

PART 1 GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Construction Meetings: Meet on site at the location of required penetrations and repairs in accordance with Section 01 31 19 – Project Meetings before ordering materials to review existing conditions affecting work of this Section, determine membrane and flashing types, patching and repair procedures and protection of interior components from water infiltration and weather, attended by the following:
 - .1 Departmental Representative.
 - .2 Contractor.
 - .3 Installer.
- .2 Sequencing: Install roofing repair materials to coincide with removal of existing roofing system; remove existing roofing in size and quantity that can be completely repaired in the same day including installation of base flashings.
- .3 Scheduling: Schedule roofing repairs when installation of rooftop mechanical equipment and other construction requiring roof penetrations is substantially complete.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for membranes and roofing system components and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

1.3 SITE CONDITIONS

- .1 Existing Conditions: Protect openings using tarps, dams and diversion materials to prevent water or snow from entering interior of building.
- .2 Ambient Conditions: Install materials during dry weather and temperatures are within manufacturer's written minimum and maximum application range.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Carpentry Materials:
 - .1 Lumber: kiln-dried, Light Framing Grade in accordance with CAN/CSA O141 and NLGA Rules; sizes as indicated on drawings and meeting the following requirements:
 - .1 Maximum Moisture Content at Time of Installation; 8%.
 - .2 Consisting of Species Group D (SPF): Construction Grade or better
 - .2 Sheathing: Exterior Grade Douglas Fir Plywood; thickness as indicated on drawings or as otherwise required to match adjacent existing construction to remain.

- .2 Auxiliary Levelling Surface: Treated gypsum core, moisture resistant exterior grade fibreglass mat faced roof sheathing material, and as follows:
 - .1 Applicable Standard: ASTM C1396 for manufacturing.
 - .2 Thickness: to match existing.
 - .3 Long Edges: Square.
- .3 Screw Fasteners: #14 Phillips pre-assembled mechanical fasteners fabricated from case hardened carbon steel with a rust preventive coating; 50 mm diameter, barbed stress plates that meet requirements of CSA B35.3 [and FM 4470 approval standard] and as follows:
 - .1 Fasteners will not be permitted in areas where acoustic steel deck is exposed in final interior construction; use insulation adhesive to prevent damage to finished surfaces.
 - .2 Space screws and stress plates one per 0.25 m², penetrating a minimum of 38 mm into top of flutes for corrosion and wind lift factors.
- .4 Roofing Nails: Spiral nails having 25 mm Ø steel round top cap 25 mm Ø and 3 mm Ø shank in accordance with membrane manufacturer's recommendations, length to penetrate solid wood supports by a minimum of 38 mm and plywood substrates by a minimum of 19 mm.
- .5 Primer: Primer comprised of elastomeric bitumen and solvents, and adhesive enhancing resins as recommended by membrane roofing manufacturer to suit substrates and installation conditions.
- .6 Membrane Vapour Retarder: Premanufactured self-adhering air/vapour barrier membrane composed of bitumen modified with thermoplastic polymers and high-density polyethylene film.
- .7 Insulation:
 - .1 Primary Flat Insulation: Rigid board roof insulation to match existing materials; thickness to match existing.
 - .2 Sloped Insulation: Moulded expanded polystyrene (MEPS) rigid board roof insulation consisting of largest panels practical, having square edges, sloped to a minimum 2% perpendicular from edge of new curbs; size as required to redirect water around new roof openings or equipment curbs.
- .8 Roofing Membrane: Compatible with existing membrane system.
- .9 Flashing: as specified in Section 07 62 00 – Sheet Metal Flashing and Trim

2.2 ACCESSORIES

- .1 Provide materials required for a complete installation including; but not limited to, accessories listed in this Section, and as required to provide a weather tight, leak proof repair.
- .2 Waterproofing Mastic: Mastic comprised of synthetic rubbers, plasticized with bitumen and solvents, and aluminum pigments to provide greater resistance to ultraviolet light degradation.
- .3 Premanufactured roof anchor guy wire roof support assembly designed and capable of resisting loads.
 - .1 Provide in qualities as indicated; but not less than 4 complete assemblies per element supported by guy wires.

- .2 Guy wire supports consisting of urethane insulated, stainless steel HSS pipe support, mounting plate, stainless steel guy wire ring, and bituminous painted flashing deck flange for modified-bitumen roof membrane.
- .3 HSS Support Pipe: stainless steel; 356 mm height; 60 mm outside diameter; 6 mm thick stainless steel.
- .4 Eye Bolt: stainless steel; 25 mm inside diameter; 57 mm outside diameter; 12 mm thread diameter.
- .5 Base Plate:
 - .1 Bolt Securement: 6 x 305 x 305 mm.
 - .2 Weld Securement: 9 x 102 x 102 mm.
- .6 Fastening Bolt: 10 mm diameter.
- .7 Tensile Force resistance at 90 Degrees: minimum 2.5 kN.
- .8 Provide stainless steel parts, plates and anchors as required for through-bolting to structural deck.
- .9 Provide guy wires as required for a complete installation.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that substrates and conditions are in accordance with manufacturer's written recommendations and installation guidelines before starting work of this Section.
- .2 Start of roofing work will be interpreted as meaning roofing conditions are in accordance with manufacturer's requirements.

3.2 PREPARATION

- .1 Building Protection: Provide tarps and hoarding as required to protect existing building finishes and assemblies from work of this Section; clean any spills and repair any damaged materials resulting from work of this Section.
- .2 Penetration Protection: Provide suitable protection during preparation and installation of new roofing penetrations to prevent water or weather from entering interior spaces:
 - .1 Lap protective coverings over existing roofing to prevent water ingress
 - .2 Secure protective coverings against wind blow-off
 - .3 Leave protective covering in place for duration of the work

3.3 ROOFING REPAIRS

- .1 General: purpose of Work of this Section is to accommodate various installations and alterations as required and as shown on Drawings. Contractor shall maintain continuity and performance of waterproofing and shall take all necessary steps to ensure that the existing roofing to remain is not damaged or performance compromised.
- .2 Remove existing roofing and flashing systems to accommodate new roofing penetrations, accessories and flashing systems:
 - .1 Remove existing systems to expose substrates
 - .2 Clean and prepare surfaces ready for new materials

- .3 Install guy wire support assemblies as required, structurally supported by structural roof deck and integrated with roofing system to ensure continuity of waterproofing performance.
- .4 Provide new materials as required to form a complete and continuous roof assembly:
 - .1 Include additional sloped insulation as required to form new crickets around new construction to prevent ponding around new curbed roof openings.
 - .2 Complete work of this Section in accordance with original design intent of existing roofing assembly
- .5 Restore existing roofing to original condition, remove construction debris and leave area of work in a condition acceptable to the Departmental Representative; remove all traces of splashed or spilled materials.
- .6 Restore existing roofing flashings to original condition, matching colour and profile where repairs are observable from grade or from other parts of the building.

3.4 SITE QUALITY CONTROL

- .1 The roofing waterproofing membrane manufacturer shall review the Work and issue a report in writing addressed to the Departmental Representative and Contractor.
 - .1 If the manufacturer finds that the Work fails to comply with its published technical datasheets and specifications, then Contractor shall re-execute the Work as required to rectify the deficiencies.

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.2 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM)

- .1 ASTM C167-15, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
- .2 ASTM C553-13, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .3 ASTM C665-17, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .4 ASTM C1320-10(2016), Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .5 ASTM F1667-17, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.2 CSA Group (CSA)

- .1 CAN/CSA B149.1-15, Natural Gas and Propane Installation Code.
- .2 CAN/CSA B149.2-15, Propane Storage and Handling Code.

.3 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC S102-10, Standard Method of Test For Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .3 CAN/ULC S604-16, Standard for Factory Built Type A Chimneys.
- .4 CAN/ULC S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .5 CAN/ULC 702.2-15, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Division 01: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications, and technical datasheets.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's printed installation instructions.

1.3 QUALITY ASSURANCE

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver insulation and accessories in original unopened packaging or cartons bearing manufacturer's seals and labels.
- .2 Store materials under cover on raised platforms, away from moisture. Keep dry at all times.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

- .1 Fibrous Rock Wool Acoustical Insulation For Fire and Smoke Rated Assemblies: Un-faced preformed mineral slag fibrous insulation meeting the requirements of CAN/ULC S702.1; having maximum flame spread and smoke developed of 20/20 in accordance with CAN/ULC S102 and being non-combustible in accordance with CAN/ULC S114 and as follows:
 - .1 Type: 1.
 - .2 Width: to friction fit in stud spaces.
 - .3 Thickness: minimum 89 mm to fill a minimum of 90% of the cavity thickness.
 - .4 Nominal density: 40 kg/m³.
- .2 Fibrous Rock Wool Insulation: Un-faced, preformed mineral slag fibrous insulation in accordance with CAN/ULC S702.1 and as follows:
 - .1 Type: 1
 - .2 Thermal Resistance: nominal RSI of 0.67/25 mm.
 - .3 Combustion Characteristics: non-combustible in accordance with CAN/ULC S114.
 - .4 Flamespread: less than 5 in accordance with CAN/ULC S102.
 - .5 Density: 32 kg/m³.
 - .6 Thickness: minimum 89 mm to fill a minimum of 90% of the cavity thickness.

2.2 ACCESSORIES

- .1 Insulation clips for mineral fiber board insulation:
 - .1 99% thermally efficient, purpose made, gas-fired direct-fasten type anchor, comprised of high density polyethylene (HDPE) shaft and integrated washer/cap with steel pin tip. Shaft point designed to pierce rigid and semi-rigid insulations.
 - .2 Anchor washer to have 60mm holding diameter. Anchor shaft length to match insulation thickness.
 - .3 Anchor tip to have 50mm spiral steel stud pins of zinc plated heat-treated carbon steel to penetrate through the gypsum sheathing and securely fasten anchor into steel studs.
 - .4 Fasteners to be colour coded to substrate applications.
 - .1 White Fasteners: Concrete and concrete block.
 - .2 Black Fasteners: Steel stud.
 - .5 Self-adhesive or metal stick pins are not acceptable.
- .2 Nails: SAE Type 304 or 316 stainless steel, length to suit insulation plus 25 mm, to ASTM F1667.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's printed installation instructions, data sheets, and standard details.

3.2 PREPARATION

- .1 Verify all in-wall construction is complete before beginning installation.
- .2 Install insulation after building substrate materials are dry.
- .3 Ensure substrate materials are properly installed and complete before beginning installation.

3.3 INSTALLATION

- .1 Meet or exceed the requirements of CAN/ULC S702.2.
- .2 Use only insulation boards that are dry and unsoiled.
- .3 Install batts between framing members, structural components and other items snug and tight.
- .4 Cut and trim batts neatly to fit spaces. Use batts free from ripped or damaged back and edges.
- .5 Do not compress insulation to fit into spaces.
- .6 Install batt insulation where indicated with continuous vapour retarder on the warm side of the insulation in accordance with ASTM C1320.
- .7 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .8 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC S604 Type A chimneys and CSA B149.1 and CSA B149.2 Type B and L vents.
- .9 Fill stud space of exterior framed walls with insulation full depth of studs.
- .10 Hold insulation in position with clips, wires or as recommended by manufacturer when insulation is installed in horizontal locations.
- .11 Do not enclose insulation until it has been reviewed by Departmental Representative.
- .12 Fasteners:
 - .1 In accordance with insulation manufacturer's recommended spacing and as required to suit project design requirements.
 - .2 Minimum spacing of fasteners to be not less than 5 equally spaced insulation fasteners per 610mm x 1220mm insulation board area: Position one fastener 75mm from each corner of each board and one in the center of each board (dice 5 pattern).

