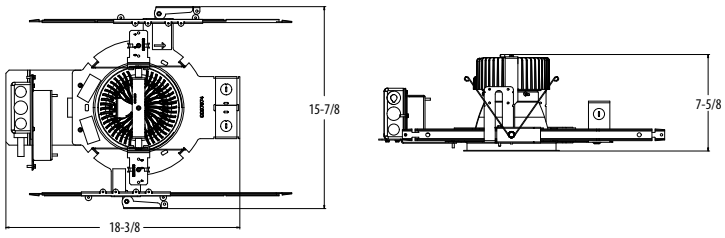
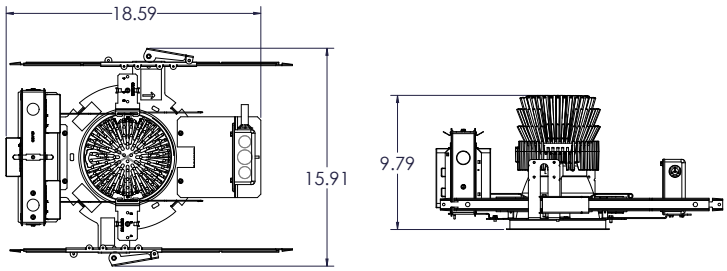
DIMENSIONAL DATA

*Dimensions in inches [centimeters]

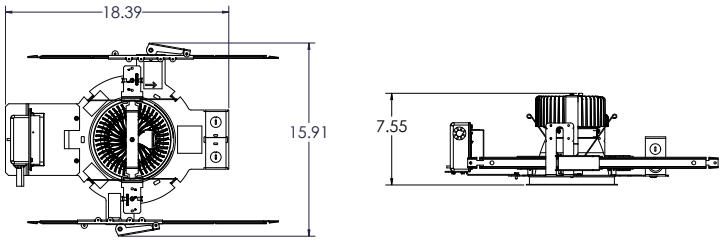
250LM-4500LM CP



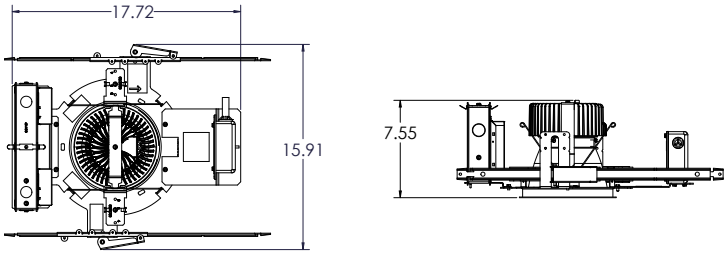
10000LM - 17,500LM Lumen Open Frame CP



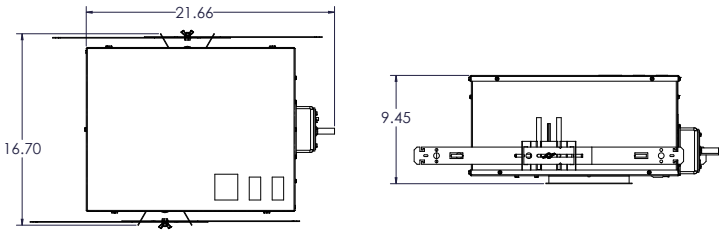
5000LM ECO/SOLO Drive Open Frame CP



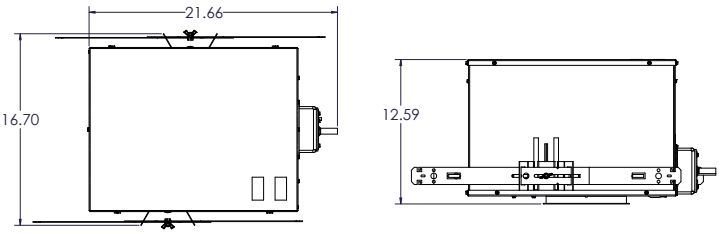
5000LM (Lutron & POWER Drive Only), 6000LM & 8000LM Open Frame CP



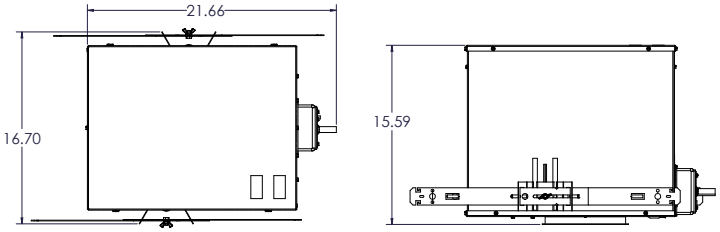
250LM - 6000LM CP Enclosed with Battery Pack and/or nLight™ Only



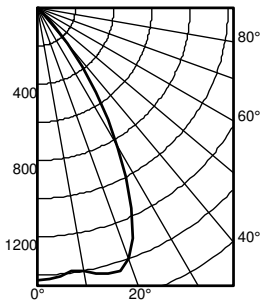
8,000LM CP Enclosed with Battery Pack and/or nLight™ Only



10,000LM-12,000LM CP Enclosed with Battery Pack and/or nLight™ Only



EV06 35/15 AR MWD LS INPUT WATTS: 14.7, DELIVERED LUMENS: 1471LM, LPW= 100, 1.03 S/MH, TEST NO. LTL27783P1505



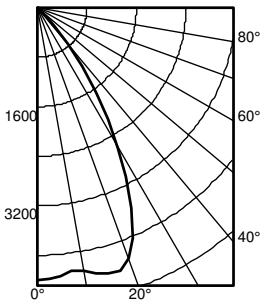
	Ave	Lumens
0	1431	
5	1410	134
15	1442	405
25	1161	523
35	540	332
45	78	72
55	3	4
65	1	1
75	0	1
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	1061.4	72.2
0° - 40°	1393.5	94.7
0° - 60°	1469.5	99.9
0° - 90°	1470.9	100.0
90° - 180°	0.0	0.0
0° - 180°	1470.9	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	47.3	5.7	23.7	8.9	4.7
10.0	25.4	7.7	12.7	12.1	2.5
12.0	15.9	9.8	7.9	15.3	1.6
14.0	10.8	11.8	5.4	18.6	1.1
16.0	7.9	13.9	3.9	21.8	0.8

EV06 35/45 AR MWD LS INPUT WATTS: 47.3, DELIVERED LUMENS: 4532.7LM, LPW= 95.8, 1.03 S/MH, TEST NO. LTL27783P1649



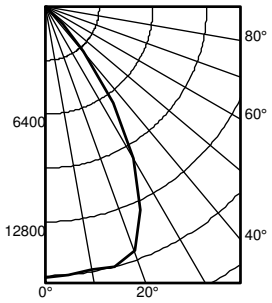
	Ave	Lumens
0	4411	
5	4346	413
15	4443	1247
25	3578	1610
35	1665	1024
45	242	222
55	8	12
65	2	3
75	1	2
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	3270.7	72.2
0° - 40°	4294.2	94.7
0° - 60°	4528.3	99.9
0° - 90°	4532.7	100.0
90° - 180°	0.0	0.0
0° - 180°	4532.7	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	145.8	5.7	72.9	8.9	14.6
10.0	78.4	7.7	39.2	12.1	7.8
12.0	48.9	9.8	24.4	15.3	4.9
14.0	33.4	11.8	16.7	18.6	3.3
16.0	24.2	13.9	12.1	21.8	2.4

EV06 35/175 AR MWD LS INPUT WATTS: 175.3, DELIVERED LUMENS: 17801LM, LPW=101.5, 1.06 S/MH, TEST NO. ISF 34035P268



	Ave	Lumens
0	16146	
5	15998	1521
15	16006	4479
25	13362	6001
35	7018	4289
45	1470	1299
55	100	156
65	37	38
75	13	14
85	2	2
90	0	

Zone	Lumens	% Lamp
0° - 30°	12002.3	67.4
0° - 40°	16291.0	91.5
0° - 60°	17746.3	99.7
0° - 90°	17801.0	100.0
90° - 120°	0.0	0.0
90° - 130°	0.0	0.0
90° - 150°	0.0	0.0
90° - 180°	0.0	0.0
0° - 180°	17801.0	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	108	106	104	104	103	101
2	103	98	95	101	97	94	98	95	92
3	95	90	86	94	89	86	91	87	84
4	89	83	79	88	82	78	85	81	77
5	83	77	72	82	76	72	80	75	71
6	77	71	67	77	71	67	75	70	66
7	73	66	62	72	66	62	71	65	61
8	68	62	58	67	62	57	66	61	57
9	64	58	54	63	58	54	62	57	53
10	60	54	50	60	54	50	59	54	50

		50% beam - 55.7°		10% beam - 79.8°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	533.7	5.8	266.9	9.2	53.4
10.0	287.0	7.9	143.5	12.5	28.7
12.0	178.9	10.0	89.4	15.9	17.9
14.0	122.1	12.1	61.0	19.2	12.2
16.0	88.6	14.3	44.3	22.6	8.9

Lumen Output Multiplier		
CRI	CCT	Multplier
80	2700K	0.96
	300K	1.00
	3500K	1.00
	4000K	1.01
	5000K	1.07
90	2700K	0.80
	300K	0.83
	3500K	0.85
	4000K	0.87
	5000K	0.91

Reflector Finish Multiplier	
Reflector Finish	Multiplier
LS - Specular	1
LSS - Semi Specular	0.956
WR - White	0.87
LD - Matte Diffuse	0.85
BR - Black	0.73

Distributions		
Nomenclature	Beam Angle	Field Angle
VND	30	64
ND	44	69
MD	54	82
MWD	67	89
WD	71	92

NLIGHT AIR

NLIGHT

nLight® AIR is the ideal solution for retrofit or new construction spaces where adding communication wiring is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each EVO Luminaire ordered with the NLTAIR option. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.

nLight® AIR Control Accessories *Order as separate catalog number. Visit nLight AIR.*	
Wall Switches	**Model Number**
On/Off single pole	rPODB (color) G2
On/Off two pole	rPODB 2P (color) G2
On/Off & raise/lower single pole	rPODB DX (color) G2
On/Off & raise/lower two pole	rPODB 2P DX (color) G2

nLight® AIR Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	rCMS 9 / rCMS PDT 9
Large motion 360°, ceiling	rCMS 10 / rCMS PDT 10

UL924 Sequence of Operation

The below information applies to all nLight AIR devices with an EM option.

- EM devices will remain at their high-end trim and ignore wireless lighting control commands, unless a normal-power-sensed (NPS) broadcast is received at least every 8 seconds.
- Using the CL**AIR**ITY+ mobile app, EM devices must be associated with a group that includes a normal power sensing device to receive NPS broadcasts.
- Only non-emergency rPP20, rLSXR, rSBOR, rSDGR, and nLight AIR luminaires with version 3.4 or later firmware can provide normal power sensing for EM devices. See specification sheets for control devices and luminaires for more information on options that support normal power sensing.

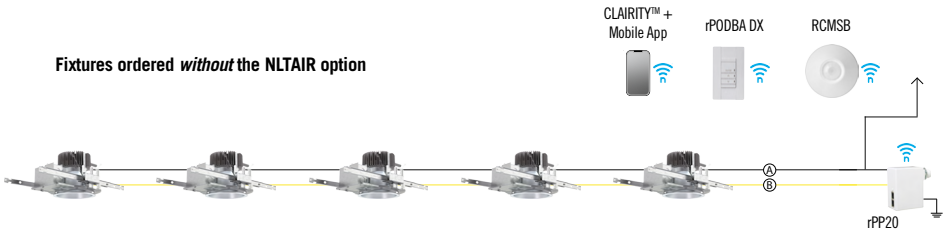
nLight® The nLight® solution is a digital networked lighting control system that provides both energy savings and increased user configurability by cost effectively integrating time-based, daylight-based, sensor-based and manual lighting control schemes.

nLight® Wired Control Accessories *Order as separate catalog number. Visit nLight.*	
Wall Switches	**Model Number**
On/Off single pole	nPODM (color)
On/Off two pole	nPODM 2P (color)
On/Off & raise/lower single pole	nPOD DX (color)
On/Off & raise/lower two pole	nPODM 2P DX (color)
Graphic touchscreen	nPOD GFX (color)
Photocell Controls	
Dimming	nCM ADCX

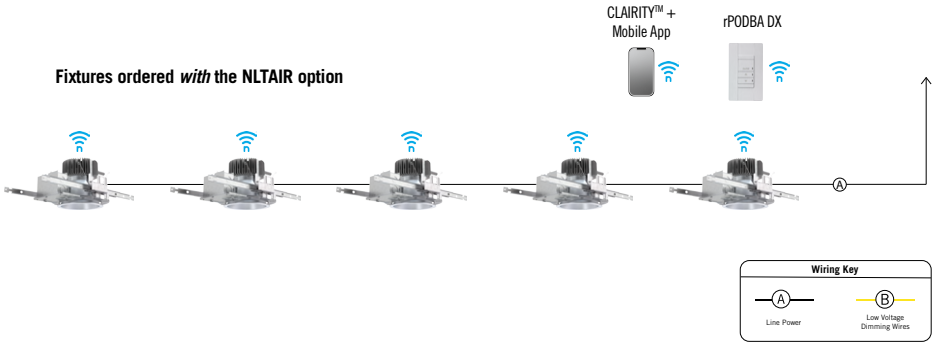
nLight® Wired Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	nCM 9 / nCM PDT 9
Large motion 360°, ceiling	nCM 10 / nCM PDT 10
Wide View	nWV 16 / nWV PDT 16
Wall switch with raise/lower	nWSX LV DX / nWSX PDT LV DX
Cat-5 Cables (plenum rated)	
10', CAT5	CAT5 10FT J1
15', CAT5	CAT5 15FT J1