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01: Construction/Demolition Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
 - .4 CAN/ULC S705.1-15, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material - Specification.
 - .5 CAN/ULC S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Division 01: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Quality assurance submittals: submit following in accordance with Division 01: Quality Control.
 - .1 Test reports: submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Submit test reports in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers: Use companies that are members and licensed CUFCA having trained and certified installers in accordance with CAN/ULC S705.2 and CUFCA requirements.
 - .2 Manufacturer: Obtain air and vapour seal materials from a single manufacturer regularly engaged in manufacturing the products specified in this Section.
- .2 Cooperate and coordinate with the requirements of other units of work specified in other sections.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Division 01: Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.5 SITE CONDITIONS

- .1 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .2 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
- .3 Ensure temperature is maintained throughout the curing period.

1.6 WARRANTY

- .1 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 3.13 of General Conditions "C" is extended to 24 months.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Foamed-in-place insulation: Class 1, single-component polyurethane foam conforming to CAN/ULC S710.1, with flame spread rating of 20 and smoke developed 25. Must be ozone friendly and containing no fluorocarbons. Density of 20.8 to 28.8 kg/cu.m. and minimum RSI-value of 0.79 per 25 mm thickness. VOC limit is 250 g/L. (Classified as Special Purpose Contact Adhesive).
- .2 Thermal Barrier: spray-applied fire-retardant overcoat meeting applicable requirements of the NBC 2015 for thermal barrier of foamed plastic.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Clean spaces that are to receive insulation, of dirt, dust, grease, loose material or other foreign matter that may inhibit adhesion.
- .2 Provide sufficient ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24-hour period after application.
- .3 Protect adjacent surfaces from overspray and dusting.
- .4 Prior to application, slightly moisten surfaces to which foam in place insulation is being applied, to accelerate curing.
- .5 Temporarily brace frames as may be required to prevent possible bowing of frames due to over expansion of the foam-in-place insulation.

3.2 INSTALLATION: GENERAL

- .1 Meet or exceed the requirements of CAN/ULC S705.2.
- .2 Foam-in-place insulation to exterior window and door frames.
- .3 Foam-in-place insulation around protrusions through and penetrations of the exterior building envelope, and juncture of different cladding materials.

3.3 INSTALLATION: HOLLOW STEEL DOOR FRAMES

- .1 Fill exterior hollow steel door frames 75% full with foam-in-place insulation prior to installation of frames. Fill the remainder of the frame after installation, through the gap between the frame and the wall construction.

3.4 INSTALLATION: AIR SEAL AROUND EXTERIOR FRAMING

- .1 Install foam-in-place insulation around all exterior window and door frames to maintain continuity of the thermal barrier after air barrier has been installed and sealed to frames.
- .2 Ensure that foam completely fills spaces without voids, and that foam is continuous at corners.

3.5 INSTALLATION: AROUND PENETRATIONS THROUGH AIR SEAL

- .1 Install foam-in-place insulation around penetrations through the exterior building envelope to achieve and maintain continuity of air/vapour seal.

3.1 INSTALLATION: MISCELLANEOUS AIR SEALING

- .1 Install foamed-in-Place insulation around mechanical exhaust boxes, perimeter of curtain wall framing, and fill voids at perimeter of doorframes.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

3.4 SCHEDULE

- .1 Install at exterior walls and roof:
 - .1 Install at hollow metal doorframe cavities, penetrations through air seal, and at cavities of perimeter framing as required to maintain continuity of air barrier performance.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM D1970/D1970M-17a, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .2 ASTM E283-04 (2012), Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .3 ASTM E779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
 - .4 ASTM E2112 - 07(2016), Standard Practice for Installation of Exterior Windows, Doors and Skylights.
 - .5 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.

1.2 DEFINITIONS

- .1 Air Barrier: Air Barriers are systems of materials designed and constructed to control airflow between conditioned and unconditioned spaces.
- .2 Air / Vapour Barrier: Systems of materials exhibiting both low air leakage (airtight) and low Vapour Permeance (vapour impermeable) levels and functioning as a combined Air Barrier and Vapour Retarder.
- .3 Enclosure: The enclosure is the boundary or barrier separating the interior of a building from the outside environment; it separates conditioned from unconditioned space.
- .4 Vapour Permeance: The moisture transmission rate of a material is referred to as its 'permeability'. This number is not dependent on the material's thickness. Its 'permeance', however, is dependent on thickness much like the R-value in heat transmission. Dividing the 'permeability' of a material by its thickness gives the material's 'permeance'.
- .5 Vapour Permeance Classes:
 - .1 Vapour impermeable: $5.72 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$ or less.
 - .2 Vapour semi-impermeable: $57.21 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$ or less, and greater than $5.72 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$.
 - .3 Vapour semi-permeable: $572.14 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$ or less, and greater than $57.21 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$.
 - .4 Vapour permeable: Greater than $572.14 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$.
- .6 Vapour Retarder (vapour diffusion retarder): The element that is designed and installed in an assembly to retard the movement of water by vapour diffusion.

1.3 DESIGN CRITERIA

- .1 Minimum Air Barrier Performance:
 - .1 The building envelope shall be constructed with a continuous Air Barrier system to control air leakage into, or out of, the conditioned space. An Air Barrier system shall also be provided for interior partitions between the conditioned space and a space designed to maintain temperature or humidity levels that differ from those in the conditioned space by more than 50% of the difference between the conditioned space and the design ambient conditions.
 - .2 The installed Air Barrier system shall meet the following minimum requirements:
 - .1 Airtight: The installed Air Barrier system shall not exceed the following maximum air leakage rates:
 - .1 Air Barrier materials in accordance with ASTM E2178: 0.020 L/(m²·s) @ 75Pa ΔP (0.072 m³/m²·h).
 - .2 Assemblies comprising the Enclosure in accordance with ASTM E283: 0.200 L/(m²·os) @ 75Pa ΔP (0.720 m³/m²·h).
 - .3 Enclosures in accordance with ASTM E779: 2.000 L/(m²·s) @ 75 Pa ΔP (7.200 m³/m²·h).
 - .2 Continuity: The Air Barrier system shall be continuous across construction, control and expansion joints, across junctions between different building assemblies, and around penetrations through the building assembly.
 - .1 The Air Barrier system shall be continuous at the following connections:
 - .1 Roof / wall connections, wall / foundation connections, wall / window connections, wall / door connections, soffit connections, corner details, and connections between different exterior wall systems.
 - .2 Connect the roof waterproofing membrane system to the Air Barrier at the walls.
 - .3 Structural integrity: The Air Barrier system shall resist peak wind loads, stack pressure effects, or sustained pressurization loads without exhibiting signs of detachment, rupturing, or creep load failure.
 - .1 The Air Barrier shall be able to resist a minimum air pressure difference of ± 2.0 kPa without tearing, rupturing or breaking away from its fastening.
 - .4 Durability: The Air Barrier system must be able to perform its intended function, be compatible with adjoining materials, and resistant to the mechanisms of deterioration that can be reasonably expected given the nature, function and exposure of the materials, over the life of the building envelope.
 - .5 Compatibility: The physical characteristics, chemical properties, and application methods of the building materials that comprise the Air Barrier system shall be compatible.

- .2 Minimum Vapour Retarder Performance:
 - .1 The Vapour Retarder shall retard the passage of moisture as it diffuses through the assembly of materials of the Enclosure.
 - .2 At above-grade walls, provide a combined Air / Vapour Barrier system at the warm side of the insulation. Both insulation and Air / Vapour Barrier shall be installed in full contact with each other at the exterior of the structure.
 - .3 Combinations of vapour semi-impermeable or vapour impermeable membranes, films, sheets or wall coverings shall not be installed on both sides (interior and exterior facings) of an Enclosure, in order to facilitate drying in at least one direction.
 - .4 Vinyl wall coverings, polyethylene vapour barriers, foil-faced batt insulation or reflective radiant barrier foil insulation shall not be installed on the interior face of Enclosure walls.
 - .5 The performance of the Air / Vapour Barrier shall have a Permeance of $5.72 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$ or less, before and after aging.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Select products to be compatible with adjoining membranes previously installed under related Sections
 - .2 Select products from a single manufacturer, or products that are compatible from different manufacturers.
 - .3 Coordination between all installers of each component of vapour and air retarder system is essential to ensure continuity of system and that junctions between the various components are effectively sealed.
 - .4 Verify with manufacturers and all tradesmen involved with installation procedures of building products incorporated into air barrier elements including, but not limited to, various membranes, coating and sealants as well as continuity with roofing membrane.
- .2 Pre-installation Meeting:
 - .1 Convene one week before commencing Work of this Section.
 - .2 Arrange for manufacturer's factory-trained agent to be on site at beginning of installation to provide training and supervision of personnel who will install membrane. Agent shall also provide frequent inspection visits thereafter to assure quality and competence of membrane installations.
- .3 Sequencing:
 - .1 Sequence work in accordance with Construction Progress Schedule.
 - .2 Sequence work to permit installation of materials in conjunction with related materials and seals.
 - .3 Overlap (shingle) materials to direct water down and away from the structure.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Division 01: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheets, and include product characteristics, performance criteria, physical size, finish, and limitations.

- .2 Submit statement from manufacturer(s), indicating products supplied under this Section are compatible with one another and with products previously installed under the work of related Sections.
- .2 Submit samples in accordance with Division 01: Submittal Procedures:
 - .1 Provide duplicate 200 mm x 200 mm samples of membrane adhered to all project substrates, including adjoining membranes specified in other Sections.
- .3 Quality Assurance Submittals: submit following in accordance with Division 01: Quality Control.
 - .1 Existing Substrate Condition: report deviations, as described in PART 3 - EXAMINATION in writing to Departmental Representative.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.6 QUALITY ASSURANCE

- .1 Applicator: company specializing in performing work of this section with experience with installation of air/vapour barrier systems.
 - .1 Completed installation must be approved by the material manufacturer.
- .2 Applicator: company:
 - .1 Currently licensed by National Air Barrier Association certifying organization.
 - .2 Must maintain their license throughout the duration of the project.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 01: Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.8 AMBIENT CONDITIONS

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Division 01: Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.

1.9 WARRANTY

- .1 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 3.13 of General Conditions "C" is extended to 24 months.

PART 2 PRODUCTS

2.1 AIR BARRIER - EXTERIOR APPLICATION

- .1 Primer: SBS synthetic rubbers, adhesive resins and solvents used to prime porous substrates to enhance adhesion of self-adhesive membranes at temperatures above -10°C; as recommended and supplied by membrane manufacturer.
- .2 Winter Grade: Air/Vapour Barrier Membrane: to ASTM D1970; SBS modified bitumen, self-adhering sheet membrane with polyethylene facer, for application temperatures between -10°C and 10°C and as follows:
 - .1 Thickness: 1 mm to 1.5 mm
 - .2 Tensile strength: 11.3 kN/m to 15.4 kN/m to ASTM D5147.
 - .3 Ultimate elongation: 25% to 40%
 - .4 Flexibility at cold temperature: minimum -30 C
 - .5 Air permeability: <0.0003 L/sec. m²
 - .6 Water vapour permeability: <0.05 perm
 - .7 Static puncture: minimum 178 N
 - .8 Tear resistance: 375 to 400 N
 - .9 Lap adhesion: 800 N/m.
- .3 Summer Grade: Air/Vapour Barrier Membrane: to ASTM D1970; SBS modified bitumen, self adhering sheet membrane with polyethylene facer, for application temperature above 5°, and as follows:
 - .1 Thickness: 1 mm to 1.5 mm
 - .2 Tensile strength: minimum 6 kN/m
 - .3 Ultimate elongation: 25% to 40%
 - .4 Flexibility at cold temperature: minimum -17 C
 - .5 Air permeability: <0.0003 L/sec. m²
 - .6 Water vapour permeability: <0.05 perm
 - .7 Static puncture: 400 N
 - .8 Tear resistance: 375 to 400 N
 - .9 Lap adhesion: minimum 1750 N/m

2.2 MASTICS AND ADHESIVES

- .1 Waterproofing Mastic: compatible with membranes, solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers, used to seal around penetrations and extrusions.
 - .1 Compatibility: With air/vapour barrier membrane, substrate and insulation.
 - .2 Specific gravity at 20 C: 1.0 kg/l to 1.12 kg/l
 - .3 Application Temperature: -10 C to +35 C
 - .4 Solids by Weight: 70% to 83 %

2.3 VAPOUR RETARDER - INTERIOR APPLICATION

- .1 Vapour Retarder: polyimide film vapour retarder for use with unfaced, vapor-permeable glass fiber and mineral wool insulation in wall and ceiling cavities, meeting or exceeding the following minimum requirements:
 - .1 Water Vapour Permeance, to ASTM E86:
 - .1 Dry cup method: 1.0 perms (57 ng/Pa•s•m²).
 - .2 Wet cup method: 10.0 perms (1144 ng/Pa•s•m²).
 - .2 Class A for flame spread and smoke developed.

2.4 ACCESSORIES

- .1 Thinners and cleaners: as recommended by sheet material manufacturer.
- .2 Attachments: galvanized steel bars and anchors.
- .3 Adhesive Primers and Adhesives: all primers and adhesives shall be manufactured by the air barrier system manufacturer and compatible with systems installed:
 - .1 Adhesive Primer for primary self-adhering water resistive air barrier membrane, self-adhering transition membrane and SBS modified bitumen membranes at all temperatures; synthetic rubber based adhesive, quick setting.
 - .2 Adhesive with low-VOC content for self-adhering membranes at all temperatures; synthetic rubber based adhesive, quick setting.
 - .3 Primer for self-adhering membranes at temperatures above -4°C; polymer emulsion based adhesive, quick setting.
- .4 Transition Membranes: Manufacturer's recommended reinforced self-adhesive, compatible with adjacent air and vapour membranes, self-adhering sheet waterproofing and wall materials specified in this Section.
- .5 Through-Wall Membranes: Manufacturer's recommended reinforced self-adhesive, compatible with air and vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.
- .6 Masonry Flashing Membrane: self adhesive membrane as recommended by membrane manufacturer and composed of thermoplastic polymer modified bitumen and a high-density polyethylene film with a silicone release film on the lower surface.
- .7 Self-Adhered membranes for window sill pan flashings: manufactured by membrane manufacturer; SBS-modified bitumen, self-adhering sheet membrane integrally laminated to a polyethylene film.
- .8 Self-adhering membrane for openings, inside and outside corners, and other transitions: pre-cut flexible flashing manufactured by membrane manufacturer; self-adhering reinforced modified polyolefin tri-laminate sheet air barrier membrane for wall construction, specifically designed to be water resistant and vapour permeable.
- .9 Penetration and Termination Sealants: all penetration and termination sealants shall be manufactured by the air barrier system manufacturer and compatible with systems installed.
 - .1 Termination Sealant shall be moisture cure, medium modulus polymer modified sealing compound.
 - .2 Termination sealant shall be a non-sag, non-staining, one component, high-performance thermoplastic sealant.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturers' printed installation instructions, typical details, and data sheets.

3.2 COORDINATION

- .1 Coordinate with other trades as required to ensure continuity of air barrier and vapour retarder performance at entire enclosure perimeter. Tie-in to adjacent systems as required, and seal transitions.

3.3 EXAMINATION AND PREPARATION

- .1 Verify that surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous, and comply with manufacturer's requirements.
- .3 Remove loose or foreign matter that might impair performance of materials.
- .4 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; concrete surfaces free of large voids, spalled areas or sharp protrusions
- .5 Do not install materials during rain or snowfall.
- .6 Report unsatisfactory conditions to Departmental Representative in writing.
- .7 Do not start work until deficiencies have been corrected. Beginning of Work implies acceptance of conditions.

3.4 INSTALLATION: SELF-ADHERING SYSTEM

- .1 Use winter or summer grade membrane materials as required to suit conditions.
- .2 Application of Substrate Adhesive Primer:
 - .1 Required Adhesive Primer for SBS Modified Self-Adhered Membranes:
 - .1 For the application of SBS modified self-adhered window sill pan flashings, through-wall flashings and other applications of SBS modified self adhered transition membranes, the substrate shall be conditioned with applicable primer.
 - .2 Apply primer at rate recommended by manufacturer to all areas to receive SBS modified self-adhering sheet membrane by roller and allow to dry.
 - .3 Primed surfaces not covered by self-adhering membrane or self-adhering through-wall flashing membrane during the same working day shall be re primed.
 - .2 Adhesive Primer for Primary Water Resistive Air Barrier Membrane:
 - .1 Adhesive prime all substrate surfaces with adhesive primer.
- .3 To the extent practicable, pre-cut membrane to manageable lengths each day.
- .4 Install multiple courses in shingle fashion at overlaps to properly shed water and avoid reverse laps. Use a non-metallic roller to apply membrane firmly and evenly to substrate; blind nail within lap to be covered to hold in place during cold weather applications.
- .5 Seal inside and outside corners of sheathing with a strip of self adhering vapour permeable membrane extending a minimum of 75 mm on either side of the corner detail.
 - .1 For inside corners, pre-treat the corner with a continuous 13 mm bead of termination sealant.
 - .2 Prime surfaces where appropriate due to surface conditions, to achieve surface adhesion as per manufacturers' instructions and allow to dry.

- .3 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all side laps and 75 mm overlap at all end laps of membrane.
- .4 Roll all laps and membrane with a counter top roller to ensure seal.
- .6 Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials with self-adhered air barrier transition membrane.
 - .1 Prime surfaces and allow to dry.
 - .2 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Provide minimum 75 mm lap to all substrates.
 - .3 Ensure minimum 50 mm overlap at all side laps and 75 mm overlap at all end laps of membrane.
 - .4 Roll all laps and membrane with a non-metallic countertop roller to ensure seal.
- .7 Place SBS modified self-adhered window sill pan flashing membrane across window sills. Pre-treat inside corners with a bead of termination sealant. Install window sill pan membrane and end dam terminations, seal cuts and terminations with termination sealant per window manufacturers instructions and ASTM E2112.
 - .1 Wrap head and jamb of rough openings with specified self-adhered water resistive air barrier transition membrane as detailed.
 - .2 Extend specified self-adhered water resistive air barrier membrane into rough window openings sufficient to provide a connection to interior vapour retarder.
 - .3 Prime surfaces where appropriate to achieve surface adhesion as per manufacturers' instructions and allow to dry.
 - .4 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all side laps and 75 mm overlap at all end laps of membrane.
 - .5 Roll all laps and membrane with a counter top roller to ensure seal.
- .8 Apply through-wall flashing membrane along the base of masonry veneer walls and over lintels as detailed.
 - .1 Apply adhesive primer to surfaces and allow to dry, press membrane firmly into place, over lap minimum 50 mm at all side and end laps. Promptly roll all laps and membrane to ensure the seal.
 - .2 Applications shall form a continuous flashing membrane and shall extend up a minimum of 200 mm up the back-up wall.
 - .3 Seal the top edge of the membrane where it meets the substrate using termination sealant. Trowel-apply a feathered edge to seal termination to shed water.
 - .4 Install through-wall flashing membrane and extend 13 mm from outside edge of veneer. Provide "end dam" flashing.
- .9 Apply self-adhering water resistive air barrier membrane complete and continuous to substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
 - .1 Prime surfaces and allow to dry.
 - .2 Align and position self-adhering membrane to substrate, remove top panel of protective release film and press firmly into place.

- .3 Ensure alignment, hold membrane in place to avoid wrinkles and sequentially remove remaining panels of protective film and press firmly into place.
 - .4 Ensure minimum 75 mm overlap at all end and 50 mm side laps of subsequent membrane applications.
 - .5 Apply pressure roller to all membrane surfaces, laps and flashings with a counter top roller or 'J-roller' to ensure appropriate surface adhesion.
 - .6 At the end of each day's work seal the top edge of the membrane where it meets the substrate with termination sealant. Apply to a feathered edge to seal termination and shed water.
- .10 Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the primary water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with specified termination sealant.

3.5 INTERIOR VAPOUR RETARDER

- .1 Verify that services are installed and have been accepted by the Departmental Representative and Authorities Having Jurisdiction prior to installation of vapour barrier.
- .2 Install sheet vapour barrier on warm side of exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous retarder in accordance with manufacturer's written instructions.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Install materials in a manner that maintains continuity; repair punctures and tears with sealing tape before work is concealed.
- .5 Openings:
 - .1 Cut sheet vapour barrier to form openings and lap and seal to window and door frames in accordance with good building envelope practice.
- .6 Seal perimeter of sheet vapour retarder 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 Adhere sheets using sealant bead at each steel framing member and at top and bottom tracks.
 - .4 Install sealant bead with no gaps; smooth out folds and ripples occurring in sheet over sealant.
- .7 Seal lap joints of sheet vapour retarder as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
 - .4 Adhere sheets using sealant bead at each steel framing member and at top and bottom tracks.
 - .5 Install sealant bead with no gaps; smooth out folds and ripples occurring in sheet over sealant.

- .8 Seal electrical switch and outlet device boxes that penetrate vapour retarder as follows:
 - .1 Install moulded box vapour retarder:
 - .2 Apply sealant to seal edges of flange to main vapour retarder and seal wiring penetrations through box cover.

3.6 FOAM-IN-PLACE INSULATION

- .1 Install Foam-in-Place insulation as required at penetrations and gaps to maintain continuity of air barrier.

3.7 FIELD QUALITY CONTROL

- .1 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.
- .2 The Departmental Representative shall inspect installed membrane for continuity of air barrier prior to placement of insulation.