Possibilites for nLight® AIR

Fixtures ordered *without* the NLTAIR option

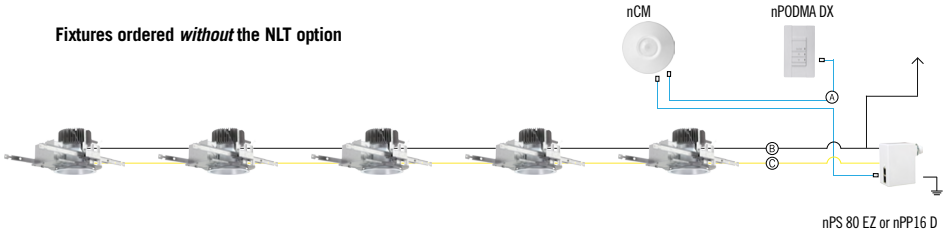


Fixtures ordered *with* the NLTAIR option

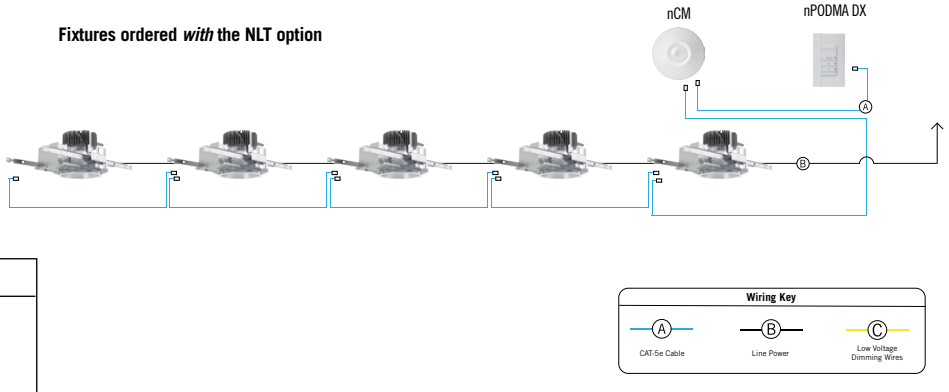


Possibilites for nLight® wired

Fixtures ordered *without* the NLT option



Fixtures ordered *with* the NLT option



gotham® | EVO®

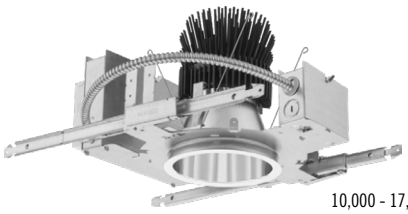
Multiple Layers of Light

Luminaire Type:

Catalog Number:

General Illumination Round Downlight 6"

250 - 8,000 lumens



10,000 - 17,500 lumens

Feature Set

- Bounding Ray™ optical design
- Unitized optics mechanically attach the light engine to the lower reflector for complete optical alignment.
- 45° cutoff to source and source image
- Fully serviceable and upgradeable lensed LED light engine
- 70% lumen maintenance at 60,000 hours
- 2.5 MacAdam Ellipse; 85 CRI typical, 90+ CRI optional
- Fixtures are wet location, covered ceiling
- Available with 10% dimming, 1% dimming, or dim to dark
- Batwing distribution with feathered edges provides even illumination on horizontal and vertical surfaces
- ENERGY STAR® certified product*
- UGR of zero for fixtures aimed at nadir with a cut-off equal to or less than 60deg per CIE 117-1995 Discomfort Glare in Interior Lighting. UGR FAQ

Distribution

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.

*See ordering tree for details

Superior Performance

Nominal Lumens	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10,000	12,000	15,000	17,500
Delivered Lumens	297	519	776	994	1471	2006	2537	3077	3542	4027	4533	5256	6371	8247	10637	12332	15776	17801
Wattage	3.4	6.2	8.2	9.6	14.7	19.7	24.7	29.5	33.8	39.0	47.3	48.7	57.6	74.9	97.1	115.0	150.9	175.3
Lumens per Watt	87.4	83.7	94.6	103.5	100.1	101.8	102.7	104.3	104.8	103.3	95.8	107.9	110.6	110.1	109.5	107.2	104.5	101.5

*Based on 3500K AR LSS MWD 80CRI

Coordinated Apertures | Multiple Layers of Light

General Illumination Layer | EVO

High Center Beam Layer | Incito

EVO + Incito — Multiple Layers of Light

Core

Healthcare

Special Applications

OVERVIEW

COMPLIMENTARY PRODUCTS

GOTHAM ARCHITECTURAL DOWNLIGHTING | 1400 Lester Road Conyers, GA 30012 | P 800-705-SERV (7378) | gothamlighting.com

ORDERING INFORMATION

Design Select options indicated by this color background.

Luminaire Type:

Catalog Number:

EXAMPLE: EV06 35/150 AR MWD LSS MVOLT EZ1

Series	Color Temperature	Nominal Lumen Values	Reflector & Flange Color	Trim Style	Finish
EV06	27/ 2700 K 30/ 3000 K 35/ 3500 K 40/ 4000 K 50/ 5000 K	02 250 lumens 05 500 lumens 07 750 lumens 10 1000 lumens 15 1500 lumens 20 2000 lumens 25 2500 lumens 30 3000 lumens 35 3500 lumens 40 4000 lumens 45 4500 lumens 50 5000 lumens 60 6000 lumens 80 8000 lumens 100 10000 lumens 120 12000 lumens 150 15000 lumens 175 17500 lumens	AR Clear PR Pewter WTR Wheat GR Gold WR[1] White BR[1] Black WRAMF[1] White Anti-microbial TRALTBD[1,2] RAL paint for pricing only TCPC[1] Custom paint color	(blank) Self-flanged FL Flangeless	LSS Semi-specular LD Matte-diffuse LS Specular

Distribution	Voltage	Driver[5]	
VND Very Narrow (0.5 s/mh) ND Narrow (0.7 s/mh) MD Medium (0.9 s/mh) MWD Medium Wide (1.0 s/mh) WD Wide (1.2 s/mh)	MVOLT 120 277 347[3,4]	GZ10 0-10V driver dims to 10% GZ1 0-10V driver dims to 1% EZ10 eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1%. EDAB eldoLED SOLOdrive DALI. Logarithmic dimming to <1%.	EDXB eldoLED POWERdrive DMX with RDM (remote device management). Square Law dimming to <1%. Includes termination resistor. Refer to DMXR Manual. Minimum 1000 lumens/Maximum 15000 lumens. ECOD[6] Lutron Ecosystem digital Hi-Lume 1% soft-on, fade to black. Max: 4000LM.

Control Interface	Emergency Options	Options
NLT[7] nLight® dimming pack controls NLTER[3,7,8] nLight® dimming pack controls emergency circuit NLTAIR2[9,10] nLight® AIR enabled NLTAIRER2[3,8,10] nLight® AIR enabled emergency NLTAIREM2[3,9] nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit with battery pack options.	EL Emergency battery pack, 10W, with integral test switch ELR Emergency battery pack, 10W, with remote test switch ELSD Emergency battery pack, 10W, with self-diagnostics, integral test switch ELRSD Emergency battery pack, 10W, with self-diagnostics, remote test switch E10WCP Emergency battery pack, 10W Constant Power, CA Title 20 compliant with integral test switch E10WCPR Emergency battery pack, 10W Constant Power, CA Title 20 compliant with remote test switch BGTD Bodine generator transfer device. Specify 120V or 277V.	SF Single fuse. Specify 120V or 277V. TRW[11] White painted flange TRBL[12] Black painted flange FRALTBD[2] Flange ring only RAL color for pricing only FCPC Flange custom paint color N80[13] nLight® Lumen Compensation GTD generator transfer device. Specify 120V or 277V 90CRI High CRI (90+) CP[14] Chicago Plenum. Specify 120V or 277V for 5000lm and above. HAO[15] HAO High Ambient Option (40°C) RRL_ RELOC®-ready luminaire connectors enable a simple and consistent factory installed option across all ABL luminaire brands. Available only with RRLA, RRLB, RRLAE, and RRLC12S. Refer to RRL spec sheet on www.acuitybrands.com for RELOC® product specifications. Above ceiling access required.

ACCESSORIES – order as separate catalog numbers (shipped separately)

SCA6	Sloped ceiling adapter. Degree of slope must be specified (5D, 10D, 15D, 20D, 25D, 30D). Ex: SCA6 10D. Refer to TECH-190.
CTA EV06	6" Aperture ceiling thickness adapter, for up to 8,000LM (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YK	4"-8" Aperture ceiling thickness adapter for use with EDXB or CP up to 8,000LM, or nTune options (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YKHL	6" Aperture ceiling thickness adapter, for 10,000LM and up (extends mounting frame to accommodate ceiling thickness up to 5"). For use with CWW/DWW trims, EDXB, CP or nTune options.
ISD BC	0-10V wallbox dimmer. Refer to ISD-BC.

ORDERING NOTES

1. Not available with finishes.
2. Replace with applicable RAL number and finish when ready to order. See RAL BROCHURE for available color options. Not available with emergency battery pack options.
3. Not available with emergency battery pack options.
4. Supplied with factory installed step down transformer.
5. Refer to TECH-240 for compatible dimmers.
6. Not available with nLight®.
7. Specify voltage.
8. ER for use with generator supply power. Will require an emergency hot feed and normal hot feed.
9. Not available DALI or DMX drivers. Not available with CP or N80 options. Not recommended for metal ceiling installations.
10. When combined with the EZ1, EZ10, or EZB option, normal luminaires (non-emergency) can be used as a normal power sensing device for nearby nLight AIR devices and luminaires with EM emergency options.
11. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with WR (white reflector) or FL (flangeless) option.
12. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with BR (black reflector) or FL (flangeless) option.
13. Fixture begins at 80% light level. Must be specified with NLT or NLTER. Only available with EZ10 and EZ1 drivers.
14. 12,000LM max with EL or nLight® options. 5,000LM max with Lutron drivers combined with EL. Not available with ELR, HAO, or EXAB, or any nLight® AIR dimming options.
15. Only available 5000LM - 15,000LM with eldoLED drivers.

SPECIFICATIONS

Optical Assembly
Optical design is a Bounding Ray™ design with 45° cutoff to source and source image. Top-down flash characteristic for superior glare control.
Unitized optics shall have mechanical attachment of the light engine to the lower reflector for complete optical alignment.

Electrical
The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
Sound Rated A+. Driver shall be >80% efficient at full load across all input voltages.
Input wires shall be 18AWG, 300V minimum, solid copper.

Controls
Luminaire shall be equipped with interface for nLight wired or wireless network with integral power supply as per specification.

Dimming
The luminaire shall be capable of continuous dimming without perceivable stroboscopic flicker as measured by flicker index (ANSI/IES RP-16-10) over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output with a smooth shut off function to step to 0%.
eldoLED LED drivers shall conform to IEEE P1789 standards. Alternatively, manufacturers must demonstrate conformance with product literature and testing which demonstrates this performance. Systems that do not meet IEEE P1789 will not be considered.
Driver is inaudible in 24dB environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Construction
Fully serviceable and upgradeable lensed LED light engine, both the driver and light engine are suitable for field maintenance and are serviceable from above or below the ceiling.
Luminaire housing shall be constructed of 16-gauge galvanized steel and have preinstalled telescopic mounting bars with maximum 32" and minimum 15" extension and 4" vertical adjustment.
Luminaires shall be suitable for installation in ceilings up to 1½" thick. (specify ceiling thickness adapter to extend frame to accommodate ceiling thickness up to 5").
Tool-less adjustments shall be possible after installation.
The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
25°C ambient temperature standard (1/2" clearance on all sides from non-combustible materials in non-IC applications, unless marked spacing noted otherwise). For use in insulated ceilings, a 3" clearance on all sides from insulation is required (unless marked spacing noted otherwise). 40°C high ambient optional.

Listings
Fixtures are CSA certified to meet US and Canadian Standards: All fixtures manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL, wet location covered ceiling. Luminaire configurations are Energy Star certified through testing in EPA–recognized laboratories, with the results reviewed by an independent, accredited certification organization. Visit www.energystar.gov for specific configurations listed. *Not all configurations are Energy Star listed.

BUY AMERICAN ACT
This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Photometrics
LEDs tested to LM-80 standards. Measured by IESNA Standard LM-79-08 in an accredited lab. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.
Color appearance from luminaire to luminaire of the same type and in all configurations, shall be consistent both initially and at 60,000 hours and operate within a tolerance of <2.5 MacAdam ellipse as defined by a point at the intersection of the CCT line and the black body locus line in CIE chromaticity space.

Warranty
5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note:
Actual performance may differ as a result of end user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.

A+ Capable Luminaire
This item is an A+ capable luminaire, which has been designed and tested to provided consistent color appearance and out-of-the-box control capability with simple commissioning when used with Acuity Brands controls products.
All configurations of this luminaire are calibrated and tested meet the Acuity Brands' specification for chromatic consistency - including color rendering, color fidelity and color temperature tolerance around standard CIE chromaticity coordinates.
To learn more about A+, visit www.acuitybrands.com/aplus.

Tables of Use

Marked Spacing in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
500-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

EVO - eldoLED Driver Default Dimming Curve			
Nomenclature	Min Dimming	Driver Dim Curve	Control Dim Curve
EZ10	10%	Linear	Linear/Logarithmic
EZ1	1%	Linear	Linear/Logarithmic
EXA1	1%	Linear	Linear/Logarithmic
EZB	<1%	Logarithmic	Linear
EDAB	<1%	Logarithmic	Linear
EXAB	<1%	Logarithmic	Linear
EDXB	<1%	Square	Linear

Marked Spacing in Inches 40°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
5000	24	12	5
6000			
8000	48	24	9
10000			
12000			
15000	72	36	9

Marked Spacing Chicago Plenum Open Frame in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

Marked Spacing Chicago Plenum Enclosure in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-6000	None	None	None
8000	36	18	6
10000	48	24	3
12000			

Driver		Control Provided (note: 347V/UVOLT versions provided with 347 option selected)			
Nomenclature	Description	NLT	NLTER	NLTAIR2	NLTAIRER2
GZ10	0-10V driver dims to 10%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
GZ1	0-10V driver dims to 1%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ10	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ1	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZB	eldoLED 0-10V SOLOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2

How to Estimate Delivered Lumens in Emergency Mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver. P = 10W for PS1055CP

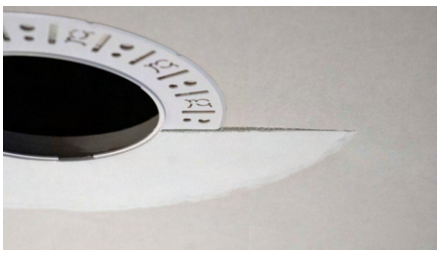
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

Flangeless

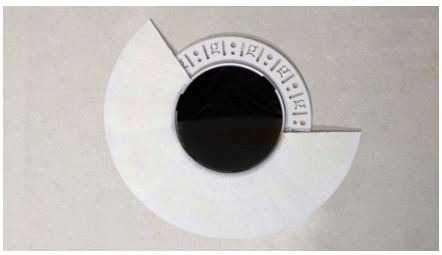
Flangeless Installation

Gotham's flangeless option utilizes a micro-thin polymer mud ring that minimizes the amount of drywall compound required to finish the ceiling. The end result is a virtually undetectable flangeless downlight installation.