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.2 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Aluminum Association Inc. (AA)
 - .1 DAF-45-03(R2009), Designation System for Aluminum Finishes.
- .2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .3 American National Standards Institute (ANSI)
 - .1 ANSI/ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .4 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-17, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .3 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
 - .4 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - .5 ASTM D2369-10(2015)e1, Standard Test Method for Volatile Content of Coatings.
 - .6 ASTM D2832-92(2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .7 ASTM F1667-17, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members, Includes Update No. 1 (2014), Update No. 2. (2014), Update No. 3 (2015).
- .6 Environmental Choice Program (ECP)
 - .1 CCD-045, Sealants and Caulking Compounds.
 - .2 CCD-046, Adhesives.

1.2 PRE-INSTALLATION MEETING

- .1 Convene pre-installation meeting one week prior to beginning work of this Section with Contractor, Departmental Representative, installer, manufacturer's representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.
 - .4 Review manufacturer's installation instructions.
- .2 Manufacturer's representative shall also provide frequent inspection visits during the course of work of this Section to assure quality and competence of membrane installation and panel alignment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's:
 - .1 Caulking and sealant materials during application and curing.
 - .2 Finishing materials.
 - .3 Insulation adhesives.
 - .4 Paints.
 - .5 Isolation coatings.
- .3 Shop Drawings:
 - .1 Submit shop drawings and indicate arrangement of cladding system including dimensions, wall openings, location of joints, profiles of inner and outer skin, types and locations of supports, fasteners, flashing, closures, compliance with design criteria and requirements of related work.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples of wall system, representative of materials, finishes and colours.
 - .2 Prior to ordering materials, provide to Departmental Representative the following for verification purposes: three samples of colour of finish specified.
- .5 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: Submit copies of manufacturers field reports.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Installer Qualifications: Engage experienced installer who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance.

1.5 MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.
- .2 Construct a portion of one exterior wall in location agreed upon by Departmental Representative to establish a standard of construction, workmanship, and appearance.
- .3 Construct mock-up indicating relationship between wall panels, air spaces, air/vapour retarder membrane, windows, and doors.
- .4 Do not continue with work of this Section until Departmental Representative has approved mock-up.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store materials in accordance with manufacturer's instructions.
- .2 Protect panels during transportation, unloading, storing, and erecting to prevent bending, warping, twisting, and surface damage.

PART 2 PRODUCTS

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Design metal panel wall system in accordance with CSA S136.
- .2 Design metal panel wall to provide for thermal movement of component materials caused by ambient temperature range of 60 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .3 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .4 Design members to withstand dead load and wind loads calculated in accordance with Alberta Building Code 2006 and applicable local regulations, to maximum allowable deflection of 1/180th of span.
- .5 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".
- .6 Provide minimum thermal resistance of RSI 2.1 W/m²K.
- .7 Permeance through wall system not to exceed 1 ng/(Pa.s.m²).
- .8 Design wall system to accommodate specified erection tolerances of structure.
- .9 Design wall system to allow for movement of air between exterior and interior side of metal cladding.
- .10 Provide an effective air barrier, to prevent infiltration and/or exfiltration of air through wall assembly.

2.2 STEEL CLADDING MATERIALS

- .1 Galvanized sheet steel cladding: Z275 galvanized sheet steel applied to both sides, commercial steel (CS), type A, grade 230 to ASTM A653/A653M and as follows:
 - .1 Nominal Core Thickness: 0.76 mm or thicker to meet design loads.
 - .2 Profile: match adjacent existing.
 - .3 Finish: prefinished as specified below.

2.3 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied silicone modified polyester.
 - .1 Colour: match adjacent existing.
 - .2 Specular gloss: 30 units +/-5 to ASTM D523.
 - .3 Coating thickness: not less than 25 micrometres.
 - .4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

- .1 Outdoor exposure period 1000 hours.**
- .2 Humidity resistance exposure period 1000 hours.**

2.4 ACCESSORIES

- .1 Sub-girts: minimum 1.21 mm base metal thickness, galvanized steel to ASTM A653/A653M, grade 230 with Z275 zinc coating; profiled to accept exterior sheet with structural attachment to building frame. Exposed materials of wall assembly to match panels.
- .2 Fasteners: Manufacturer's standard to suit design loads and applications.
 - .1 Screws to ANSI B18.6.4. Purpose made double hot dipped galvanized steel; exposed parts to match finish of exterior sheet.
- .3 Sealant: as indicated in Section 07 92 00 and as recommended by manufacturer. Colour of exposed sealant to match adjacent panel.
- .4 Isolation coating: bituminous paint.
- .5 Exterior corners: of same profile, material and finish as adjacent cladding material, shop cut and brake formed to required angle, concealed corner brace, pop rivet connections with painted head to match cladding.
- .6 Exposed joint (perpendicular to profile): ends of cladding sheet shop cut clean and square, backed with tight fitting filler lapping back of joint, exposed components colour matched to cladding.
- .7 Accessories: cap flashings, drip flashings, internal corner flashings, copings and closures for head, jamb, sill and corners, of same material, thickness and finish as exterior cladding, brake formed to shape.
- .8 Expansion joints: as recommended by Manufacturers Instructions.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.
- .2 Touch up building framing members with primer as required.

3.3 INSTALLATION

- .1 Install cladding horizontal on curved walls in accordance with CGSB 93.5, and manufacturer's written instructions
- .2 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.
- .3 Install outside corners, fillers and closure strips with carefully formed and profiled work.
- .4 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

- .5 Attach components in manner not restricting thermal movement.
- .6 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealing.

3.4 CONTROL/EXPANSION JOINTS

- .1 Construct control and expansion joints as indicated.
- .2 Use cover sheets, of brake formed profile, of same material and finish as adjacent material.
- .3 Use mechanical fasteners to secure sheet materials.
- .4 Assemble and secure wall system to structural frame so stresses on sealants are within manufacturers' recommended limits.

3.5 CONSTRUCTION

- .1 Installation Tolerances: Shim and align panels and cladding system within installed tolerance of 6 mm in 6100 mm on level, plumb, and location lines as indicated, and within 3 mm offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's field services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .4 Submit reports to Departmental Representative within three days of review and submit.

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.2 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 The Aluminum Association Inc. (AA)
 - .1 Specifications for Aluminum Sheet Metal Work in Building Construction.
 - .2 AA DAF-45-2003(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International (ASTM)
 - .1 ASTM A606/A606M-18, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .2 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .4 ASTM B32-08(2014), Standard Specification for Solder Metal.
 - .5 ASTM B907-16 Standard Specification for Zinc, Tin and Cadmium Base Alloys Used as Solders.
 - .6 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
 - .7 ASTM D822/D822M-13 Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - .8 ASTM D4586/D4586M-07(2018), Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 - .9 ASTM F1667-17, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual, 2012.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA A440-17, North American Fenestration Standard / Specification for windows, doors, and skylights.
 - .2 CSA A440.2-14/A440.3-14, Fenestration energy performance/User guide to CSA A440.2-14, Includes Update No. 1 (2015).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings showing proposed method of shaping, forming, jointing, fastening, and application of flashing and sheet metal work.
- .4 Verification Samples:
 - .1 Submit duplicate 300 x 300 mm samples of each type of sheet metal material, colour and finish proposed to be used for the project, and obtain written acceptance from Departmental Representative before ordering materials.

- .2 Submit representative sample section of pre-painted metal flashing illustrating S-locking jointing method, minimum 600 mm long.
- .5 Quality assurance submittals: submit following in accordance with Division 01: Quality Control.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Coordination:
 - .1 Coordinate work of this Section with interfacing and adjoining Work for proper sequencing of each installation and to provide positive weather resistance, durability of the work, and protection of materials and finishes.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor's representative and Departmental Representative in accordance with Division 01: Construction Progress Schedule to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .3 General: Fabricate and install sheet metal flashing and trim in accordance with SMACNA's Architectural Sheet Metal Manual, and to the CRCA Roofing Specifications Manual.
- .4 Sheet Metal Flashing: Comply with the applicable recommendations and guidelines of the CRCA Canadian Roofing Reference Manual, CRCA Specification Manual, and applicable CRCA technical bulletins.
- .5 Aluminum Flashing: Comply with the applicable recommendations and guidelines of the CRCA Canadian Roofing Reference Manual, CRCA Specification Manual, and applicable CRCA technical bulletins.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Stack pre-formed and pre-finished material in manner to prevent twisting bending and rubbing.
- .2 Provide protection for galvanized surfaces.
- .3 Prevent contact of dissimilar metals during storage and protect from acids, flux, and other corrosive materials and elements
- .4 Protect prefinished surfaces from scratches and from rust staining.

1.5 WARRANTY

- .1 Manufacturer's Standard Finish Warranty: minimum 20-years.
- .2 For the work of this Section, the 12-month warranty period prescribed in Contract is extended to 36 months.

PART 2 PRODUCTS

2.1 METAL FLASHING

- .1 Alloy time in construction schedule to custom order the products specified herein, which may be non-standard.
- .2 (Use at Aluminum-Framed Fabrications) Aluminum-zinc alloy (55% Al / 45% Zn) hot dipped coated steel sheet: to ASTM A792/A792M, Structural Steel Grade 33, AZ50/AZM150, Aluminum-Zinc alloy coated, and as follows:
 - .1 Minimum Metal Thickness: 0.5512 mm thick (26 gauge).
 - .2 Coating System: shall include aluminum-zinc alloy to specifications, factory-applied to both sides of substrate using reverse roll coaters or similar.
 - .3 Factory-Applied Coating:
 - .1 Polyvinylidene fluoride (PVDF) factory-applied paint system over aluminum-zinc alloy hot dipped coated sheet metal.
 - .2 Class: F1S.
 - .3 Colours:
 - .1 Roof related work: match roof panel colour.
 - .2 Work related to wood siding, fibreglass windows and metal doors: match wood siding colour.
 - .4 Specular gloss: 30 units +/- 5 to ASTM D523.
 - .5 Coating thickness: not less than 22 micrometres.
 - .6 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .7 Outdoor exposure period 2,500 hours.
 - .8 Humidity resistance exposure period 5,000 hours.
- .3 (General Use) Hot dip galvanized steel sheet (pre-finished): Type A commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
 - .1 Class: F1S-Finished one side (manufacturer's standard prime finish on unexposed face).
 - .2 Thickness: minimum 0.7010 mm base metal thickness.
 - .3 Manufacturer's Coil Coating System: silicone modified polyester (SMP) system, applied over a zinc phosphate pre-treatment, and high-performance, flexible primer.
 - .4 Colours: as selected by Departmental Representative from manufacturer's full range.
- .4 Formed aluminum flashing: Tension levelled, commercial quality aluminum sheet in accordance with ASTM B209 and ANSI H35.1 alloy designation 5005-H14 and as follows:
 - .1 Minimum Thicknesses:
 - .1 General Applications where indicated: minimum 0.8128 mm thick.
 - .2 Prefinished Aluminum Frieze Panels: 3 mm thick solid prefinished aluminum, formed to profile indicated.
 - .2 Factory Finish: powder-coated, to AAMA 2605; colour as selected by Departmental Representative from manufacturer's full range to match adjacent construction (to match Composite Wall Panels at related parapets).
 - .3 Unexposed aluminum: Mill finish.

- .5 Form flashing, coping, and fascia to profiles indicated or as required to achieve the design intent illustrated on the Drawings.

1.1 GUTTERS AND DOWNSPOUTS

- .1 Form downspouts from 0.7010 mm thick prefinished Z275 hot dip galvanized sheet metal. Sizes and profiles as indicated. Colours as determined by Departmental Representative.
- .2 Form gutters from 1.30 mm thick prefinished Z275 hot dip galvanized sheet metal. Sizes and profiles as indicated. Colours as determined by Departmental Representative.
- .3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Roofing Cement: to ASTM D4586, asphalt based, asbestos free.
- .3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.
- .4 Sealants: as indicated in Section 07 92 00 – Joint Sealants.
 - .1 Mastic Sealant: CAN/CGSB 37.29 polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
 - .2 Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00.
- .5 Fasteners: of same material as sheet metal, to ASTM F1667, as recommended by sheet metal manufacturer; non-corrosive. Finish of exposed parts to match material being fastened.
- .6 Washers: same material as sheet metal, 1 mm thick with rubber packing.
- .7 Solder and Flux: as recommended by sheet material manufacturer.
- .8 Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet metal.
- .9 Metal Accessories: Provide non-corrosive sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work. Accessories shall match or be compatible with material being installed; size and thickness as required.
- .10 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

- .1 Roofing: Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .2 Zinc or aluminum-zinc galvanized sheet steel, as specified: Fabricate in accordance with SMACNA Architectural Sheet Metal Manual.
- .3 Aluminum flashing (mill finished, pre-finished or anodized as specified) and other sheet aluminum work: Fabricate in accordance with AAI-Aluminum Sheet Metal Work in Building Construction. Back-paint aluminum flashing in contact with concrete or masonry, or dissimilar metal, with bituminous paint prior to installation.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .6 Make flashing of prefinished metal for all cap flashing, for all flashing adjacent to roofing at roof edges and area dividers and where exposed to view from ground. Make flashing for other locations, of plain galvanized metal as follows:
- .7 Make metal flashings for other locations of hot dip galvanized metal, Type A commercial quality to ASTM A653/A653M, with Z275 designation zinc coating, as follows:
 - .1 Use 0.7010 mm metal core thickness except where otherwise specified.
 - .2 Use 0.84 mm metal core thickness for concealed fastening strips.
 - .3 Use material of thickness specified for other applications, and as indicated.
- .8 All straight run joints shall be S-Lock in roof flashing.
- .9 Make joints to allow for thermal movement, space S-Lock joints at 1500 mm maximum centers.
- .10 Make flashing for building into masonry and concrete so that joints can be lapped 100 mm or more.
- .11 Strengthen free edges of metal flashing by folding to form a 13-mm hem.
- .12 Make flashing to curbs, walls and parapets a minimum of 200 mm high, where possible.
- .13 Where curb-mounted roof penetrations are not required, provide flashing sleeves and collars for all pipes and conduit extending through the roof. Sleeves shall be soldered to a piece of sheet metal extending at least 150 mm onto the surrounding roof.
- .14 Make joints for corners and intersections with standing seams except where exposed of pre-finished metal when seams shall be flat locked.
- .15 All bends machine made; form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .16 All metal flashing shall be back painted with bituminous paint prior to installation.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Check mounting and counter-flashing of mechanical items and report any defect to the Departmental Representative.
- .2 Verify that solid wood blocking or sheathing provided to back-up all flashing and that all nails, screws set and wood provides a smooth flat plane.
- .3 Verify that all Work by other trades is in place, and properly and securely located, true and level in line.

3.3 INSTALLATION: METAL FLASHING

- .1 Install sheet metal flashing and trim in accordance with applicable CRCA 'FL' series details, SMACNA's Architectural Sheet Metal Manual, and as indicated.
- .2 Verify shapes and dimensions of surfaces being covered before fabricating sheet metal.

- .3 Do not install metal flashings over flexible roof flashing until the flexible roof flashing has been inspected and approved by the Departmental Representative. This includes curbs for roof mounted items.
- .4 Do not use exposed fastening unless indicated, or concealed fastening is not possible. Locations and methods shall be approved by Departmental Representative.
- .5 Anchor units of work securely in place, providing for thermal expansion of metal units. Conceal fasteners where possible and set units true to line and level.
- .6 Install work with laps, joints, and seams that are watertight and weatherproof.
- .7 Install exposed sheet metal work that is without oil canning, buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weatherproof performance.
- .8 Install surface mounted reglets true and level, and caulk top of reglet with sealant. Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Install pans where shown around items projecting through roof membrane.
- .10 Insert metal flashing into reglets or under cap flashing as indicated to form weather tight junction.
- .11 Fasten metal base flashing to walls or upstands along top of flashing. Do not secure to cant strip. Form lapped corner joints. Extend rolled edge of base flashing approximately 25 mm on to roof from toe of cant, and rest on top of roof surface.
- .12 Roof Edge Flashing: Secure metal flashing at roof edges at a maximum of 610 mm o.c.
- .13 Expansion Provisions:
 - .1 Provide for the thermal expansion of exposed sheet metal Work.
 - .2 Space movement joints at maximum of 3050 mm, with no joints allowed within 610 mm of a corner or intersection.
 - .3 Form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with mastic sealant (concealed within joints) where lapped or bayonet type expansion provisions in the work cannot be used or are not sufficiently weatherproof and waterproof.
- .14 Sealed Joints:
 - .1 Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant.
 - .2 Fill joint with sealant and form metal to conceal sealant completely.
 - .3 Use joint adhesive for non-moving joints specified.
- .15 Lock Seams:
 - .1 Fabricate non-moving seams in sheet metal with flat lock seams.
- .16 Separations:
 - .1 Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with bituminous paint or other permanent separation as recommended by the manufacturer.
 - .2 Underlayment: Install a slip-sheet of No. 15 perforated asphalt saturated felt and a course of polyethylene underlayment where installing sheet metal directly on cementitious or wood substrates. Secure in place and lap joints minimum 100 mm.

- .3 Bed flanges of work in a thick coat of roofing cement where required for waterproof performance.
- .17 Counter Flashing:
 - .1 Coordinate installation of counter flashing with installation of assemblies being protected by counter flashing.
 - .2 Secure in a waterproof manner.
 - .3 Lap counter flashing joints a minimum of 50 mm and bed with sealant.
- .18 Flashing and metal closures: where flashing and metal closures overlap at any point in a system, ensure that flashing and closures are shingled over top lower sheet(s) and not behind, so that water is directed, and drains, to the exterior.

3.4 INSTALLATION: GUTTERS AND DOWNSPOUTS

- .1 Install gutters and secure to building at minimum 750 mm on centre with gutter spikes through spacer ferrules.
 - .1 Slope gutters to downpipes as indicated.
 - .2 Solder joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
 - .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section Division 01: 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 Division 01: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01: Construction/Demolition Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing of Materials (ASTM)
 - .1 ASTM E119-12a, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .2 ASTM E605-93(R2011), Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
 - .3 ASTM E736-00(2011), Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
 - .4 ASTM E759-92(2011), Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
 - .5 ASTM E760-92(2011), Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
 - .6 ASTM E761-92(2011), Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
 - .7 ASTM E859-93(2011), Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
 - .8 ASTM E937-93(2011), Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 251-06, Fire Tests of Building Construction and Materials.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
 - .4 ULC List of Equipment and Materials.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meeting: Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Consultant and manufacturer's representative to:
 - .1 Verify Project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions.
- .2 Coordination: Ensure surfaces to which fireproofing is to be applied meet manufacturer's minimum surface preparation requirements for bond surface, free from wax, grease or other deleterious material that could affect bond of materials specified in this Section, and as follows:

- .1 Coordinate and ensure installation of hangers, inserts, clips and similar items to surfaces needing protection before applying sprayed fire-resistive materials.
- .2 Coordinate and ensure installation of ducts, pipes, conduits and similar items that could obstruct spraying operations before applying sprayed fire-resistive materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Division 01: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit samples in accordance with Division 01: Submittal Procedures:
 - .1 Submit duplicate 300 x 300 mm size sample of exposed fireproofing for approval of texture and colour.
- .3 Submit quality assurance submittals in accordance with Division 01: Quality Control:
 - .1 Test Reports:
 - .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
 - .2 Submit test results in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.
 - .3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
- .5 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- .1 Qualifications: Provide proof of qualifications when requested by Consultant:
 - .1 Installer: company specializing in sprayed-on fireproofing approved by manufacturer.
 - .2 Materials: Use materials produced under label service of an agency that has tested material, or assemblies containing material, in accordance with specified test standards.
- .2 Delegated Design Submittals: Design sprayed-on fireproofing thickness required by the Contract Documents to withstand fire ratings indicated and in accordance with requirements of the Building Code, and as follows:
 - .1 Provide manufacturers standard listing where site conditions match standard assembly listings by Underwriters Laboratories of Canada (ULC).

- .2 Provide manufacturers engineered judgment, indicating acceptance by the authorities having jurisdiction, signed and sealed by manufacturer's design engineer, where assembly does not match standard assembly listing.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Division 01: Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver packaged materials in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
 - .3 Damaged or opened containers will be rejected.
 - .4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.
 - .5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
 - .6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.

1.6 AMBIENT CONDITIONS

- .1 At temperatures less than 5 degrees C, ensure that 5 degrees C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.
- .2 Maintain relative humidity within limits recommended fireproofing manufacturer.
- .3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application is provided.
- .4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

PART 2 PRODUCTS

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Adhesion: Provide materials that meet or exceed adhesion requirements in accordance with ASTM E736.
- .2 Thickness and Weight: Determine application thickness and weight of applied fireproofing based on tests of assemblies in accordance with CAN/ULC S101; apply same thickness of fireproofing material to all structural components forming a part of the assembly including; but not limited to, cross bracing, support angles and hangers.

- .3 Engineered Judgements: Provide engineered judgement acceptable to Authority Having Jurisdiction where assembly being protected differs from the tested assembly used to determine thickness.

2.2 MATERIALS

- .1 Sprayed fireproofing: ULC certified gypsum based cementitious or asbestos-free mineral fibre fireproofing qualified for use in ULC Designs and fire-resistance rating requirements indicated on Drawings.
- .2 Provide materials containing no asbestos.
- .3 Water: Clean, fresh, suitable for domestic consumption, and free from such amounts of mineral or organic substance as would affect set of fire resistant material.
- .4 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .5 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
- .1 Colour: white.
- .6 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
- .1 Fireproofing for structural components concealed above ceiling, or within wall, chase, or furred space: minimum applied dry density of 240 kg per cubic meter and cohesion/adhesion strength of 9.57 kPa.
- .2 Fireproofing for exposed structural components, except where otherwise specified or indicated: minimum applied dry density of 350 kg per cubic meter and cohesion/adhesion strength of 20.83 kPa.
- .3 Fireproofing for structural components located in mechanical rooms and storage areas: minimum applied dry density of 640 kg per cubic meter and cohesion/adhesion strength of 350 kPa.
- .4 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.
- .5 Minimum compressive strength: 48 kPa.
- .6 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
- .7 Dust removal: not exceed 0.25 gram per square meter.
- .7 Accessories: Reinforcement mesh, wire lath, mould inhibitors and other components necessary for a complete and functioning fireproof coating installation.