The polymer mud ring is installed independent of the of the recessed frame, therefore floating with the ceiling. This innovation minimizes any surface cracks during reflector installation, ceiling movement and any future service to the recessed frame, wiring, electronics, etc.



Partially finished mud ring, showing cross-section detail.



An EVO downlight requires only approximately 3" of plaster to finish.

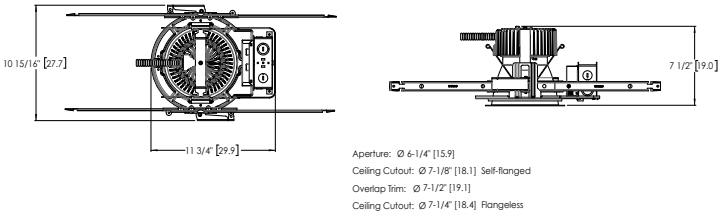
EVO with flangeless trim

DIMENSIONAL DATA

*Dimensions in inches [centimeters]

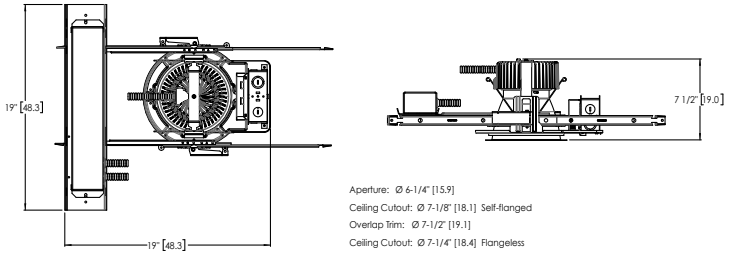
Aperture: 6 1/4" [15.9)]	Ceiling Opening: 7 1/8" [18.1] self-flanged
Overlap Trim: 7 1/2" [19.1]	7 1/4" [18.4] flangeless

250LM-5000LM Standard



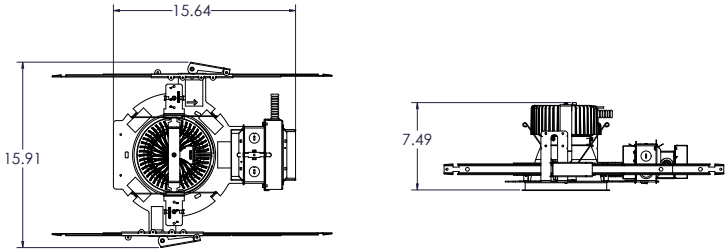
Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

250LM-5000LM Battery Pack

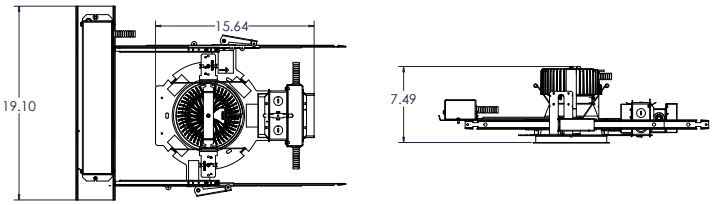


Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

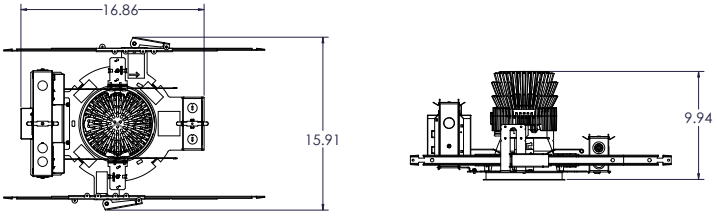
6000LM-8000LM Standard



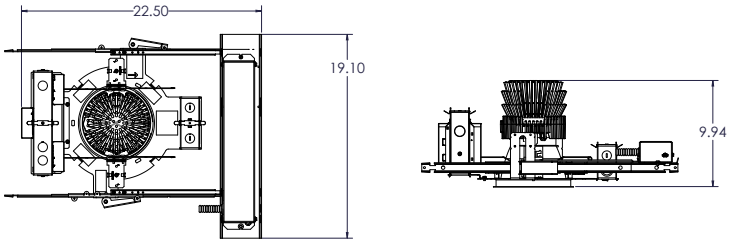
6000LM-8000LM Battery Pack



10,000LM-17,500LM Standard



10,000LM-17,500LM Battery Pack

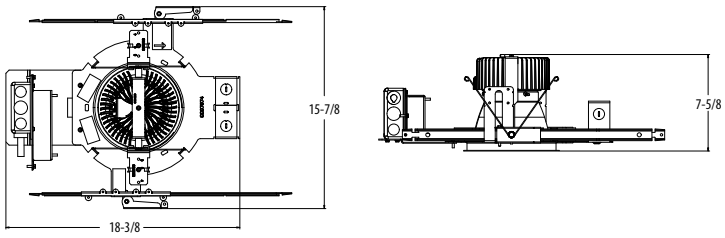


gotham®

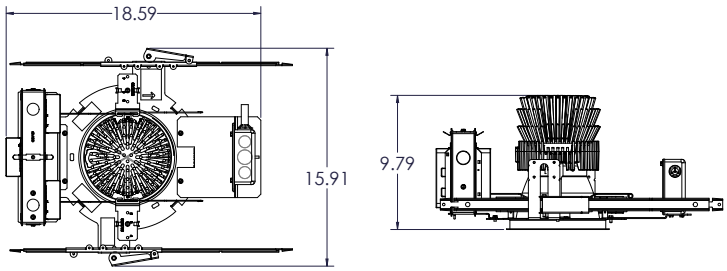
DIMENSIONAL DATA

*Dimensions in inches [centimeters]

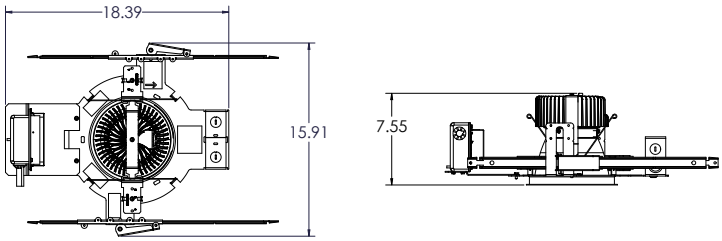
250LM-4500LM CP



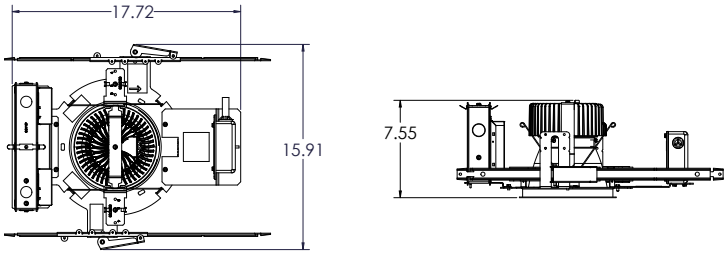
10000LM - 17,500LM Lumen Open Frame CP



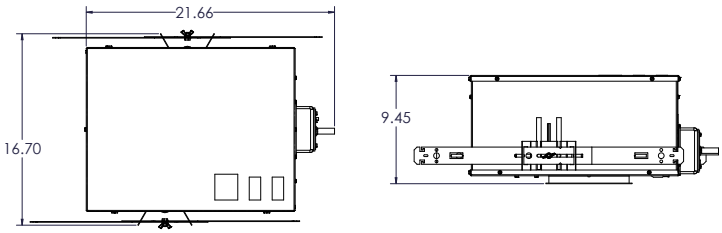
5000LM ECO/SOLO Drive Open Frame CP



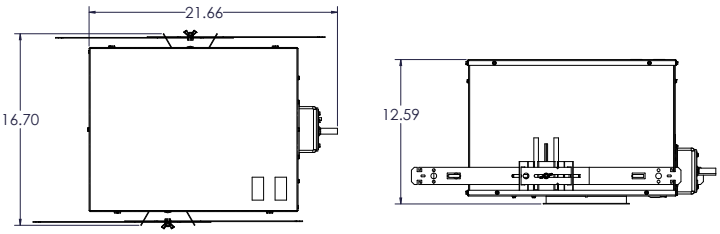
5000LM (Lutron & POWER Drive Only), 6000LM & 8000LM Open Frame CP



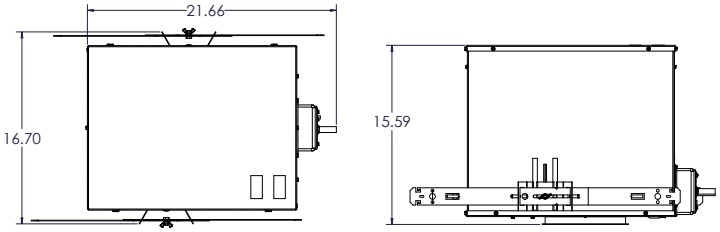
250LM - 6000LM CP Enclosed with Battery Pack and/or nLight™ Only



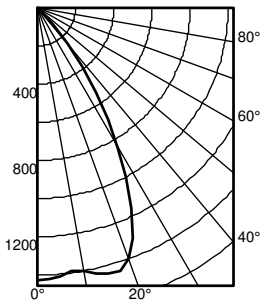
8,000LM CP Enclosed with Battery Pack and/or nLight™ Only



10,000LM-12,000LM CP Enclosed with Battery Pack and/or nLight™ Only



EV06 35/15 AR MWD LS INPUT WATTS: 14.7, DELIVERED LUMENS: 1471LM, LPW= 100, 1.03 S/MH, TEST NO. LTL27783P1505



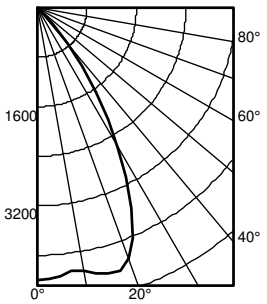
	Ave	Lumens
0	1431	
5	1410	134
15	1442	405
25	1161	523
35	540	332
45	78	72
55	3	4
65	1	1
75	0	1
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	1061.4	72.2
0° - 40°	1393.5	94.7
0° - 60°	1469.5	99.9
0° - 90°	1470.9	100.0
90° - 180°	0.0	0.0
0° - 180°	1470.9	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	47.3	5.7	23.7	8.9	4.7
10.0	25.4	7.7	12.7	12.1	2.5
12.0	15.9	9.8	7.9	15.3	1.6
14.0	10.8	11.8	5.4	18.6	1.1
16.0	7.9	13.9	3.9	21.8	0.8

EV06 35/45 AR MWD LS INPUT WATTS: 47.3, DELIVERED LUMENS: 4532.7LM, LPW= 95.8, 1.03 S/MH, TEST NO. LTL27783P1649



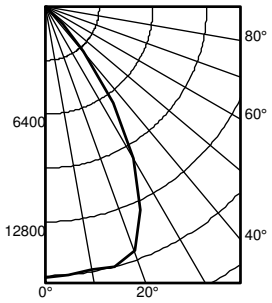
	Ave	Lumens
0	4411	
5	4346	413
15	4443	1247
25	3578	1610
35	1665	1024
45	242	222
55	8	12
65	2	3
75	1	2
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	3270.7	72.2
0° - 40°	4294.2	94.7
0° - 60°	4528.3	99.9
0° - 90°	4532.7	100.0
90° - 180°	0.0	0.0
0° - 180°	4532.7	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	145.8	5.7	72.9	8.9	14.6
10.0	78.4	7.7	39.2	12.1	7.8
12.0	48.9	9.8	24.4	15.3	4.9
14.0	33.4	11.8	16.7	18.6	3.3
16.0	24.2	13.9	12.1	21.8	2.4

EV06 35/175 AR MWD LS INPUT WATTS: 175.3, DELIVERED LUMENS: 17801LM, LPW=101.5, 1.06 S/MH, TEST NO. ISF 34035P268



	Ave	Lumens
0	16146	
5	15998	1521
15	16006	4479
25	13362	6001
35	7018	4289
45	1470	1299
55	100	156
65	37	38
75	13	14
85	2	2
90	0	

Zone	Lumens	% Lamp
0° - 30°	12002.3	67.4
0° - 40°	16291.0	91.5
0° - 60°	17746.3	99.7
0° - 90°	17801.0	100.0
90° - 120°	0.0	0.0
90° - 130°	0.0	0.0
90° - 150°	0.0	0.0
90° - 180°	0.0	0.0
0° - 180°	17801.0	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	108	106	104	104	103	101
2	103	98	95	101	97	94	98	95	92
3	95	90	86	94	89	86	91	87	84
4	89	83	79	88	82	78	85	81	77
5	83	77	72	82	76	72	80	75	71
6	77	71	67	77	71	67	75	70	66
7	73	66	62	72	66	62	71	65	61
8	68	62	58	67	62	57	66	61	57
9	64	58	54	63	58	54	62	57	53
10	60	54	50	60	54	50	59	54	50

		50% beam - 55.7°		10% beam - 79.8°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	533.7	5.8	266.9	9.2	53.4
10.0	287.0	7.9	143.5	12.5	28.7
12.0	178.9	10.0	89.4	15.9	17.9
14.0	122.1	12.1	61.0	19.2	12.2
16.0	88.6	14.3	44.3	22.6	8.9

Lumen Output Multiplier		
CRI	CCT	Multplier
80	2700K	0.96
	300K	1.00
	3500K	1.00
	4000K	1.01
	5000K	1.07
90	2700K	0.80
	300K	0.83
	3500K	0.85
	4000K	0.87
	5000K	0.91

Reflector Finish Multiplier	
Reflector Finish	Multiplier
LS - Specular	1
LSS - Semi Specular	0.956
WR - White	0.87
LD - Matte Diffuse	0.85
BR - Black	0.73

Distributions		
Nomenclature	Beam Angle	Field Angle
VND	30	64
ND	44	69
MD	54	82
MWD	67	89
WD	71	92

NLIGHT AIR

NLIGHT

nLight® AIR is the ideal solution for retrofit or new construction spaces where adding communication wiring is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each EVO Luminaire ordered with the NLTAIR option. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.

nLight® AIR Control Accessories *Order as separate catalog number. Visit nLight AIR.*	
Wall Switches	**Model Number**
On/Off single pole	rPODB (color) G2
On/Off two pole	rPODB 2P (color) G2
On/Off & raise/lower single pole	rPODB DX (color) G2
On/Off & raise/lower two pole	rPODB 2P DX (color) G2

nLight® AIR Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	rCMS 9 / rCMS PDT 9
Large motion 360°, ceiling	rCMS 10 / rCMS PDT 10

UL924 Sequence of Operation

The below information applies to all nLight AIR devices with an EM option.