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 Check environmental conditions and examine surfaces to receive fire-resistant material; report any conditions that would detrimentally affect application of material.
- .2 Commence Work when conditions of surfaces and working conditions are suitable.

3.3 PREPARATION

- .1 Where adjacent floors, walls and similar surfaces are going to be exposed, provide and maintain masking, drop cloths and polyethylene coverings for such surfaces to protect them during spraying operations.
- .2 Provide complete enclosures and human protective devices when spraying hazardous materials.
- .3 All surfaces to receive cementitious fireproofing material will be applied shall be free of oil, grease, dirt, loose paint, mill scale or any other matter that would impair bond, including paint unless test application of cementitious fireproofing material has been done to determine that paint formulation will not impair adhesion.
- .4 Prime surfaces as required.
- .5 Make provisions for natural ventilation to properly dry fire resistant material during and subsequent to its application. In enclosed areas or area lacking openings for natural ventilation, circulate interior air and exhaust it to outside by use of temporary circulators, exhaust fans, or air-conditioning system.

3.4 APPLICATION

- .1 Mix and apply fire resistive material to all structural steel and metal decking, as required to provide a fire resistance rated assembly, in accordance with approved submittals and manufacturer's instructions. Ratings as indicated.
- .2 Apply spray coats of no greater thickness per coat than maximum recommended by manufacturer until required thickness is applied.
- .3 Do not re-temper material or use frozen, caked, or lumpy material.
- .4 Mix each batch of material separately, following manufacturer's instructions, to achieve required density.
- .5 Cut, patch, and repair any material which fails to meet requirements of this specification or which fails to attain properties stipulated in reports of tests used to determine fire resistance rating of assembly.
- .6 Repair damage to fire-resistant material caused by installation of subsequent Work, to acceptance of Consultant and authorities having jurisdiction.
- .7 Apply sealer in accordance with manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

- .1 Perform field tests required by authorities having jurisdiction.
- .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 Inspection and Site Tests:
- .1 The Consultant may select, and Owner will pay for, an independent testing laboratory to sample and verify thickness and density of fire resistant material in accordance with provisions of ASTM E605.
 - .2 Test results will be forwarded to the Consultant. The Consultant will distribute the results of above tests to all parties at completion of each floor.
 - .3 One series of tests will be performed in accordance with both laboratory and field-tests for each 1000 m² (10,000 ft²) of floor area sprayed. Make good after all cut tests.
 - .4 Non-Conforming Work: Repair deficiencies identified in test results; patch damage to mineral fibre fireproofing caused by other work of the Project before mineral fibre fireproofing is concealed; or if exposed before substantial performance.

3.6 PATCHING

- .1 Patch and properly repair damage to fire resistant materials caused by testing, or by other trades, before fire resistant material is concealed, or if exposed, before final inspection.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM E119-16a, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .2 ASTM D2240-15, Standard Test Method for Rubber Property - Durometer Hardness.
 - .3 ASTM D2794-93(2010), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - .4 ASTM D4060-14, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abrader.
 - .5 ASTM E84-17, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .6 ASTM E595-15, Standard test Method for Total Mass Loss and Collected Volatile Condensable Materials from Out-gassing in a Vacuum Environment
 - .7 ASTM E736/E736M-17, Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
 - .8 ASTM E759-92(2015)e1, Standard test method for Effect of Deflection on Sprayed Fire-Resistive Materials Applied to Structural Members
 - .9 ASTM E761-92(2015)e1, Standard test method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.
- .2 Intertek Group plc.
 - .1 Directory of Listed Products, current edition.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 edition.
- .4 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International)
 - .1 Coating Materials Guidelines.
 - .2 Surface Preparation Guidelines: SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
 - .3 SSPC-PA2, Procedure for Determining Conformance to Dry Coatings Thickness.
- .5 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC S101-14, Fire Endurance Tests of Building Construction and Materials
 - .2 CAN/ULC S102-10, Surface burning characteristics of building materials and assemblies
 - .3 ULC List of Equipment and Materials, latest edition.

1.2 SUPPLY AND COORDINATION

- .1 Supply primer compatible with intumescent coating system as recommended by coating manufacturer to structural steel supplier/erector in accordance with the Project Schedule.
- .2 Structural steel supplier/erector shall prepare steel surfaces prior to application of primer to SSPC-SP6/NACE No.3; ensure that structural steel supplier/erector to made aware of this requirement.

1.3 REGULATORY REQUIREMENTS

- .1 Work of this Section shall meet or exceed the requirements of the National Building Code of Canada 2015 as amended (NBC).
- .2 Conform to authorities having jurisdiction for fire resistance ratings required for this project.
- .3 Submit certification of acceptability of fire resistant materials to authority having jurisdiction.

1.4 DELEGATED DESIGN REQUIREMENTS

- .1 Design intumescent coating thickness required by the Contract Documents to withstand fire ratings indicated and in accordance with requirements of the National Building Code of Canada 2015 as amended.
 - .1 Provide manufacturer's standard listing where site conditions match standard assembly listings.
 - .2 Provide manufacturer's engineered judgment, indicating acceptance by the authorities having jurisdiction, signed and sealed by manufacturer's design engineer, where assembly does not match standard assembly listing.
 - .3 Design thickness of intumescent fire-resistant system to provide a fire resistance rating for time period indicated on drawings for columns and beams in accordance with Metric Steel Mass/Heated Perimeter (M/D) calculations.
- .2 Submit Letter of Commitment in accordance with Section 01 35 01 – Delegated Design, indicating scope of design work, and attach manufacturer's standard listing and engineered judgements, if any.
- .3 Submit Letter of Compliance indicating that installed systems meet the requirements of the manufacturer's standard assembly listings and engineered judgements.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions and regulatory requirements.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide required submittals in accordance with the requirements of Section 01 33 00 – Submittal Procedures.
- .2 Submit design data indicating film thicknesses required by design, and if applicable related ULC assemblies. Include names of products being used.
- .3 Submit product data indicating product characteristics, performance and limitation criteria, and application thicknesses specific to identified assemblies.
- .4 Submit manufacturer's recommended thicknesses for applied materials for fire resistant ratings listed.
- .5 Submit manufacturer's printed preparation and application instructions.
- .6 Submit colour samples for initial selection by Departmental Representative prior to ordering and mixing materials.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Applicator: Approved, licensed and supervised by the manufacturer of fire resistant materials. Company shall have experience applying intumescent coatings.
 - .2 Manufacturer: Company specializing in manufacturing intumescent and related products.
- .2 Use materials and methods of determining required thickness of application that have the full acceptance of authority having jurisdiction.
- .3 Each container or package shall bear one of the following labels:



- .4 Single Source Responsibility:
 - .1 Obtain intumescent system materials from a single source of manufacture and installation responsibility.
 - .2 Intumescent system materials shall be supplied by a single manufacturer.
- .5 The manufacturer's direct technical representative (not distributor or agent) shall be on-site during the initial installation of the intumescent system to provide training to the applicator's personnel in proper preparation and application procedures.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 –Common Product Requirements.
- .2 Deliver and store materials at temperature not below 10°C in a dry, protected area, off ground in original, undamaged, sealed containers with manufacturer's labels and seals intact.
- .3 Protect from freezing.

- .4 Do not store in direct sunlight.
- .5 Check "Freeze Watch" indicators before accepting delivery of materials.
- .6 Discard any materials which have come into contact with contaminants prior to actual use.

1.9 PROJECT CONDITIONS

- .1 Apply sprayed intumescent fire-resistant materials when temperature of substrate and surrounding air is above 10°C.
- .2 Apply intumescent fire-resistant materials after concrete toppings, roofing applications and other assemblies having a high moisture load have been installed and are cured.
- .3 Ventilate in areas to receive work of this Section during and 24-hours after application.
- .4 Excessive humidity may affect the application and drying for the intumescent fire-resistant materials; maintain manufacturer's recommended relative humidity in work area.

1.10 SEQUENCING AND SCHEDULING

- .1 Sequence work in conjunction with installation of structural steel and finishing materials, sprinkler pipes, HVAC systems and other mechanical systems.
- .2 For steel surfaces with less than 900 mm clear working access, apply materials to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site prior to erection.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Supply water-based intumescent coating with low-odour, low-VOCs, meeting fire resistance rating tested to ULC S101 and NBC 2015 requirements.
- .2 Supply manufacturer's recommended primer.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Examine surfaces to receive work of this Section and report any defects that may affect the Work of this Section. Identification marking of steel components must be by wax crayon to facilitate ease of removal prior to application of this intumescent fire resistant.
- .2 Confirm that substrate surfaces are ready to receive work.
- .3 Coordinate with structural steel supplier/erector to ensure that surfaces are prepared in accordance with SSPC-SP6/NACE No.3 and that primer is properly applied.
- .4 Supply primer and coordinate application with structural steel supplier/erector.
- .5 Structural steel supplier/erector shall grind weld flashes smooth prior to commencement of Work of this Section and touch-up any damaged primer application.
- .6 Verify that all clips, hangers, sleeves and similar devices have been attached.
- .7 Confirm compatibility of surfaces to receive fire resistant materials.

- .8 Verify that compatible primer is applied to steel prior to shipping to site.
- .9 Beginning of installation means acceptance of substrate.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's printed preparation and application instructions, technical datasheets, illustrations and specifications.

3.3 PREPARATION

- .1 Clean substrate free of dust, dirt, grease or other foreign matter that could impair bond of fire resistance material.
- .2 Touch-up any damaged primer, and allow to cure.
- .3 Protect adjacent surfaces and equipment from overspray of sprayed materials.
- .4 Protect workers and others in accordance with MSDS information.

3.4 APPLICATION

- .1 Apply intumescent fire resistant in accordance with manufacturer's instructions in sufficient thickness to achieve fire rating indicated.
- .2 Intumescent fire resistant and protective decorative finish shall be applied using spray application to achieve a smooth, high gloss finish. Orange peel texture and other surface runs or marks arising from painting operations will require remedial action or replacement.
- .3 Apply decorative finishes according to manufacturer's recommendations.

3.5 FIELD QUALITY CONTROL

- .1 Quality control inspection of field applied intumescent coatings by third party inspector will include, but not be limited to, the following:
 - .1 Owner may require, and pay for testing of applied intumescent coatings to verify thickness of intumescent fire-resistant material, in accordance with SSPC-PA2.
 - .2 Inspection shall be carried out prior to application of colour top coat.
- .2 Notify Departmental Representative when system is ready for testing a minimum of 48 hours prior to tests being required.

3.6 PATCHING

- .1 Patch and repair any fire-resistant material that has been damaged by the Work of this Section or the Work of any other Section.
- .2 Cost of repairs shall be borne by the party responsible for the damage as determined by Design-Builder at its sole discretion.

3.7 PROJECT RECORD DOCUMENTATION

- .1 At completion of intumescent Work, ensure that each location that intumescent coating has been applied is recorded along with all applicable fire resistive rating on as-built drawings.
- .2 Ensure that each application of intumescent coating is documented with location and installation details provided.

- .3 At the location of each application of intumescent coating, secure an identification label, easy to read location, that documents the product used, manufacturer, applicator, date of application, and the ULC designation and fire-rating involved.
- .4 Submit updated as-built drawings in accordance with the requirements of Section 01 78 00 - Closeout Submittals, including accurate as-built information.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Section Division 01: Construction/Demolition Waste Management and Disposal.

3.9 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM A1008/A1008M-16, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .2 ASTM E814-13a(2017), Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .2 Firestop Contractors International Association (FCIA)
 - .1 FCIA Firestop Manual of Practice (MOP).
 - .2 FM 4991, Standard for the Approval of Firestop Contractors.
- .3 International Firestop Council (IFC)
 - .1 Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs).
- .4 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S102-10, Standard Method of Tests for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC S115-11, Standard Method of Fire Tests of Fire stop Systems.
 - .4 CAN/ULC S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
 - .5 CAN/ULC 702.2-15, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.
 - .6 ULC List of Equipment and Materials.
 - .7 ULC Guide No. 40 U19 Series, Firestop Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Division 01: Submittal Procedures.
 - .1 Not later than 30 working days following Award of Contract, submit a schedule and shop drawings. Show ULC assembly number for each condition, required temperature rise and flame rating, hose stream rating, thickness, installation methods and materials of firestopping and smoke seals, damming materials, reinforcements, anchorages and fastenings, size of opening, adjacent materials and number of penetrations.
 - .2 Where possible determine thickness to be applied from tests of assemblies identical to the assembly to be protected, conducted in accordance with CAN/ULC S101.
 - .3 Engineering Judgements: where a UL / ULC Design (assembly number) has not been issued, obtain an engineering judgement from the system manufacturer for a solution relevant to the job conditions involved, and obtain approval of the authorities having jurisdiction.

- .1 Determine system from available engineering studies, or correspondence with the labelling agency indicating the effect of the differences on the fire separation of the assembly. Confirm acceptance of system by authorities having jurisdiction in writing.
- .2 Obtain and submit fire stop system manufacturer's engineering judgement(s) meeting the requirements of authorities having jurisdiction.
- .3 Engineering judgements shall comply with "Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs)."
- .2 Submit product data in accordance with Division 01: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality assurance submittals: submit following in accordance with Division 01: Quality Control.
 - .1 Test reports: in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer:
 - .1 Company or person specializing in fire stopping installations, and approved by the manufacturer.
 - .2 Company or person shall be a member in good standing of the Firestop Contractors International Association (FCIA).
- .2 Work of this Section shall comply with the FCIA Firestop Manual of Practice (MOP), the Nova Scotia Building Code, and the Nova Scotia Fire Code, including errata and amendments.
- .3 Use materials and methods of determining required thickness of application that have the full acceptance of authority having jurisdiction.
- .4 Use materials tested to CAN/ULC S115. Assemblies containing the materials shall be in accordance with assemblies tested and approved by agencies acceptable to authority having jurisdiction.

- .5 Single Source Responsibility:
 - .1 Obtain through-penetration firestop and joint systems, for each kind of penetration and construction condition indicated, from a single source of installation responsibility.
- .6 Delegated Design:
 - .1 Retain a Professional Engineer, registered in the Province of the work, to design the work of this Section in accordance with applicable Building Code and Contract Documents requirements.
 - .2 Sign and seal shop drawings and design submittals.
 - .3 Review installations.
 - .4 Submit signed Letters of Commitment and Supervision with regards to duties of specialty professionals appointed during construction period.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Division 01: Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
 - .3 Use stock before its expiration date.

1.5 PROJECT CONDITIONS

- .1 Install firestopping and smoke seals materials only when the areas in which they are scheduled are closed-in and protected from dampness.
- .2 Environmental Limitations: Install firestopping and smoke seals systems when ambient or substrate temperatures are within temperature and moisture limits permitted by firestopping and smoke seals system manufacturers or when substrates are not wet due to rain, frost, condensation, or other causes.
- .3 Ventilate firestopping and smoke seals systems in accordance with manufacturer's written instructions by natural means or forced air circulation where natural means are not adequate.

1.6 WARRANTY

- .1 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 3.13 of General Conditions "C" is extended to 24 months.

PART 2 PRODUCTS

2.1 PERFORMANCE/DESIGN CRITERIA

- .1 Delegated Design Requirements: Design firestopping and smoke seals required by the Contract Documents to withstand fire ratings indicated, and in accordance with requirements of the National Building Code.
- .2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the Nova Scotia Building Code, Underwriters Laboratories Canada, and authorities having jurisdiction, and as follows:
 - .1 Provide through-penetration firestop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated:
 - .1 Fire resistance rated load bearing walls, including partitions, with fire protection rated openings.
 - .2 Fire resistance rated non-load bearing walls, including partitions, with fire protection rated openings.
 - .3 Fire resistance rated floor assemblies.
 - .2 F-Rated Systems: Provide through penetration firestop systems with F-ratings indicated, as determined by ULC S115, but not less than that equalling or exceeding fire resistance rating of constructions penetrated.
 - .3 T-Rated Systems: For the following conditions, provide through penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per by ULC S115 or ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials:
 - .1 Penetrations located outside wall cavities.
 - .2 Penetrations located outside fire resistive shaft enclosures.
 - .3 Penetrations located in construction containing fire protection rated openings.
 - .4 Penetrating items larger than 100 mm diameter nominal pipe or 100 cm² in overall cross-sectional area.
 - .4 Firestopping and Smoke seals Systems Exposed to View: Systems exposed to view, traffic, moisture, and physical damage; provide products that after curing do not deteriorate when exposed to these conditions both during and after construction, and as follows:
 - .1 Provide moisture resistant through penetration firestop systems for piping penetrations for plumbing and wet pipe sprinkler systems.
 - .2 Provide firestopping and smoke seals systems capable of supporting floor loads involved either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic.
 - .3 Provide firestopping and smoke seals systems not requiring removal of insulation for penetrations involving insulated piping.
 - .4 Provide products with flame spread ratings of less than 25 and smoke developed ratings of less than 50 for firestopping and smoke seals and joint systems exposed to view.

- .5 Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equalling or exceeding fire resistance rating of constructions in which joints are located.

2.2 FIRESTOPPING AND SMOKESEALS: GENERAL

- .1 Compatibility: Provide firestopping and smoke seals systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping and smoke seals systems, under conditions of service and application, as demonstrated by firestopping and smoke seals system manufacturer based on testing and field experience, and as follows:
 - .1 Service penetration assemblies: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.
 - .2 Service penetration firestopping and smoke seals components: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.13, under the Label Service of ULC.
 - .3 Fire resistance rating of installed firestopping and smoke seals assembly not less than the fire resistance rating of surrounding floor and wall assembly.
 - .4 Firestopping and Smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
 - .5 Firestopping and Smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations. Exemption to fire dampers.
- .2 Accessories: Provide components for each firestopping and smoke seals systems that are needed to install fill materials. Use only components specified by firestopping and smoke seals system manufacturer and approved by the qualified testing and inspecting agency for firestopping and smoke seals systems indicated. Accessories include, but are not limited to, the following items:
 - .1 Permanent forming, damming and backing materials, including the following:
 - .1 Slag or rock wool fibre insulation.
 - .2 Sealants used in combination with other forming, damming or backing materials to prevent leakage of fill materials in liquid state.
 - .3 Fire-rated form board.
 - .4 Fillers for sealants.
 - .2 Temporary forming materials.
 - .3 Substrate primers.
 - .4 Collars.
 - .5 Steel sleeves.
 - .6 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
 - .7 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
 - .8 Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.912 mm.

- .9 Labels: Peel-and-stick labels printed with the following information:
 - .1 ATTENTION: FIRE RATED ASSEMBLY. DO NOT MODIFY
 - .2 Name of firestopping manufacturer
 - .3 Names of products used
 - .4 Hour Rating of Assembly
 - .5 Manufacturers standard detail number, or Engineered Judgement identifier; ULC or cUL_{us} Number
 - .6 Date of installation
 - .7 Name of installing Trade Contractor
 - .8 Contact telephone number for repair or replacement of firestopping materials.

2.3 **FILL MATERIALS**

- .1 General:
 - .1 Provide firestopping and smoke seals systems containing the types of fill materials indicated in the Firestopping and Smoke seals System Schedule below by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
 - .2 Firestopping and smoke seal systems shall be tested in accordance with ULC S115, and be comprised of asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases, and not to exceed opening sizes for which they are intended for the ratings as indicated on drawings.
- .2 Cast-in-Place Firestopping and Smoke seals Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- .3 Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- .4 Firestopping and Smoke seals Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- .5 Cable Penetration Devices: Premanufactured intumescent blocks, consisting of a system of inserts and adjustable cores and/or premanufactured fire rated cable pathway systems.
- .6 Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
- .7 Intumescent Putties: Non-hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.
- .8 Intumescent Spray Foam: Expanding spray-in-place intumescent foam sealant.
- .9 Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
- .10 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

- .11 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- .12 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
 - .1 Grade for Horizontal Surfaces: Pourable (self levelling) formulation for openings in floors and other horizontal surfaces.
 - .2 Grade for Vertical Surfaces: non-sag formulation for openings in vertical and other surfaces.

2.4 ACCESSORIES

- .1 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .2 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .3 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .4 Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.95 mm (20 ga.).

2.5 MIXING

- .1 For those products requiring mixing before application, comply with firestopping and smoke seals system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application 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 datasheets.

3.2 EXAMINATION

- .1 Examine surfaces, components, materials to receive firestopping and smoke seals material; report any conditions that would detrimentally affect the application of the material or the proper firestopping and smoke seals of the system.
- .2 Commence Work when conditions of surfaces and the working conditions are suitable.
- .3 Where penetration sealants or caulking are required, ensure all service lines are in place, tested and approved.
- .4 Verify all proper blocking, framing (using non-combustible materials) are properly installed and prepared to receive firestopping and smoke seals. Notify Departmental Representative in writing of any deficiencies affecting the proper performance of the firestopping and smoke seals, do not proceed until deficiencies are corrected.