- EM devices will remain at their high-end trim and ignore wireless lighting control commands, unless a normal-power-sensed (NPS) broadcast is received at least every 8 seconds.
- Using the CL**AIR**ITY+ mobile app, EM devices must be associated with a group that includes a normal power sensing device to receive NPS broadcasts.
- Only non-emergency rPP20, rLSXR, rSBOR, rSDGR, and nLight AIR luminaires with version 3.4 or later firmware can provide normal power sensing for EM devices. See specification sheets for control devices and luminaires for more information on options that support normal power sensing.

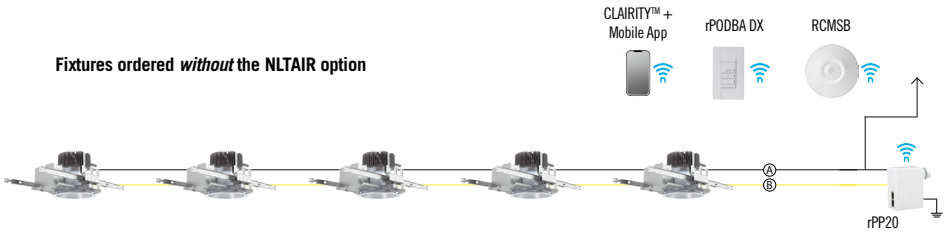
nLight® The nLight® solution is a digital networked lighting control system that provides both energy savings and increased user configurability by cost effectively integrating time-based, daylight-based, sensor-based and manual lighting control schemes.

nLight® Wired Control Accessories *Order as separate catalog number. Visit nLight.*	
Wall Switches	**Model Number**
On/Off single pole	nPODM (color)
On/Off two pole	nPODM 2P (color)
On/Off & raise/lower single pole	nPOD DX (color)
On/Off & raise/lower two pole	nPODM 2P DX (color)
Graphic touchscreen	nPOD GFX (color)
Photocell Controls	
Dimming	nCM ADCX

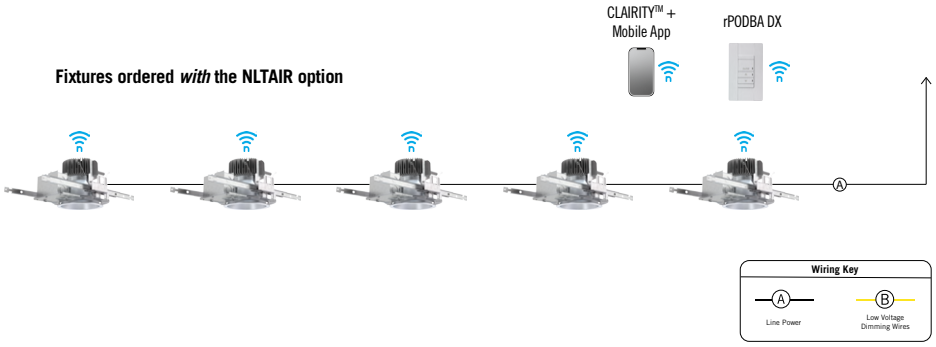
nLight® Wired Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	nCM 9 / nCM PDT 9
Large motion 360°, ceiling	nCM 10 / nCM PDT 10
Wide View	nWV 16 / nWV PDT 16
Wall switch with raise/lower	nWSX LV DX / nWSX PDT LV DX
Cat-5 Cables (plenum rated)	
10', CAT5	CAT5 10FT J1
15', CAT5	CAT5 15FT J1

Possibilites for nLight® AIR

Fixtures ordered *without* the NLTAIR option

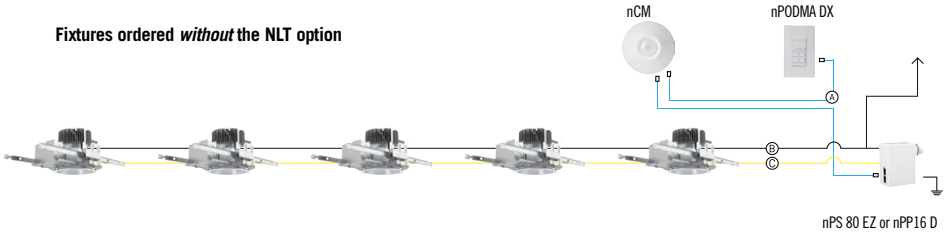


Fixtures ordered *with* the NLTAIR option

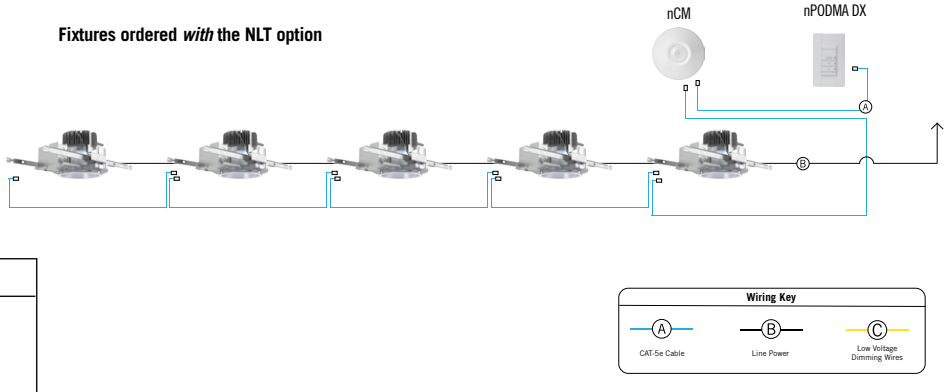


Possibilites for nLight® wired

Fixtures ordered *without* the NLT option



Fixtures ordered *with* the NLT option



gotham® | EVO®

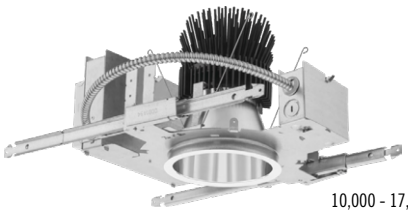
Multiple Layers of Light

Luminaire Type:

Catalog Number:

General Illumination Round Downlight 6"

250 - 8,000 lumens



10,000 - 17,500 lumens

Feature Set

- Bounding Ray™ optical design
- Unitized optics mechanically attach the light engine to the lower reflector for complete optical alignment.
- 45° cutoff to source and source image
- Fully serviceable and upgradeable lensed LED light engine
- 70% lumen maintenance at 60,000 hours
- 2.5 MacAdam Ellipse; 85 CRI typical, 90+ CRI optional
- Fixtures are wet location, covered ceiling
- Available with 10% dimming, 1% dimming, or dim to dark
- Batwing distribution with feathered edges provides even illumination on horizontal and vertical surfaces
- ENERGY STAR® certified product*
- UGR of zero for fixtures aimed at nadir with a cut-off equal to or less than 60deg per CIE 117-1995 Discomfort Glare in Interior Lighting. UGR FAQ

Distribution

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.

*See ordering tree for details

Superior Performance

Nominal Lumens	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10,000	12,000	15,000	17,500
Delivered Lumens	297	519	776	994	1471	2006	2537	3077	3542	4027	4533	5256	6371	8247	10637	12332	15776	17801
Wattage	3.4	6.2	8.2	9.6	14.7	19.7	24.7	29.5	33.8	39.0	47.3	48.7	57.6	74.9	97.1	115.0	150.9	175.3
Lumens per Watt	87.4	83.7	94.6	103.5	100.1	101.8	102.7	104.3	104.8	103.3	95.8	107.9	110.6	110.1	109.5	107.2	104.5	101.5

*Based on 3500K AR LSS MWD 80CRI

Coordinated Apertures | Multiple Layers of Light

General Illumination Layer | EVO

High Center Beam Layer | Incito

EVO + Incito — Multiple Layers of Light

Core

Healthcare

Special Applications

OVERVIEW

COMPLIMENTARY PRODUCTS

GOTHAM ARCHITECTURAL DOWNLIGHTING | 1400 Lester Road Conyers, GA 30012 | P 800-705-SERV (7378) | gothamlighting.com

ORDERING INFORMATION

Design Select options indicated by this color background.

Luminaire Type:

Catalog Number:

EXAMPLE: EV06 35/150 AR MWD LSS MVOLT EZ1

Series	Color Temperature	Nominal Lumen Values	Reflector & Flange Color	Trim Style	Finish
EV06	27/ 2700 K 30/ 3000 K 35/ 3500 K 40/ 4000 K 50/ 5000 K	02 250 lumens 05 500 lumens 07 750 lumens 10 1000 lumens 15 1500 lumens 20 2000 lumens 25 2500 lumens 30 3000 lumens 35 3500 lumens 40 4000 lumens 45 4500 lumens 50 5000 lumens 60 6000 lumens 80 8000 lumens 100 10000 lumens 120 12000 lumens 150 15000 lumens 175 17500 lumens	AR Clear PR Pewter WTR Wheat GR Gold WR[1] White BR[1] Black WRAMF[1] White Anti-microbial TRALTBD[1,2] RAL paint for pricing only TCPC[1] Custom paint color	(blank) Self-flanged FL Flangeless	LSS Semi-specular LD Matte-diffuse LS Specular

Distribution	Voltage	Driver[5]	
VND Very Narrow (0.5 s/mh) ND Narrow (0.7 s/mh) MD Medium (0.9 s/mh) MWD Medium Wide (1.0 s/mh) WD Wide (1.2 s/mh)	MVOLT 120 277 347[3,4]	GZ10 0-10V driver dims to 10% GZ1 0-10V driver dims to 1% EZ10 eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1%. EDAB eldoLED SOLOdrive DALI. Logarithmic dimming to <1%.	EDXB eldoLED POWERdrive DMX with RDM (remote device management). Square Law dimming to <1%. Includes termination resistor. Refer to DMXR Manual. Minimum 1000 lumens/Maximum 15000 lumens. ECOD[6] Lutron Ecosystem digital Hi-Lume 1% soft-on, fade to black. Max: 4000LM.

Control Interface	Emergency Options	Options
NLT[7] nLight® dimming pack controls NLTER[3,7,8] nLight® dimming pack controls emergency circuit NLTAIR2[9,10] nLight® AIR enabled NLTAIRER2[3,8,10] nLight® AIR enabled emergency NLTAIREM2[3,9] nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit with battery pack options.	EL Emergency battery pack, 10W, with integral test switch ELR Emergency battery pack, 10W, with remote test switch ELSD Emergency battery pack, 10W, with self-diagnostics, integral test switch ELRSD Emergency battery pack, 10W, with self-diagnostics, remote test switch E10WCP Emergency battery pack, 10W Constant Power, CA Title 20 compliant with integral test switch E10WCPR Emergency battery pack, 10W Constant Power, CA Title 20 compliant with remote test switch BGTD Bodine generator transfer device. Specify 120V or 277V.	SF Single fuse. Specify 120V or 277V. TRW[11] White painted flange TRBL[12] Black painted flange FRALTBD[2] Flange ring only RAL color for pricing only FCPC Flange custom paint color N80[13] nLight® Lumen Compensation GTD generator transfer device. Specify 120V or 277V 90CRI High CRI (90+) CP[14] Chicago Plenum. Specify 120V or 277V for 5000lm and above. HAO[15] HAO High Ambient Option (40°C) RRL_ RELOC®-ready luminaire connectors enable a simple and consistent factory installed option across all ABL luminaire brands. Available only with RRLA, RRLB, RRLAE, and RRLC12S. Refer to RRL spec sheet on www.acuitybrands.com for RELOC® product specifications. Above ceiling access required.

ACCESSORIES – order as separate catalog numbers (shipped separately)

SCA6	Sloped ceiling adapter. Degree of slope must be specified (5D, 10D, 15D, 20D, 25D, 30D). Ex: SCA6 10D. Refer to TECH-190.
CTA EV06	6" Aperture ceiling thickness adapter, for up to 8,000LM (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YK	4"-8" Aperture ceiling thickness adapter for use with EDXB or CP up to 8,000LM, or nTune options (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YKHL	6" Aperture ceiling thickness adapter, for 10,000LM and up (extends mounting frame to accommodate ceiling thickness up to 5"). For use with CWW/DWW trims, EDXB, CP or nTune options.
ISD BC	0-10V wallbox dimmer. Refer to ISD-BC.

ORDERING NOTES

1. Not available with finishes.
2. Replace with applicable RAL number and finish when ready to order. See RAL BROCHURE for available color options. Not available with emergency battery pack options.
3. Not available with emergency battery pack options.
4. Supplied with factory installed step down transformer.
5. Refer to TECH-240 for compatible dimmers.
6. Not available with nLight®.
7. Specify voltage.
8. ER for use with generator supply power. Will require an emergency hot feed and normal hot feed.
9. Not available DALI or DMX drivers. Not available with CP or N80 options. Not recommended for metal ceiling installations.
10. When combined with the EZ1, EZ10, or EZB option, normal luminaires (non-emergency) can be used as a normal power sensing device for nearby nLight AIR devices and luminaires with EM emergency options.
11. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with WR (white reflector) or FL (flangeless) option.
12. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with BR (black reflector) or FL (flangeless) option.
13. Fixture begins at 80% light level. Must be specified with NLT or NLTER. Only available with EZ10 and EZ1 drivers.
14. 12,000LM max with EL or nLight® options. 5,000LM max with Lutron drivers combined with EL. Not available with ELR, HAO, or EXAB, or any nLight® AIR dimming options.
15. Only available 5000LM - 15,000LM with eldoLED drivers.

SPECIFICATIONS

Optical Assembly
Optical design is a Bounding Ray™ design with 45° cutoff to source and source image. Top-down flash characteristic for superior glare control.
Unitized optics shall have mechanical attachment of the light engine to the lower reflector for complete optical alignment.

Electrical
The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
Sound Rated A+. Driver shall be >80% efficient at full load across all input voltages.
Input wires shall be 18AWG, 300V minimum, solid copper.

Controls
Luminaire shall be equipped with interface for nLight wired or wireless network with integral power supply as per specification.

Dimming
The luminaire shall be capable of continuous dimming without perceivable stroboscopic flicker as measured by flicker index (ANSI/IES RP-16-10) over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output with a smooth shut off function to step to 0%.
eldoLED LED drivers shall conform to IEEE P1789 standards. Alternatively, manufacturers must demonstrate conformance with product literature and testing which demonstrates this performance. Systems that do not meet IEEE P1789 will not be considered.
Driver is inaudible in 24dB environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Construction
Fully serviceable and upgradeable lensed LED light engine, both the driver and light engine are suitable for field maintenance and are serviceable from above or below the ceiling.
Luminaire housing shall be constructed of 16-gauge galvanized steel and have preinstalled telescopic mounting bars with maximum 32" and minimum 15" extension and 4" vertical adjustment.
Luminaires shall be suitable for installation in ceilings up to 1½" thick. (specify ceiling thickness adapter to extend frame to accommodate ceiling thickness up to 5").
Tool-less adjustments shall be possible after installation.
The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
25°C ambient temperature standard (1/2" clearance on all sides from non-combustible materials in non-IC applications, unless marked spacing noted otherwise). For use in insulated ceilings, a 3" clearance on all sides from insulation is required (unless marked spacing noted otherwise). 40°C high ambient optional.

Listings
Fixtures are CSA certified to meet US and Canadian Standards: All fixtures manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL, wet location covered ceiling. Luminaire configurations are Energy Star certified through testing in EPA–recognized laboratories, with the results reviewed by an independent, accredited certification organization. Visit www.energystar.gov for specific configurations listed. *Not all configurations are Energy Star listed.

BUY AMERICAN ACT
This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Photometrics
LEDs tested to LM-80 standards. Measured by IESNA Standard LM-79-08 in an accredited lab. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.
Color appearance from luminaire to luminaire of the same type and in all configurations, shall be consistent both initially and at 60,000 hours and operate within a tolerance of <2.5 MacAdam ellipse as defined by a point at the intersection of the CCT line and the black body locus line in CIE chromaticity space.

Warranty
5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note:
Actual performance may differ as a result of end user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.

A+ Capable Luminaire
This item is an A+ capable luminaire, which has been designed and tested to provided consistent color appearance and out-of-the-box control capability with simple commissioning when used with Acuity Brands controls products.
All configurations of this luminaire are calibrated and tested meet the Acuity Brands' specification for chromatic consistency - including color rendering, color fidelity and color temperature tolerance around standard CIE chromaticity coordinates.
To learn more about A+, visit www.acuitybrands.com/aplus.

Tables of Use

Marked Spacing in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
500-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

EVO - eldoLED Driver Default Dimming Curve			
Nomenclature	Min Dimming	Driver Dim Curve	Control Dim Curve
EZ10	10%	Linear	Linear/Logarithmic
EZ1	1%	Linear	Linear/Logarithmic
EXA1	1%	Linear	Linear/Logarithmic
EZB	<1%	Logarithmic	Linear
EDAB	<1%	Logarithmic	Linear
EXAB	<1%	Logarithmic	Linear
EDXB	<1%	Square	Linear

Marked Spacing in Inches 40°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
5000	24	12	5
6000			
8000	48	24	9
10000			
12000			
15000	72	36	9

Marked Spacing Chicago Plenum Open Frame in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

Marked Spacing Chicago Plenum Enclosure in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-6000	None	None	None
8000	36	18	6
10000	48	24	3
12000			

Driver		Control Provided (note: 347V/UVOLT versions provided with 347 option selected)			
Nomenclature	Description	NLT	NLTER	NLTAIR2	NLTAIRER2
GZ10	0-10V driver dims to 10%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
GZ1	0-10V driver dims to 1%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ10	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ1	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZB	eldoLED 0-10V SOLOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2

How to Estimate Delivered Lumens in Emergency Mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver. P = 10W for PS1055CP

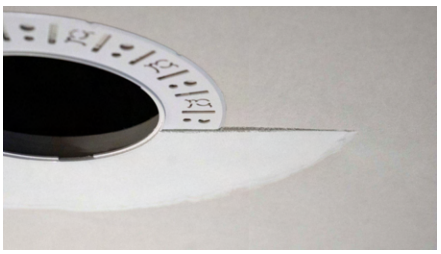
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

Flangeless

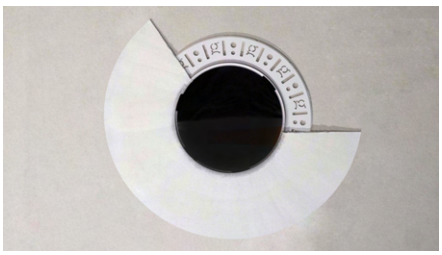
Flangeless Installation

Gotham's flangeless option utilizes a micro-thin polymer mud ring that minimizes the amount of drywall compound required to finish the ceiling. The end result is a virtually undetectable flangeless downlight installation.

The polymer mud ring is installed independent of the of the recessed frame, therefore floating with the ceiling. This innovation minimizes any surface cracks during reflector installation, ceiling movement and any future service to the recessed frame, wiring, electronics, etc.



Partially finished mud ring, showing cross-section detail.



An EVO downlight requires only approximately 3" of plaster to finish.

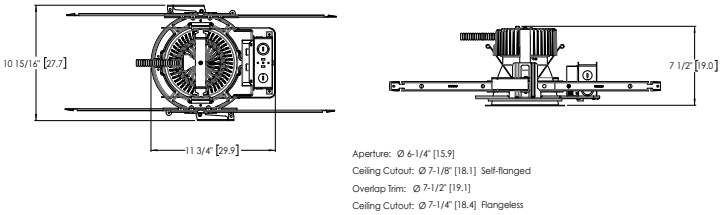
EVO with flangeless trim

DIMENSIONAL DATA

*Dimensions in inches [centimeters]

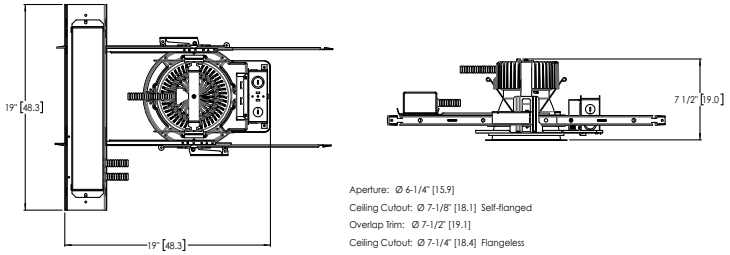
Aperture: 6 1/4" [15.9)]	Ceiling Opening: 7 1/8" [18.1] self-flanged
Overlap Trim: 7 1/2" [19.1]	7 1/4" [18.4] flangeless

250LM-5000LM Standard



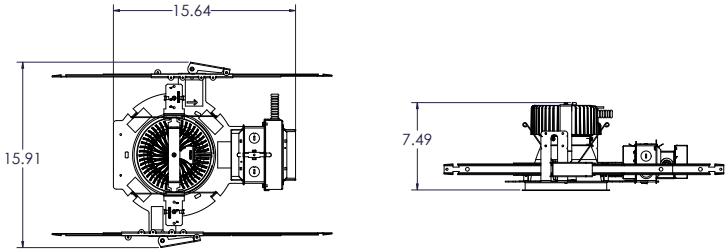
Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

250LM-5000LM Battery Pack

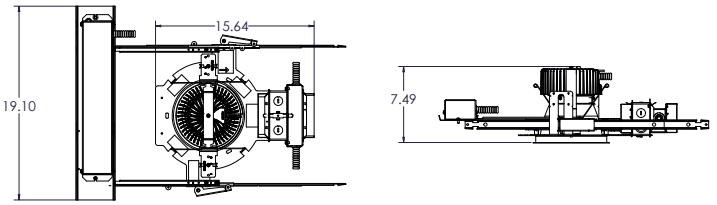


Aperture: Ø 6-1/4" [15.9]
Ceiling Cutout: Ø 7-1/8" [18.1] Self-flanged
Overlap Trim: Ø 7-1/2" [19.1]
Ceiling Cutout: Ø 7-1/4" [18.4] Flangeless

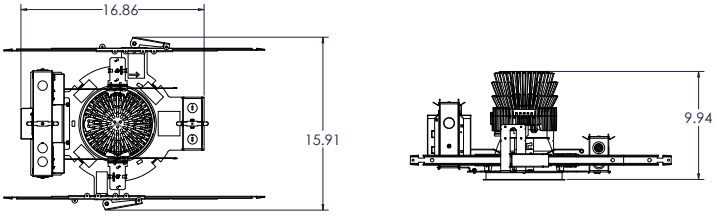
6000LM-8000LM Standard



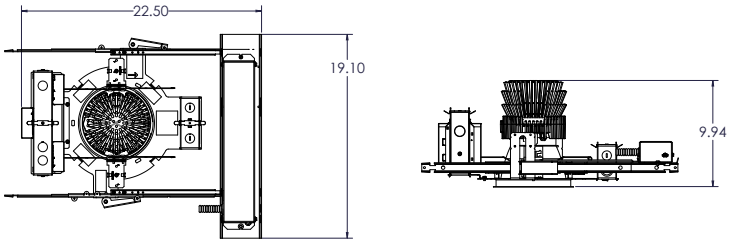
6000LM-8000LM Battery Pack



10,000LM-17,500LM Standard



10,000LM-17,500LM Battery Pack

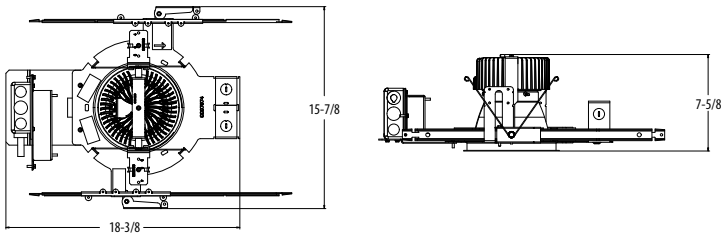


gotham®

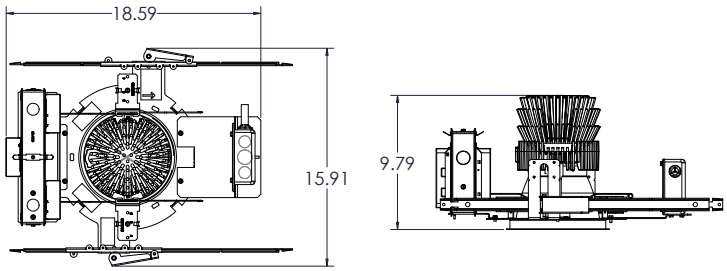
DIMENSIONAL DATA

*Dimensions in inches [centimeters]

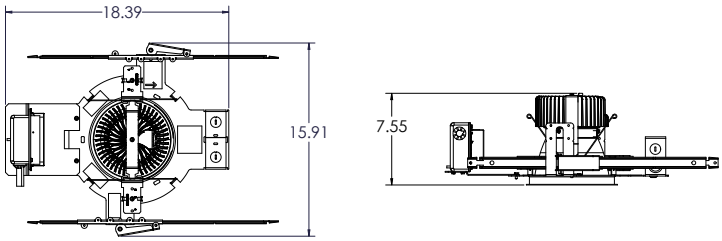
250LM-4500LM CP



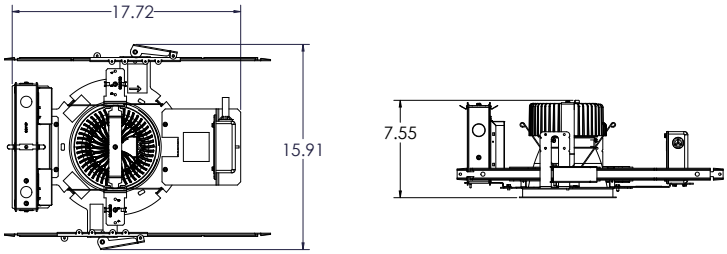
10000LM - 17,500LM Lumen Open Frame CP



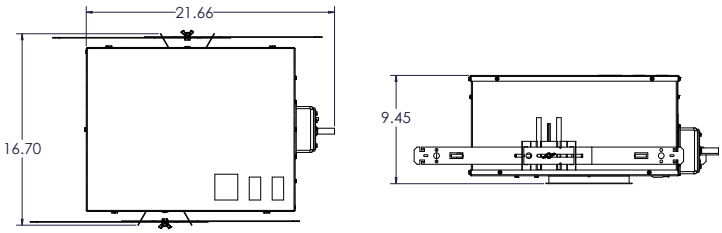
5000LM ECO/SOLO Drive Open Frame CP



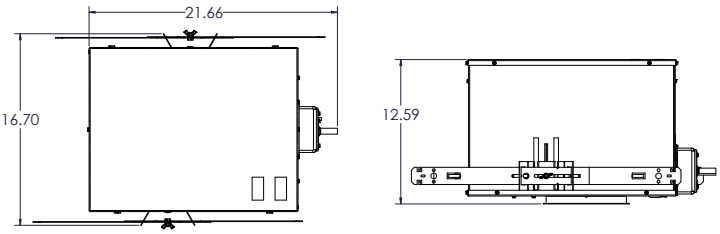
5000LM (Lutron & POWER Drive Only), 6000LM & 8000LM Open Frame CP



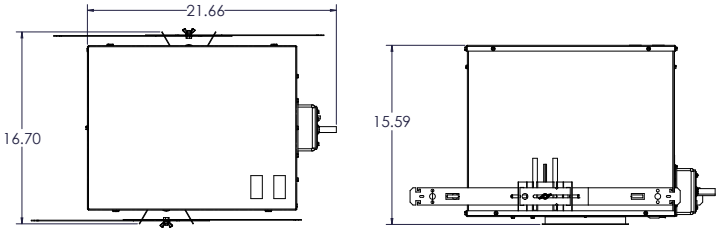
250LM - 6000LM CP Enclosed with Battery Pack and/or nLight™ Only



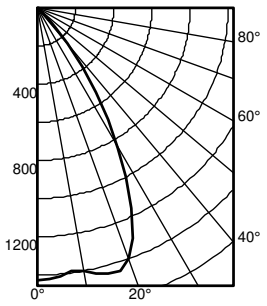
8,000LM CP Enclosed with Battery Pack and/or nLight™ Only



10,000LM-12,000LM CP Enclosed with Battery Pack and/or nLight™ Only



EV06 35/15 AR MWD LS INPUT WATTS: 14.7, DELIVERED LUMENS: 1471LM, LPW= 100, 1.03 S/MH, TEST NO. LTL27783P1505



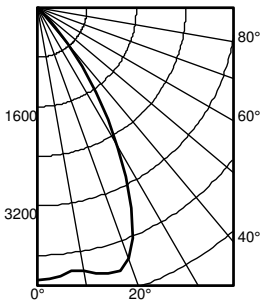
	Ave	Lumens
0	1431	
5	1410	134
15	1442	405
25	1161	523
35	540	332
45	78	72
55	3	4
65	1	1
75	0	1
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	1061.4	72.2
0° - 40°	1393.5	94.7
0° - 60°	1469.5	99.9
0° - 90°	1470.9	100.0
90° - 180°	0.0	0.0
0° - 180°	1470.9	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	47.3	5.7	23.7	8.9	4.7
10.0	25.4	7.7	12.7	12.1	2.5
12.0	15.9	9.8	7.9	15.3	1.6
14.0	10.8	11.8	5.4	18.6	1.1
16.0	7.9	13.9	3.9	21.8	0.8

EV06 35/45 AR MWD LS INPUT WATTS: 47.3, DELIVERED LUMENS: 4532.7LM, LPW= 95.8, 1.03 S/MH, TEST NO. LTL27783P1649



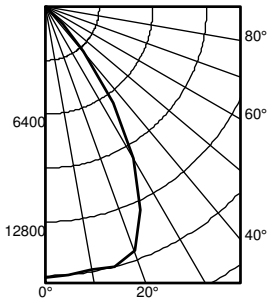
	Ave	Lumens
0	4411	
5	4346	413
15	4443	1247
25	3578	1610
35	1665	1024
45	242	222
55	8	12
65	2	3
75	1	2
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	3270.7	72.2
0° - 40°	4294.2	94.7
0° - 60°	4528.3	99.9
0° - 90°	4532.7	100.0
90° - 180°	0.0	0.0
0° - 180°	4532.7	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	145.8	5.7	72.9	8.9	14.6
10.0	78.4	7.7	39.2	12.1	7.8
12.0	48.9	9.8	24.4	15.3	4.9
14.0	33.4	11.8	16.7	18.6	3.3
16.0	24.2	13.9	12.1	21.8	2.4

EV06 35/175 AR MWD LS INPUT WATTS: 175.3, DELIVERED LUMENS: 17801LM, LPW=101.5, 1.06 S/MH, TEST NO. ISF 34035P268



	Ave	Lumens
0	16146	
5	15998	1521
15	16006	4479
25	13362	6001
35	7018	4289
45	1470	1299
55	100	156
65	37	38
75	13	14
85	2	2
90	0	

Zone	Lumens	% Lamp
0° - 30°	12002.3	67.4
0° - 40°	16291.0	91.5
0° - 60°	17746.3	99.7
0° - 90°	17801.0	100.0
90° - 120°	0.0	0.0
90° - 130°	0.0	0.0
90° - 150°	0.0	0.0
90° - 180°	0.0	0.0
0° - 180°	17801.0	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	108	106	104	104	103	101
2	103	98	95	101	97	94	98	95	92
3	95	90	86	94	89	86	91	87	84
4	89	83	79	88	82	78	85	81	77
5	83	77	72	82	76	72	80	75	71
6	77	71	67	77	71	67	75	70	66
7	73	66	62	72	66	62	71	65	61
8	68	62	58	67	62	57	66	61	57
9	64	58	54	63	58	54	62	57	53
10	60	54	50	60	54	50	59	54	50

		50% beam - 55.7°		10% beam - 79.8°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	533.7	5.8	266.9	9.2	53.4
10.0	287.0	7.9	143.5	12.5	28.7
12.0	178.9	10.0	89.4	15.9	17.9
14.0	122.1	12.1	61.0	19.2	12.2
16.0	88.6	14.3	44.3	22.6	8.9

Lumen Output Multiplier		
CRI	CCT	Multplier
80	2700K	0.96
	300K	1.00
	3500K	1.00
	4000K	1.01
	5000K	1.07
90	2700K	0.80
	300K	0.83
	3500K	0.85
	4000K	0.87
	5000K	0.91

Reflector Finish Multiplier	
Reflector Finish	Multiplier
LS - Specular	1
LSS - Semi Specular	0.956
WR - White	0.87
LD - Matte Diffuse	0.85
BR - Black	0.73

Distributions		
Nomenclature	Beam Angle	Field Angle
VND	30	64
ND	44	69
MD	54	82
MWD	67	89
WD	71	92

NLIGHT AIR

NLIGHT

nLight® AIR is the ideal solution for retrofit or new construction spaces where adding communication wiring is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each EVO Luminaire ordered with the NLTAIR option. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.

nLight® AIR Control Accessories *Order as separate catalog number. Visit nLight AIR.*	
Wall Switches	**Model Number**
On/Off single pole	rPODB (color) G2
On/Off two pole	rPODB 2P (color) G2
On/Off & raise/lower single pole	rPODB DX (color) G2
On/Off & raise/lower two pole	rPODB 2P DX (color) G2

nLight® AIR Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	rCMS 9 / rCMS PDT 9
Large motion 360°, ceiling	rCMS 10 / rCMS PDT 10

UL924 Sequence of Operation

The below information applies to all nLight AIR devices with an EM option.

- EM devices will remain at their high-end trim and ignore wireless lighting control commands, unless a normal-power-sensed (NPS) broadcast is received at least every 8 seconds.
- Using the CL**AIR**ITY+ mobile app, EM devices must be associated with a group that includes a normal power sensing device to receive NPS broadcasts.
- Only non-emergency rPP20, rLSXR, rSBOR, rSDGR, and nLight AIR luminaires with version 3.4 or later firmware can provide normal power sensing for EM devices. See specification sheets for control devices and luminaires for more information on options that support normal power sensing.

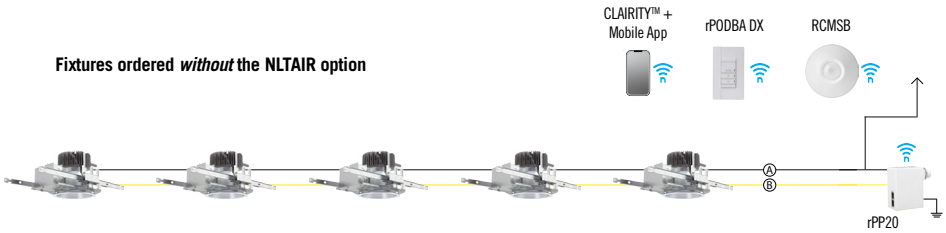
nLight® The nLight® solution is a digital networked lighting control system that provides both energy savings and increased user configurability by cost effectively integrating time-based, daylight-based, sensor-based and manual lighting control schemes.

nLight® Wired Control Accessories *Order as separate catalog number. Visit nLight.*	
Wall Switches	**Model Number**
On/Off single pole	nPODM (color)
On/Off two pole	nPODM 2P (color)
On/Off & raise/lower single pole	nPOD DX (color)
On/Off & raise/lower two pole	nPODM 2P DX (color)
Graphic touchscreen	nPOD GFX (color)
Photocell Controls	
Dimming	nCM ADCX

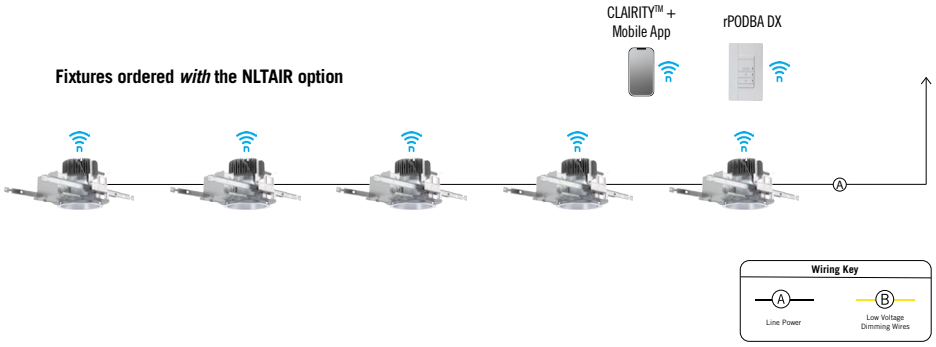
nLight® Wired Control Accessories *(cont.)*	
Occupancy Sensors (PIR/dual tech)	**Model Number**
Small motion 360°, ceiling	nCM 9 / nCM PDT 9
Large motion 360°, ceiling	nCM 10 / nCM PDT 10
Wide View	nWV 16 / nWV PDT 16
Wall switch with raise/lower	nWSX LV DX / nWSX PDT LV DX
Cat-5 Cables (plenum rated)	
10', CAT5	CAT5 10FT J1
15', CAT5	CAT5 15FT J1

Possibilites for nLight® AIR

Fixtures ordered *without* the NLTAIR option

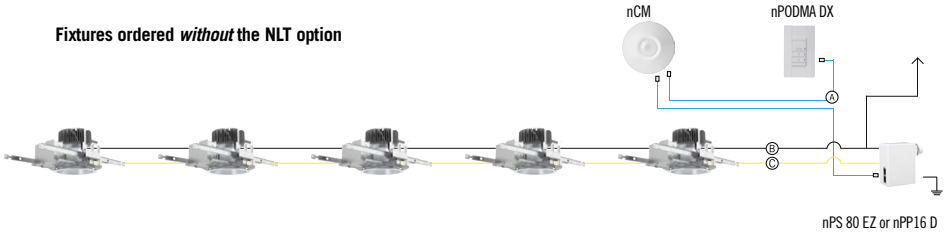


Fixtures ordered *with* the NLTAIR option

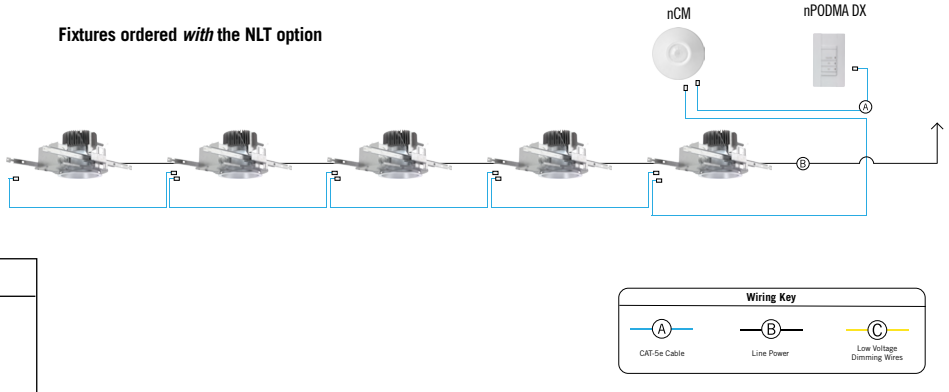


Possibilites for nLight® wired

Fixtures ordered *without* the NLT option



Fixtures ordered *with* the NLT option



gotham® | EVO®

Multiple Layers of Light

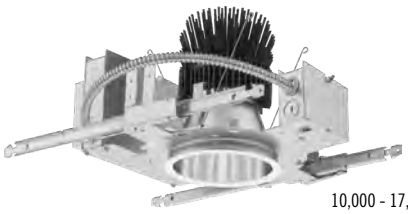
Luminaire Type:

Catalog Number:

General Illumination Round Downlight

6"

250 - 8,000 lumens



10,000 - 17,500 lumens

OVERVIEW

Feature Set

- Bounding Ray™ optical design
- Unitized optics mechanically attach the light engine to the lower reflector for complete optical alignment.
- 45° cutoff to source and source image
- Fully serviceable and upgradeable lensed LED light engine
- 70% lumen maintenance at 60,000 hours
- 2.5 MacAdam Ellipse; 85 CRI typical, 90+ CRI optional
- Fixtures are wet location, covered ceiling
- Available with 10% dimming, 1% dimming, or dim to dark
- Batwing distribution with feathered edges provides even illumination on horizontal and vertical surfaces
- ENERGY STAR® certified product*
- UGR of zero for fixtures aimed at nadir with a cut-off equal to or less than 60deg per CIE 117-1995 Discomfort Glare in Interior Lighting. UGR FAQ

Distribution

Very Narrow (VND) 0.5 S:MH | Narrow (ND) 0.7 S:MH | Medium (MD) 0.8 S:MH | Medium Wide (MWD) 1.0 S:MH | Wide (WD) 1.2 S:MH

design select

Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect.

*See ordering tree for details

Superior Performance

Nominal Lumens	250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	8000	10,000	12,000	15,000	17,500
Delivered Lumens	297	519	776	994	1471	2006	2537	3077	3542	4027	4533	5256	6371	8247	10637	12332	15776	17801
Wattage	3.4	6.2	8.2	9.6	14.7	19.7	24.7	29.5	33.8	39.0	47.3	48.7	57.6	74.9	97.1	115.0	150.9	175.3
Lumens per Watt	87.4	83.7	94.6	103.5	100.1	101.8	102.7	104.3	104.8	103.3	95.8	107.9	110.6	110.1	109.5	107.2	104.5	101.5

*Based on 3500K AR LSS MWD 80CRI

COMPLIMENTARY PRODUCTS

Coordinated Apertures | Multiple Layers of Light

General Illumination Layer | EVO

High Center Beam Layer | Incito

EVO + Incito — Multiple Layers of Light

Core

Downlight | Adjustable | Open Wallwash | Lensed Wallwash | Cylinder | Pinhole | Bevel | Hyperbolic

Healthcare

MRI | Surgical Suite | Patient Room

Special Applications

Dynamic | Food Service | Vandal/Tamper | Clean Room | Shower | Steam Room

GOTHAM ARCHITECTURAL DOWNLIGHTING | 1400 Lester Road Conyers, GA 30012 | P 800-705-SERV (7378) | gothamlighting.com

ORDERING INFORMATION

Design Select options indicated by this color background.

Luminaire Type:

Catalog Number:

EXAMPLE: EV06 35/150 AR MWD LSS MVOLT EZ1

Series	Color Temperature	Nominal Lumen Values	Reflector & Flange Color	Trim Style	Finish
EV06	27/ 2700 K 30/ 3000 K 35/ 3500 K 40/ 4000 K 50/ 5000 K	02 250 lumens 05 500 lumens 07 750 lumens 10 1000 lumens 15 1500 lumens 20 2000 lumens 25 2500 lumens 30 3000 lumens 35 3500 lumens 40 4000 lumens 45 4500 lumens 50 5000 lumens 60 6000 lumens 80 8000 lumens 100 10000 lumens 120 12000 lumens 150 15000 lumens 175 17500 lumens	AR Clear PR Pewter WTR Wheat GR Gold WR[1] White BR[1] Black WRAMF[1] White Anti-microbial TRALTBD[1,2] RAL paint for pricing only TCPC[1] Custom paint color	(blank) Self-flanged FL Flangeless	LSS Semi-specular LD Matte-diffuse LS Specular

Distribution	Voltage	Driver[5]	
VND Very Narrow (0.5 s/mh) ND Narrow (0.7 s/mh) MD Medium (0.9 s/mh) MWD Medium Wide (1.0 s/mh) WD Wide (1.2 s/mh)	MVOLT 120 277 347[3,4]	GZ10 0-10V driver dims to 10% GZ1 0-10V driver dims to 1% EZ10 eldoLED 0-10V ECOdrive. Linear dimming to 10% min. EZ1 eldoLED 0-10V ECOdrive. Linear dimming to 1% min. EZB eldoLED 0-10V SOLOdrive. Logarithmic dimming to <1%. EDAB eldoLED SOLOdrive DALI. Logarithmic dimming to <1%.	EDXB eldoLED POWERdrive DMX with RDM (remote device management). Square Law dimming to <1%. Includes termination resistor. Refer to DMXR Manual. Minimum 1000 lumens/Maximum 15000 lumens. ECOD[6] Lutron Ecosystem digital Hi-Lume 1% soft-on, fade to black. Max: 4000LM.

Control Interface	Emergency Options	Options
NLT[7] nLight® dimming pack controls NLTER[3,7,8] nLight® dimming pack controls emergency circuit NLTAIR2[9,10] nLight® AIR enabled NLTAIRER2[3,8,10] nLight® AIR enabled emergency NLTAIREM2[3,9] nLight® AIR Dimming Pack Wireless Controls. Controls fixtures on emergency circuit with battery pack options.	EL Emergency battery pack, 10W, with integral test switch ELR Emergency battery pack, 10W, with remote test switch ELSD Emergency battery pack, 10W, with self-diagnostics, integral test switch ELRSD Emergency battery pack, 10W, with self-diagnostics, remote test switch E10WCP Emergency battery pack, 10W Constant Power, CA Title 20 compliant with integral test switch E10WCPR Emergency battery pack, 10W Constant Power, CA Title 20 compliant with remote test switch BGTD Bodine generator transfer device. Specify 120V or 277V.	SF Single fuse. Specify 120V or 277V. TRW[11] White painted flange TRBL[12] Black painted flange FRALTBD[2] Flange ring only RAL color for pricing only FCPC Flange custom paint color N80[13] nLight® Lumen Compensation GTD generator transfer device. Specify 120V or 277V 90CRI High CRI (90+) CP[14] Chicago Plenum. Specify 120V or 277V for 5000lm and above. HAO[15] HAO High Ambient Option (40°C) RRL_ RELOC®-ready luminaire connectors enable a simple and consistent factory installed option across all ABL luminaire brands. Available only with RRLA, RRLB, RRLAE, and RRLC12S. Refer to RRL spec sheet on www.acuitybrands.com for RELOC® product specifications. Above ceiling access required.

ACCESSORIES – order as separate catalog numbers (shipped separately)

SCA6	Sloped ceiling adapter. Degree of slope must be specified (5D, 10D, 15D, 20D, 25D, 30D). Ex: SCA6 10D. Refer to TECH-190.
CTA EV06	6" Aperture ceiling thickness adapter, for up to 8,000LM (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YK	4"-8" Aperture ceiling thickness adapter for use with EDXB or CP up to 8,000LM, or nTune options (extends mounting frame to accommodate ceiling thickness up to 5").
CTA4-8 YKHL	6" Aperture ceiling thickness adapter, for 10,000LM and up (extends mounting frame to accommodate ceiling thickness up to 5"). For use with CWW/DWW trims, EDXB, CP or nTune options.
ISD BC	0-10V wallbox dimmer. Refer to ISD-BC.

ORDERING NOTES

1. Not available with finishes.
2. Replace with applicable RAL number and finish when ready to order. See RAL BROCHURE for available color options. Not available with emergency battery pack options.
3. Not available with emergency battery pack options.
4. Supplied with factory installed step down transformer.
5. Refer to TECH-240 for compatible dimmers.
6. Not available with nLight®.
7. Specify voltage.
8. ER for use with generator supply power. Will require an emergency hot feed and normal hot feed.
9. Not available DALI or DMX drivers. Not available with CP or N80 options. Not recommended for metal ceiling installations.
10. When combined with the EZ1, EZ10, or EZB option, normal luminaires (non-emergency) can be used as a normal power sensing device for nearby nLight AIR devices and luminaires with EM emergency options.
11. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with WR (white reflector) or FL (flangeless) option.
12. For use with different reflector finish only (i.e. AR, PR, WTR, GR options). Not applicable with BR (black reflector) or FL (flangeless) option.
13. Fixture begins at 80% light level. Must be specified with NLT or NLTER. Only available with EZ10 and EZ1 drivers.
14. 12,000LM max with EL or nLight® options. 5,000LM max with Lutron drivers combined with EL. Not available with ELR, HAO, or EXAB, or any nLight® AIR dimming options.
15. Only available 5000LM - 15,000LM with eldoLED drivers.

SPECIFICATIONS

Optical Assembly
Optical design is a Bounding Ray™ design with 45° cutoff to source and source image. Top-down flash characteristic for superior glare control.
Unitized optics shall have mechanical attachment of the light engine to the lower reflector for complete optical alignment.

Electrical
The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
Sound Rated A+. Driver shall be >80% efficient at full load across all input voltages.
Input wires shall be 18AWG, 300V minimum, solid copper.

Controls
Luminaire shall be equipped with interface for nLight wired or wireless network with integral power supply as per specification.

Dimming
The luminaire shall be capable of continuous dimming without perceivable stroboscopic flicker as measured by flicker index (ANSI/IES RP-16-10) over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output with a smooth shut off function to step to 0%.
eldoLED LED drivers shall conform to IEEE P1789 standards. Alternatively, manufacturers must demonstrate conformance with product literature and testing which demonstrates this performance. Systems that do not meet IEEE P1789 will not be considered.
Driver is inaudible in 24dB environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Construction
Fully serviceable and upgradeable lensed LED light engine, both the driver and light engine are suitable for field maintenance and are serviceable from above or below the ceiling.
Luminaire housing shall be constructed of 16-gauge galvanized steel and have preinstalled telescopic mounting bars with maximum 32" and minimum 15" extension and 4" vertical adjustment.
Luminaires shall be suitable for installation in ceilings up to 1½" thick. (specify ceiling thickness adapter to extend frame to accommodate ceiling thickness up to 5").
Tool-less adjustments shall be possible after installation.
The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
25°C ambient temperature standard (1/2" clearance on all sides from non-combustible materials in non-IC applications, unless marked spacing noted otherwise). For use in insulated ceilings, a 3" clearance on all sides from insulation is required (unless marked spacing noted otherwise). 40°C high ambient optional.

Listings
Fixtures are CSA certified to meet US and Canadian Standards: All fixtures manufactured in strict accordance with the appropriate and current requirements of the "Standards for Safety" to UL, wet location covered ceiling. Luminaire configurations are Energy Star certified through testing in EPA–recognized laboratories, with the results reviewed by an independent, accredited certification organization. Visit www.energystar.gov for specific configurations listed. *Not all configurations are Energy Star listed.

BUY AMERICAN ACT
This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT regulations. Please refer to www.acuitybrands.com/buy-american for additional information.

Photometrics
LEDs tested to LM-80 standards. Measured by IESNA Standard LM-79-08 in an accredited lab. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.
Color appearance from luminaire to luminaire of the same type and in all configurations, shall be consistent both initially and at 60,000 hours and operate within a tolerance of <2.5 MacAdam ellipse as defined by a point at the intersection of the CCT line and the black body locus line in CIE chromaticity space.

Warranty
5-year limited warranty. This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note:
Actual performance may differ as a result of end user environment and application.
All values are design or typical values, measured under laboratory conditions at 25 °C.

A+ Capable Luminaire
This item is an A+ capable luminaire, which has been designed and tested to provided consistent color appearance and out-of-the-box control capability with simple commissioning when used with Acuity Brands controls products.
All configurations of this luminaire are calibrated and tested meet the Acuity Brands' specification for chromatic consistency - including color rendering, color fidelity and color temperature tolerance around standard CIE chromaticity coordinates.
To learn more about A+, visit www.acuitybrands.com/aplus.

Tables of Use

Marked Spacing in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
500-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

EVO - eldoLED Driver Default Dimming Curve			
Nomenclature	Min Dimming	Driver Dim Curve	Control Dim Curve
EZ10	10%	Linear	Linear/Logarithmic
EZ1	1%	Linear	Linear/Logarithmic
EXA1	1%	Linear	Linear/Logarithmic
EZB	<1%	Logarithmic	Linear
EDAB	<1%	Logarithmic	Linear
EXAB	<1%	Logarithmic	Linear
EDXB	<1%	Square	Linear

Marked Spacing in Inches 40°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
5000	24	12	5
6000			
8000	48	24	9
10000			
12000			
15000	72	36	9

Marked Spacing Chicago Plenum Open Frame in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-5000	None	None	None
6000	24	12	5
8000	36	18	11
10000			9
12000			
15000			
17500	72	36	

Marked Spacing Chicago Plenum Enclosure in Inches 25°C Ambient			
Lumen Package	Fixed Center to Center MIN	Fixture Center to Building Member MIN	Space Above Fixture
250-6000	None	None	None
8000	36	18	6
10000	48	24	3
12000			

Driver		Control Provided (note: 347V/UVOLT versions provided with 347 option selected)			
Nomenclature	Description	NLT	NLTER	NLTAIR2	NLTAIRER2
GZ10	0-10V driver dims to 10%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
GZ1	0-10V driver dims to 1%	nPP16 D EFP	nPP16 D ER EFP	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ10	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZ1	eldoLED 0-10V ECOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2
EZB	eldoLED 0-10V SOLOdrive	nPS 80 EZ	nPS 80 EZ ER	RPP20 D 24V G2	RPP20 D 24V ER G2

How to Estimate Delivered Lumens in Emergency Mode

Delivered Lumens = 1.25 x P x LPW

P = Output power of emergency driver. P = 10W for PS1055CP

LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet.

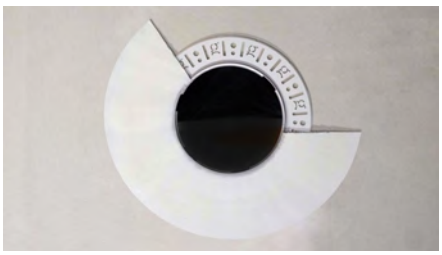
Flangeless

Flangeless Installation

Gotham's flangeless option utilizes a micro-thin polymer mud ring that minimizes the amount of drywall compound required to finish the ceiling. The end result is a virtually undetectable flangeless downlight installation.

The polymer mud ring is installed independent of the of the recessed frame, therefore floating with the ceiling. This innovation minimizes any surface cracks during reflector installation, ceiling movement and any future service to the recessed frame, wiring, electronics, etc.

Partially finished mud ring, showing cross-section detail.



An EVO downlight requires only approximately 3" of plaster to finish.

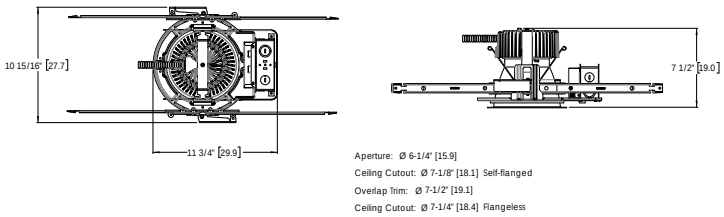
EVO with flangeless trim

DIMENSIONAL DATA

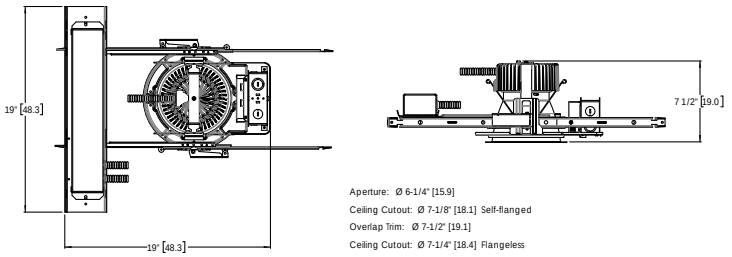
*Dimensions in inches [centimeters]

Aperture: 6 1/4" [15.9)]	Ceiling Opening: 7 1/8" [18.1] self-flanged
Overlap Trim: 7 1/2" [19.1]	7 1/4" [18.4] flangeless

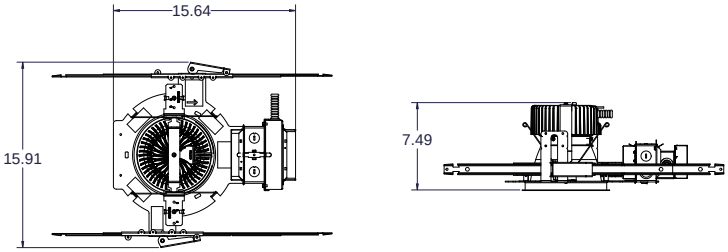
250LM-5000LM Standard



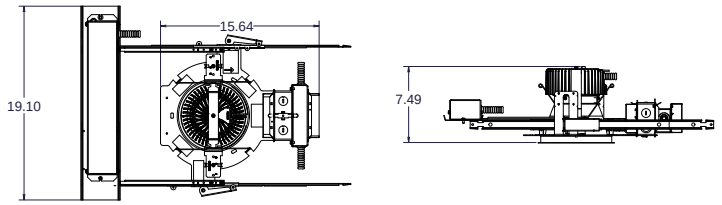
250LM-5000LM Battery Pack



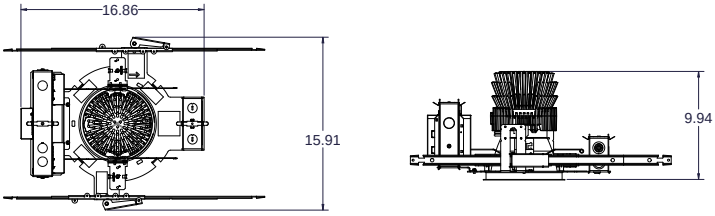
6000LM-8000LM Standard



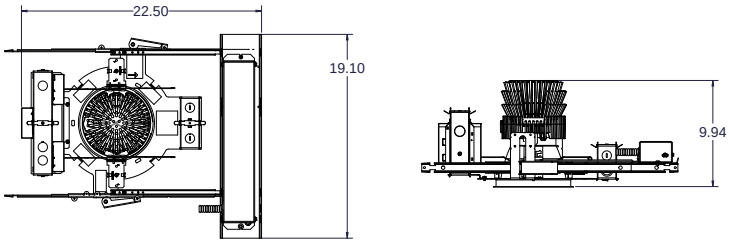
6000LM-8000LM Battery Pack



10,000LM-17,500LM Standard



10,000LM-17,500LM Battery Pack

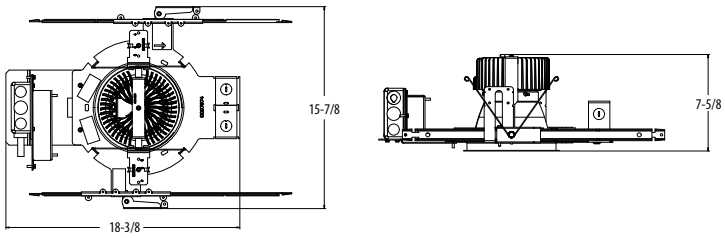


gotham®

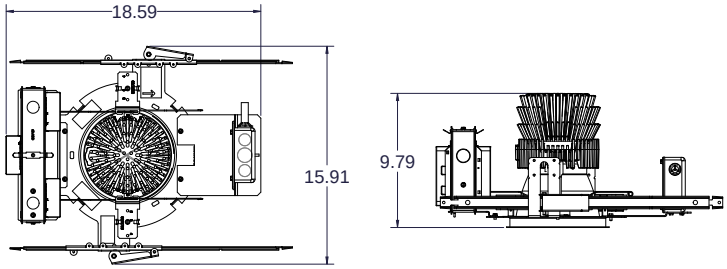
DIMENSIONAL DATA

*Dimensions in inches [centimeters]

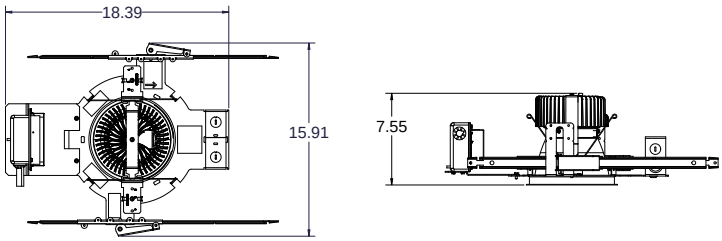
250LM-4500LM CP



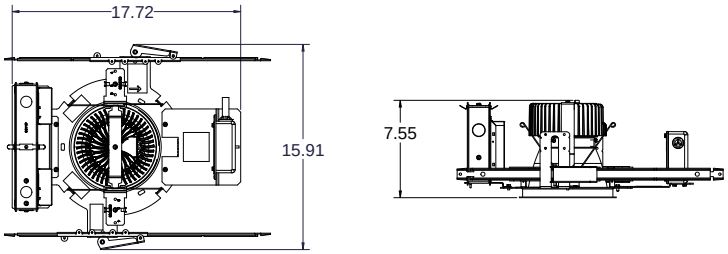
10000LM - 17,500LM Lumen Open Frame CP



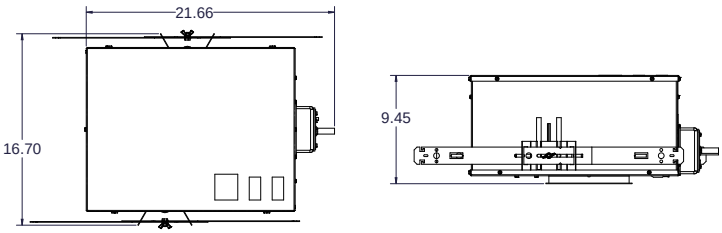
5000LM ECO/SOLO Drive Open Frame CP



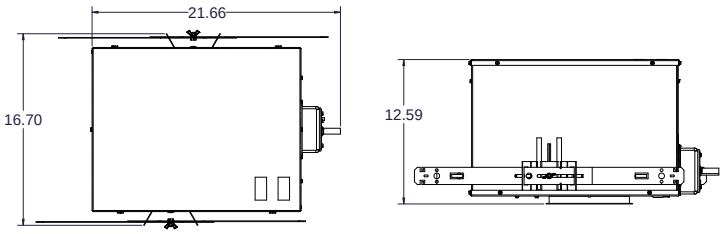
5000LM (Lutron & POWER Drive Only), 6000LM & 8000LM Open Frame CP



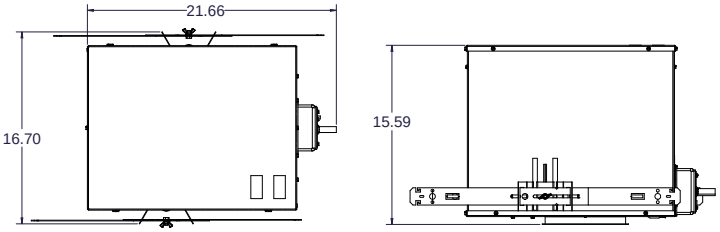
250LM - 6000LM CP Enclosed with Battery Pack and/or nLight™ Only



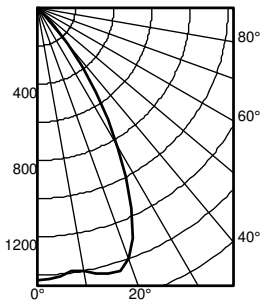
8,000LM CP Enclosed with Battery Pack and/or nLight™ Only



10,000LM-12,000LM CP Enclosed with Battery Pack and/or nLight™ Only



EV06 35/15 AR MWD LS INPUT WATTS: 14.7, DELIVERED LUMENS: 1471LM, LPW= 100, 1.03 S/MH, TEST NO. LTL27783P1505



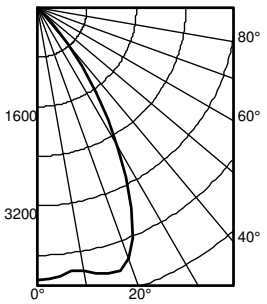
	Ave	Lumens
0	1431	
5	1410	134
15	1442	405
25	1161	523
35	540	332
45	78	72
55	3	4
65	1	1
75	0	1
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	1061.4	72.2
0° - 40°	1393.5	94.7
0° - 60°	1469.5	99.9
0° - 90°	1470.9	100.0
90° - 180°	0.0	0.0
0° - 180°	1470.9	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	47.3	5.7	23.7	8.9	4.7
10.0	25.4	7.7	12.7	12.1	2.5
12.0	15.9	9.8	7.9	15.3	1.6
14.0	10.8	11.8	5.4	18.6	1.1
16.0	7.9	13.9	3.9	21.8	0.8

EV06 35/45 AR MWD LS INPUT WATTS: 47.3, DELIVERED LUMENS: 4532.7LM, LPW= 95.8, 1.03 S/MH, TEST NO. LTL27783P1649



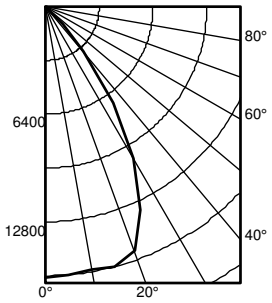
	Ave	Lumens
0	4411	
5	4346	413
15	4443	1247
25	3578	1610
35	1665	1024
45	242	222
55	8	12
65	2	3
75	1	2
85	0	0
90	0	

Zone	Lumens	% Lamp
0° - 30°	3270.7	72.2
0° - 40°	4294.2	94.7
0° - 60°	4528.3	99.9
0° - 90°	4532.7	100.0
90° - 180°	0.0	0.0
0° - 180°	4532.7	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	109	106	104	105	103	101
2	103	99	96	101	98	95	98	95	93
3	96	91	87	95	90	87	92	88	85
4	90	84	80	89	84	80	87	82	79
5	84	78	74	83	78	74	81	77	73
6	79	73	69	78	73	69	77	72	68
7	74	68	64	74	68	64	72	67	63
8	70	64	60	69	64	60	68	63	59
9	66	60	56	65	60	56	64	59	56
10	62	56	52	62	56	52	61	56	52

		50% beam - 54.4°		10% beam - 77.9°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	145.8	5.7	72.9	8.9	14.6
10.0	78.4	7.7	39.2	12.1	7.8
12.0	48.9	9.8	24.4	15.3	4.9
14.0	33.4	11.8	16.7	18.6	3.3
16.0	24.2	13.9	12.1	21.8	2.4

EV06 35/175 AR MWD LS INPUT WATTS: 175.3, DELIVERED LUMENS: 17801LM, LPW=101.5, 1.06 S/MH, TEST NO. ISF 34035P268



	Ave	Lumens
0	16146	
5	15998	1521
15	16006	4479
25	13362	6001
35	7018	4289
45	1470	1299
55	100	156
65	37	38
75	13	14
85	2	2
90	0	

Zone	Lumens	% Lamp
0° - 30°	12002.3	67.4
0° - 40°	16291.0	91.5
0° - 60°	17746.3	99.7
0° - 90°	17801.0	100.0
90° - 120°	0.0	0.0
90° - 130°	0.0	0.0
90° - 150°	0.0	0.0
90° - 180°	0.0	0.0
0° - 180°	17801.0	*100.0
*Efficiency		

pf	80%			20%			50%		
pc				70%					
pw	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	119	119	119	116	116	116	111	111	111
1	111	108	106	108	106	104	104	103	101
2	103	98	95	101	97	94	98	95	92
3	95	90	86	94	89	86	91	87	84
4	89	83	79	88	82	78	85	81	77
5	83	77	72	82	76	72	80	75	71
6	77	71	67	77	71	67	75	70	66
7	73	66	62	72	66	62	71	65	61
8	68	62	58	67	62	57	66	61	57
9	64	58	54	63	58	54	62	57	53
10	60	54	50	60	54	50	59	54	50

		50% beam - 55.7°		10% beam - 79.8°	
Mounting Height	Inital FC Center Beam	Diameter	FC	Diameter	FC
8.0	533.7	5.8	266.9	9.2	53.4
10.0	287.0	7.9	143.5	12.5	28.7
12.0	178.9	10.0	89.4	15.9	17.9
14.0	122.1	12.1	61.0	19.2	12.2
16.0	88.6	14.3	44.3	22.6	8.9

Lumen Output Multiplier		
CRI	CCT	Multplier
80	2700K	0.96
	300K	1.00
	3500K	1.00
	4000K	1.01
	5000K	1.07
90	2700K	0.80
	300K	0.83
	3500K	0.85
	4000K	0.87
	5000K	0.91

Reflector Finish Multiplier	
Reflector Finish	Multiplier
LS - Specular	1
LSS - Semi Specular	0.956
WR - White	0.87
LD - Matte Diffuse	0.85
BR - Black	0.73

Distributions		
Nomenclature	Beam Angle	Field Angle
VND	30	64
ND	44	69
MD	54	82
MWD	67	89
WD	71	92

NLIGHT AIR

NLIGHT

nLight® AIR is the ideal solution for retrofit or new construction spaces where adding communication wiring is cost prohibitive. The integrated nLight AIR rPP20 Power Pack is part of each EVO Luminaire ordered with the NLTAIR option. These individually addressable controls offer the ultimate in flexibility during initial setup and for space repurposing.

nLight® AIR Control Accessories

Order as separate catalog number. Visit nLight AIR.

Wall Switches	Model Number
On/Off single pole	rPODB (color) G2
On/Off two pole	rPODB 2P (color) G2
On/Off & raise/lower single pole	rPODB DX (color) G2
On/Off & raise/lower two pole	rPODB 2P DX (color) G2

nLight® AIR Control Accessories *(cont.)*

Occupancy Sensors (PIR/dual tech)	Model Number
Small motion 360°, ceiling	rCMS 9 / rCMS PDT 9
Large motion 360°, ceiling	rCMS 10 / rCMS PDT 10

UL924 Sequence of Operation

The below information applies to all nLight AIR devices with an EM option.

- EM devices will remain at their high-end trim and ignore wireless lighting control commands, unless a normal-power-sensed (NPS) broadcast is received at least every 8 seconds.
- Using the CL**AIR**ITY+ mobile app, EM devices must be associated with a group that includes a normal power sensing device to receive NPS broadcasts.
- Only non-emergency rPP20, rLSXR, rSBOR, rSDGR, and nLight AIR luminaires with version 3.4 or later firmware can provide normal power sensing for EM devices. See specification sheets for control devices and luminaires for more information on options that support normal power sensing.

nLight® The nLight® solution is a digital networked lighting control system that provides both energy savings and increased user configurability by cost effectively integrating time-based, daylight-based, sensor-based and manual lighting control schemes.

nLight® Wired Control Accessories

Order as separate catalog number. Visit nLight.

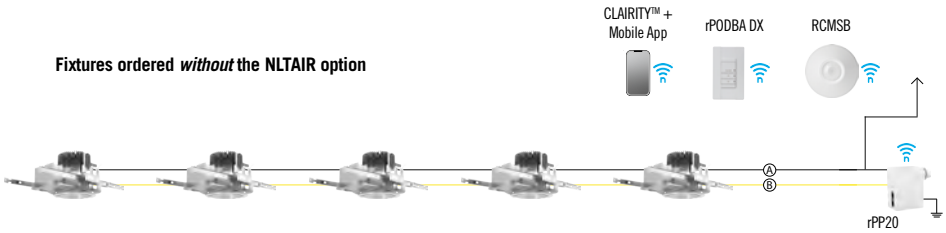
Wall Switches	Model Number
On/Off single pole	nPODM (color)
On/Off two pole	nPODM 2P (color)
On/Off & raise/lower single pole	nPOD DX (color)
On/Off & raise/lower two pole	nPODM 2P DX (color)
Graphic touchscreen	nPOD GFX (color)
Photocell Controls	
Dimming	nCM ADCX

nLight® Wired Control Accessories *(cont.)*

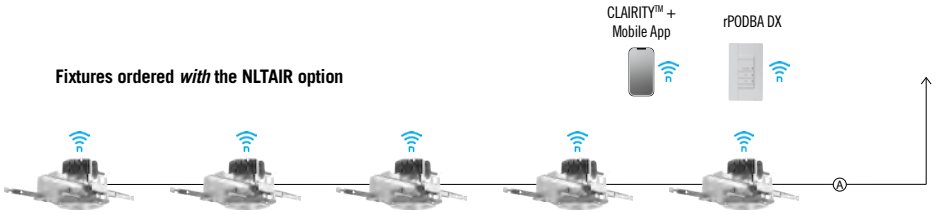
Occupancy Sensors (PIR/dual tech)	Model Number
Small motion 360°, ceiling	nCM 9 / nCM PDT 9
Large motion 360°, ceiling	nCM 10 / nCM PDT 10
Wide View	nWV 16 / nWV PDT 16
Wall switch with raise/lower	nWSX LV DX / nWSX PDT LV DX
Cat-5 Cables (plenum rated)	
10', CAT5	CAT5 10FT J1
15', CAT5	CAT5 15FT J1

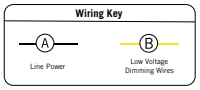
Possibilites for nLight® AIR

Fixtures ordered *without* the NLTAIR option



Fixtures ordered *with* the NLTAIR option





Possibilites for nLight® wired

Fixtures ordered *without* the NLT option

Fixtures ordered *with* the NLT option