3.3 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Prime surfaces as required.
- .5 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.4 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Apply firestopping and smoke seals materials/systems to maintain the fire separations in the project as indicated on drawings.
- .3 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .5 Tool or trowel exposed surfaces to neat finish.
- .6 Remove excess compound promptly as work progresses and upon completion.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
 - .1 Cut tests may be made at random by the Departmental Representative. Frequency of cut tests shall be determined by the Departmental Representative but will not be more than 1% of total length of firestopping and smoke seals.
 - .2 Make all necessary repairs and correct all deficiencies noted after completion of cut tests.
- .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.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Section Division 01: Construction/Demolition Waste Management and Disposal.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

3.8 SCHEDULE

- .1 Meet or exceed Code requirements.
- .2 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.
 - .9 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C834-17, Standard Specification for Latex Sealants.
 - .2 ASTM C919-12(2017), 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 C1330-02(2013) Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
 - .6 ASTM C1521-13 Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - .7 ASTM D2240-15e1, Standard Test Methods for Rubber Property, Durometer Hardness.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals shall comply with requirements of Division 01: Submittal Procedures.
- .2 Submit manufacturer's product data as follows:
 - .1 Printed product literature describing type, composition recommendations, and directions for surface preparation, material preparation, and material installation.
- .3 Submit manufacturer's installation instructions for each product used.
 - .1 Before performing work of this Section, submit the names of proposed materials.
 - .2 When required by Departmental Representative, submit test certificates from an approved Canadian material testing laboratory indicating that sealants meet the requirements specified, and that the tests have been conducted in accordance with ASTM D2240.
- .4 Submit samples for initial selection and quality assurance as follows:
 - .1 Samples of back-up material, primer, joint fillers, and of each type and colour of sealant to be used. Cure samples under conditions anticipated at the site during application.
- .5 Reports: submit written pre-installation meeting recommendations, field inspection, and test report results after each inspection.
- .6 Submit Warranty.

1.3 QUALITY ASSURANCE

- .1 Work shall conform to or exceed ASTM C1193 guidelines.
- .2 Pre-Installation Meeting:
 - .1 Arrange with manufacturer's representative to inspect substrates and to review installation procedures 48-hours in advance of installation.
 - .1 Review conditions under which work will be done.
 - .2 Joint condition and profile.
 - .3 Weather conditions.
 - .2 Submit written report of meeting to Departmental Representative.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with manufacturer's recommendations and instructions.
- .2 Deliver containers labelled and sealed, complete with written application and maintenance instructions.
- .3 Store materials in a dry, heated enclosure.

1.5 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
 - .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.
 - .2 Substrate must be clean, dry, and frost free.

1.6 WARRANTY

- .1 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 3.13 of General Conditions "C" is extended to 24 months.

PART 2 PRODUCTS

2.1 SEALANTS - GENERAL

- .1 Sealants shall be construction grade, commercial quality; residential class "do-it-yourself" (DIY) products not permitted.

2.2 SEALANT MATERIALS

- .1 Type S-1: Mildew-Resistant Sealant: to ASTM C920 and GSB 19-GP-22M; meets one or more of the following approvals / specifications: fungi resistant to ASTM G21, FDA Regulation No. 21 CFR 177.2600, National Sanitation Foundation Standard 51, Federal Specifications TT-S-001543A and TT-S-00230C, USDA acceptance for use in meat and poultry processing plants; one-component, mildew-resistant, non-sag, silicone sealant.
- .2 Type S-2: Silicone Sealant; to CAN/CGSB 19.13-M87, ASTM C1248, and ASTM C920: Type S Grade NS Class 50 use NT, M, G, A, O; medium-modulus, single-component, high-performance, neutral-cure silicone sealant; may be used as a joint sealant on substrates such as aluminum, glass, steel, painted metal, plastic, stone, concrete and brick.

- .3 Type S-3: Paintable one-component polyurethane sealant; silane end-capped, non-sag, moisture-cure for general construction, low-VOC, to ASTM C920 type S grade NS class 35 or class 25 use NT, M, A, O. Meets ASTM C1248, meets CAN/CGSB 19.13-M87, meets U.S. Federal Specification TT-S-00230C Class A, Type II.
- .4 Type S-4: Horizontal joint sealant; two-component, self-levelling.
 - .1 To ASTM C920: type M; grade P; class 25; use T, M, O.
- .5 Type S-5: One-part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to ASTM C920, type S, grade P, class 50, use T, M, A, O.
- .6 Type S-6: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.
- .7 Type S-7: two-component, gun-grade, slump-resistant elastomeric polyurethane sealant, specially formulated for sealing joints in water-immersion conditions, and highly resistant to biodegradation by both aerobic and anaerobic bacteria; to ASTM C920, Type M, Grade NS, Class 25, use T, NT, M, G, A, O; certified to CAN/ULC S115.

2.3 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 Use 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/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .3 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.
- .2 Primer: Non-staining type as recommended by sealant manufacturer.
- .3 Joint Cleaner: Non-corrosive solvent type recommended by sealant manufacturer for applicable substrate materials.

2.4 COLOURS

- .1 Colours: Sealants to match colour of adjacent exposed material.

2.5 SEALANT SELECTION

- .1 General:
 - .1 Where no specified type of sealant is shown or specified, choose one of the sealants specified in this Section appropriate for its location and conditions as recommended by the sealant manufacturer in accordance with its warranty provisions and technical product datasheet.
 - .2 Make sealant selections consistent with manufacturer's printed guidelines.
 - .3 Always clean and prime bonding surfaces prior to applying sealants.
- .2 Type S-1: Mould and mildew resistant, interior sealing applications exposed to high moisture; designed to seal nonporous surfaces around showers, tubs, sinks and plumbing fixtures where conditions of high humidity and temperature extremes exist; sealing around shower-tub enclosures, tubs, sinks, urinals and whirlpools; sealing around bathroom fixtures; Waterproofing rimless sinks.
- .3 Type S-2: Use for metal-to-metal joints where no other specific sealant type is specified.
- .4 Type S-3: Paintable, use one-component polyurethane general construction sealant at joints other than metal-to-metal where no other specific sealant type specified, or where its paintable properties are required.
- .5 Type S-4: Use multi-component sealant for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .6 Type S-5: Use one-part sealant for horizontal joint sealant of plaza, floors and decks, exterior areas only, not subject to pedestrian and vehicular traffic.
- .7 Type S-6: Use control joint sealant as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .8 Type S-7: Use at floor-to-wall joints exposed to frequent floor washing and other joints exposed to frequent wetting; use as a wet area sealant for horizontal and vertical joints, and perimeter joints, at wet area applications. Use traffic grade (TG) at horizontal floor locations.

PART 3 EXECUTION

3.1 PROTECTION

- .1 Protect installed work of other trades from staining, damage, or contamination.

3.2 EXAMINATION

- .1 Verify condition of previously installed work upon which this Section depends. Report defects to Departmental Representative. Commencement of work means acceptance of existing conditions.
- .2 Ensure joints are suitable to accept and receive the sealants.
- .3 Ensure surfaces are sound, dry, and free from dirt, water, frost, loose scale, corrosion, bitumen, paints, and other contaminants that may adversely affect the performance of the sealing materials.
- .4 Do not apply sealant to masonry until mortar has cured.
- .5 Before any sealing work is commenced, test the materials for indications of staining or poor adhesion.

- .6 Ensure joints and spaces which are to receive sealants are less than 10 mm deep; not less than 6 mm wide; and not more than 19 mm wide.

3.3 SURFACE PREPARATION

- .1 Perform cleaning to the extent required to achieve acceptable joint surfaces, and as approved by sealant manufacturer.
- .2 Protect adjacent finishes from damage.
- .3 Cleaning Procedures:
 - .1 Metal:
 - .1 Blast cleaning: Sandblast or iron shot blast surfaces requiring heavy cleaning down to bright metal. Remove loose matter by compressed air or commercial vacuum cleaner.
 - .2 Power tool cleaning: Clean surfaces by wire brush, impact tools, abrasive wheels or by buffing. Remove loose matter by compressed air or vacuum cleaner.
 - .3 Solvent cleaning: Clean with solvent applied by spray or brush. Wipe with clean, dry wiping cloths. Remove paints with paint remover and wipe with solvent. Remove residue.
 - .2 Concrete, Marble, Stone, Brick:
 - .1 Remove friable material with wire brush or by chipping, until surfaces are sound. Remove surface residue with a stiff brush, vacuum cleaner or compressed air.
 - .2 Concrete surfaces shall be cured for at least 28 days. Acid etch joint surfaces to remove alkaline salts and neutralize acid with a solution of tri sodium phosphate, followed by rinsing with clean, cold water.
 - .3 Allow joints to dry thoroughly.
 - .4 Completely remove resinous products used, such as curing compounds and form release agents.
 - .3 Glass, Ceramics, and Porcelain: Brush with solvent and wipe with clean, dry wiping cloths. Remove residue.
 - .4 Wood: Remove foreign matter such as soil, paint, grease, bitumen, resin with solvents, abrasives and paint removers; remove residue. Provide surfaces that are clean and dry.
- .4 Do not exceed shelf life and pot life of the materials, and installation times, as stated by the manufacturers.
- .5 Be familiar with the work life of the sealant to be used. Do not mix multiple component materials until required for use.
- .6 Thoroughly mix multiple component sealants, and bulk sealants when recommended by manufacturer, using a mechanical mixer capable of mixing at 80-100 rpm without mixing air into the material. Continue mixing until the material is a uniform colour and free from streaks of unmixed material.
- .7 Mask areas adjacent to joints to be sealed. Prevent contamination of adjacent surfaces. Remove masking promptly after the joint sealing has been completed.

3.4 INSTALLATION

- .1 Install materials in compliance with the recommendations of their manufacturer.
- .2 Fill joints with joint backing to produce joint profile with optimum sealant cross section. Provide joint depth of one half the joint width.

- .3 Prime joints to receive sealants as recommended by the sealant manufacturer to prevent staining, to assist the bond and to stabilize pouring surfaces.
- .4 Apply primer with a brush that will permit joint surfaces to be primed. Perform priming immediately before installation of sealants, allowing minimal time between priming and sealing as recommended by the sealant manufacturer.
- .5 Sealants generally shall be of gun grade or knife grade non-sag consistency to suit the joint condition. Use gun nozzles of the proper sizes to suit the joints and the sealant material. Sealants for horizontal joints (other than overhead joints) shall be self-levelling type.
- .6 Install sealant with pressure operated guns.
- .7 Use sufficient pressure to fill all voids and joints solid. Sealant shall bond to the sides of the joint only and shall not adhere to the joint backing material. Provide bond breaker material where necessary.
- .8 Pour or gun self-levelling, low viscosity grades of sealant into horizontal joints. If applied by gun, hold the nozzle to the bottom of the joints to ensure complete filling of the joints.
- .9 Ensure that the correct sealant depth is maintained. Superficial coating with a skin bead will not be accepted.
- .10 Except as otherwise specified, sealant installations shall be a full bead free from air pockets and embedded impurities, providing smooth surfaces, free from ridges, wrinkles, sags, air pockets and imbedded impurities.
- .11 After joints have been completely filled, tool them neatly to a slightly concave surface.
- .12 Tool sealants to achieve airtight joints. Use wet tools as required.
- .13 Insert plastic vent tubes where required or shown, extending from the cavity to exterior face, sloped to the exterior. Seal around the tube and tool for positive adhesion. Insert joint backing for remainder of the joint. Do not plug vent tube during sealing operation.

3.5 REPAIR

- .1 Cut out damaged sealant, repeat preparation, prime joints, and install new material as specified, and acceptable to the manufacturer.

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01: 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 Division 01: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Division 01: Construction/Demolition Waste Management and Disposal.

3.2 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION