

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D1227-13, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
 - .2 ASTM D8099/D8099M-17, Standard Specification for Asphalt Emulsion Pavement Sealer (Mineral Colloid or Chemically Stabilized Type).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01: Submittal Procedures.
- .2 Product Data:
 - .1 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
 - .2 Submit product data sheets for bituminous dampproofing products including:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Application methods.
 - .4 Limitations.
- .3 **Manufacturer's Instructions: Submit manufacturer's written installation instructions indicating:**
 - .1 Special handling criteria.
 - .2 Installation sequence.
 - .3 Surface preparation.
 - .4 Environmental restrictions.
 - .5 Cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Obtain primary dampproofing materials from single manufacturer and/or ensure materials ordered and supplied are compatible with one another. Ensure dampproofing materials are compatible with air and vapour retarder specified under Section 07 27 13 – Modified Bituminous Air and Vapour Barrier.
- .2 Obtain secondary materials recommended by manufacturer of, and compatible with primary dampproofing materials.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store materials on supports to prevent deformation.
- .3 Remove only in quantities required for same day use.
- .4 Store materials in accordance with manufacturer's written instructions.

1.5 PROJECT/SITE ENVIRONMENTAL REQUIREMENTS

- .1 Temperature, relative humidity, moisture content.
 - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
 - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
 - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
 - .4 Do not apply dampproofing in wet weather.
- .2 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .3 Ventilation:
 - .1 Arrange for ventilation system to be operated during installation of dampproofing.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after dampproofing application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of dampproofing installation.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Emulsion Type Dampproofing Coating: Asphaltic, water-based emulsion dampproofing, asbestos free, designed for application to exterior side of below grade foundations and walls, containing no solvents in accordance with ASTM D1227 Type II Class I, and per following minimum criteria:
 - .1 Application Temperature: 7°C minimum and rising.
 - .2 Grade: heavy-paint consistency.
 - .3 Asphalt by weight: 41 - 51%.
 - .4 Behaviour at 60-degrees-C: no blistering / sagging / sliding.
 - .5 Solids by weight: 45 - 55%.
 - .6 Minerals or stabilizers by weight: 7 - 14%.

2.2 ACCESSORIES

- .1 Protection Board: Asphalt impregnated fibreboard, 13 mm thickness.
- .2 Board Rigid Insulation: foundation insulation as specified in Section 07 21 13.
- .3 Joint Sealing Compound: as recommended by dampproofing manufacturer.
- .4 Primer: as recommended by dampproofing manufacturer.

- .5 Patching Compound: fibred mastic compound as recommended by dampproofing manufacturer.
- .6 Reinforcing Fabric: asphalt coated fabric as recommended by dampproofing manufacture.

PART 3 EXECUTION

3.1 PROTECTION

- .1 Protect adjoining surfaces from soiling and/or staining during application.

3.2 EXAMINATION

- .1 Examine substrates and verify that surface smoothness, moisture emissions and other conditions affecting performance of materials specified in this Section complies with the dampproofing manufacturer's recommended substrate requirements.

3.3 PREPARATION

- .1 Protect and mask adjoining exposed surfaces from being stained, spotted or coated with dampproofing; prevent dampproofing materials from entering or clogging weep holes, drains and perimeter drainage systems.
- .2 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound and reinforcing fabric before applying dampproofing.
- .3 Clean substrates, remove projections; fill voids and apply bond breakers (if required), and apply primer as recommended by dampproofing manufacturer.

3.4 INSTALLATION

- .1 Apply dampproofing in accordance with material manufacturer's printed technical datasheet and specifications.
- .2 Apply dampproofing to provide a continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finish grade level to and including tops of foundation wall footings:
 - .1 Do not permit dampproofing to extend onto surfaces exposed to view in final construction.
 - .2 Reinforce changes in direction greater than 45° at intersections, projecting surfaces, internal and external corners, changes in plane, and across construction joints, cracks and honeycombing; apply additional coat of dampproofing material to embed reinforcing fabric into primary dampproofing membrane; extend reinforcing fabric 200 mm to each side of areas requiring reinforcing.
 - .3 Allow for additional coats to achieve required coating.
 - .4 Provide sufficient drying time between successive coatings.
 - .5 Provide drying time according to manufacturer's recommendations before backfilling. Allow for a range of ambient temperatures and humidity.
- .3 Seal holes around pipes and other services passing through coating surfaces by using joint sealing compound applied in accordance with manufacturer's directions.

3.5 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.

3.6 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 ASTM International (ASTM)
 - .1 ASTM C109/C109M-16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
 - .2 ASTM C321-00(2012), Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
 - .3 ASTM C348-14, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
 - .4 ASTM C452/C452M-15, Standard Test Method for Potential Expansion of Portland-Cement Mortars Exposed to Sulfate.
 - .5 ASTM C596-09(2017), Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
 - .6 ASTM C944/C944M-12, Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit the following in accordance with Division 01: Submittal Procedures.
 - .1 Manufacturer's printed data sheets, installation instructions and standard details.
 - .2 Laboratory test results and data that validates product compliance with the performance criteria specified.
 - .3 Copy of test report with magnified photos demonstrating crystalline growth within the concrete.
 - .4 Manufacturer's literature showing product's capability to post-seal cracks up to 0.3 mm that appear after the application.
 - .5 Written certification from manufacturer that proposed materials, details and systems comply with this Section and are compatible.

1.3 QUALITY ASSURANCE

- .1 Installer qualifications: Use a qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products, who has a minimum of 5-years of experience with installations of similar complexity and scope.
- .2 Obtain materials from single manufacturer or ensure that materials ordered and supplied are compatible with one another.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver Products and store off the ground under cover. Handle and protect Products from moisture in accordance with manufacturer's instructions.
- .2 Deliver Products in manufacturer's unopened containers, fully identified with brand, type, grade, class and all other qualifying information.
- .3 Provide safety data sheets for each product.

1.5 FIELD CONDITIONS

- .1 Maintain surfaces to be waterproofed and surrounding air temperature at not less than 5 degrees C for at least 48 hours before, during, and after application of waterproofing.
- .2 Do not apply products to frozen or frost-filled surfaces.
- .3 Exercise caution when temperatures exceed 32 degrees C. It may be necessary to apply waterproofing during times when the sun is not at its strongest.

1.6 WARRANTY

- .1 Warrant installed waterproofing to be free of leaks and defects including delamination for two years from date of Substantial Performance, with exception of structural cracks in the waterproofed concrete that are 0.3 mm wide or wider. Repair and/or replace defects and damages that appear during the warranty period to Owner's satisfaction and at no cost to Owner.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Crystalline Waterproofing: Blend of rapid-hardening Portland cement, specially treated quartz sand and a compound of active chemicals, with the following minimum performance requirements:
 - .1 Potable water certification: NSF/ANSI 61.
 - .2 Permeability in accordance with COE CRD-C48: 0.00 cm/sec permeability at 1.5 MPa or 148 m over 20 days testing period on negative side.
 - .3 Compressive strength, to ASTM C109: 70.3 MPa at 28 days.
 - .4 Flexural strength, to ASTM C348: 5 MPa at 28 days.
 - .5 Bond strength, to ASTM C321: 4.7 MPa at 14 days.
 - .6 Abrasion resistance, to ASTM C944: 1.28 g.
 - .7 Sulphate resistance, to ASTM C452: 0.0012 % at 28 days.
 - .8 Chloride Ion penetration, to AASHTO T-259: 99.99% resistant at 6 mm, 100% at 25 mm depth.
 - .9 Bond of reinforcement, to ASTM C321: No loss of bond due to waterproofing material.
- .2 Water: Clean, clear, non-alkaline and free of salts and other harmful elements; potable.
- .3 Patching Compound: Ready-mixed crystalline waterproofing and repair mortar as manufactured by waterproofing manufacturer for honeycombs, tie holes, seal strips, fillets, coves with following minimum characteristics:
 - .1 Compressive strength, to ASTM C109: 52.5 MPa at 28 days.
 - .2 Flexural strength, to ASTM C348: 4.8 MPa at 28 days.
 - .3 Shrinkage, to ASTM C596: Minimum 0.093% at 28 days; plus 0.073% at 120 days.
- .4 Plugging Compound for Active Water Penetrations: Accelerating agent for capillary waterproofing products or pulverized rapid-setting cement.

- .5 Premanufactured water stop at the base of the pits: Swellable Profiles and Sealants for Construction Joints, Penetrations and Waterproofing Detailing. Swellable waterproofing system products and materials shall be supplied by a single manufacturer and be compatible with waterproofing systems.
 - .1 Commercial-grade bentonite-based and/or acrylic-based water-swellable profiles, selected to suit job conditions and requirements.

PART 3 EXECUTION

3.1 APPLICATION

- .1 Examination:
 - .1 Examine substrates and adjoining construction and conditions under which work is to be installed. Do not proceed with work until unsatisfactory conditions are corrected.
 - .2 Verify following substrate conditions before application of waterproofing:
 - .1 Substrate condition is satisfactory and in accordance with manufacturer's instructions.
 - .2 Concrete surfaces have open pores and wood float finish on horizontal surfaces.
 - .3 Concrete surfaces are free of voids, spalled areas, loose aggregate and sharp protrusions, and with no coarse aggregate visible.
 - .4 Curing compounds or surface hardeners incompatible with waterproofing have not been used on concrete.
- .2 Preparation:
 - .1 Protect adjacent surfaces not designated to receive waterproofing.
 - .2 Remove grease, oil and other contaminants. Use steam cleaning, high-pressure water blasting, wet or dry sand blasting, wire brush or other methods recommended by waterproofing manufacturer to produce surfaces suitable for application of waterproofing.
 - .3 Follow manufacturer's instructions to clean and prepare surfaces and seal cracks and joints.
 - .4 Rout out faulty construction joints and visible cracks not subject to movement that exceed 0.3 mm in width to approximately 20 mm width and minimum 20 mm depth.
 - .5 Remove all protrusions, work back to sound concrete and chisel out any spalled or honeycombed areas.
 - .6 Roughen form tie holes.
 - .7 Stop water leakages according to manufacturer's plugging specifications.
 - .8 Rinse surfaces to be waterproofed several times and at least one day before application of waterproofing so that the concrete is thoroughly saturated. Surfaces shall be saturated surface dry when waterproofing system is applied. Remove all surface water on horizontal surfaces.
 - .9 Have items to be installed into substrate such as anchors, plates, supports etc. installed prior to installation of waterproofing.

- .3 Mixing:
 - .1 Mix waterproofing material in proportions recommended by manufacturer.
 - .2 Apply waterproofing material in accordance with manufacturer's specifications and recommendations.
- .4 Cavity Fill:
 - .1 Prime cavities at cleaned and prepared faulty construction joints, cracks, form tie holes, etc. with waterproofing material and fill flush to surface with patching compound in mortar consistency.
 - .2 Laminate patching compound in 2 to 3 layers in accordance with manufacturer's instructions for larger spalled or honeycombed areas.
- .5 Horizontal and Vertical Construction Joints:
 - .1 Prime seal strips and reglets in pre-formed 25 mm x 25 mm cavities with waterproofing material and fill flush to surface with patching compound in mortar consistency.
- .6 Freshly Poured Slabs:
 - .1 Dry-sprinkle waterproofing material to freshly poured slabs-on-grade at rate of 1 kg/sq.m and power trowel.
- .7 Vertical Surfaces:
 - .1 Apply base coat of waterproofing material in slurry consistency at uniform rate of 0.7 to 0.75 kg/sq.m. Apply using appropriate compressed air spray equipment, stiff masonry brush, or stiff broom.
 - .2 After base coat has reached initial set but is still "green" (tacky), apply finish slurry coat of waterproofing mixture at 0.7 to 0.75 kg/sq.m. Apply so that final brush or broom strokes leave parallel, uniform texture.

3.2 SWEALLABLE WATERPROOFING DETAILING SYSTEMS

- .1 Install sweallable waterproofing materials and products as required at pipe penetrations, cracks, cold joints, T-joints, evident working cracks, expansion and control joints, and isolation joints in conjunction with and in addition to waterproofing membrane system products and accessories in order to provide primary and supplementary waterproofing protection and security. Redundancy of protection is a project and Contract requirements.
- .2 Install sweallable waterproofing system products and materials in accordance with manufacturer's data sheets, printed installation instructions, and standard details.

3.3 CURING

- .1 Follow manufacturer's general instructions for curing and hardening of waterproofing material.
- .2 Protect surfaces from rain, frost, and drying out.

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. 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.

3.5 PROTECTION

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

3.6 SCHEDULE

- .1 Install at inside surfaces, 100% coverage, of the following:
 - .1 Pipe pits.
 - .2 Sump pits.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D1621-10, Standard Test Methods for Compressive Properties of Rigid Cellular Plastics.
 - .2 ASTM D2842-12, Standard Test Methods for Water Absorption of Rigid Cellular Plastics.
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CGA B149.1-15, Natural Gas and Propane Installation Code, Includes Update No.1 (2010).
 - .2 CAN/CGA B149.2-15, Propane Storage and Handling Code.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S604-16, Standard for Factory-Built Type A Chimneys.
 - .2 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

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 data sheet.
 - .2 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's 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 Storage and Handling Requirements:
 - .1 Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
 - .2 Protect plastic insulation as follows:
 - .1 Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - .2 Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.

- .3 Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
- .4 Care for insulation in accordance with PIMA technical bulletin 109.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- .1 Extruded polystyrene (XPS) to CAN/ULC S701 and as follows:
 - .1 Suitable for permanent below-grade applications.
 - .2 Type: 4
 - .3 Thermal Resistance: RSI 0.87/25 mm minimum.
 - .4 Edges: ship-lapped.
 - .5 Size: 610 mm x 2440 mm x thickness as indicated on Drawings.
 - .6 Compressive Strength: minimum 170 kPa at 10% deformation in accordance with ASTM D1621.
 - .7 Water Absorption: maximum 0.7% (% by volume) in conformance with ASTM D2842.

2.2 ACCESSORIES

- .1 Adhesive (for polystyrene): trowel consistency, synthetic rubber-based insulation adhesive compatible with polystyrene insulation; suitable for application in temperature down to -12°C. Complies with CGSB 71-GP-24M, Type II.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Examine substrates and immediately inform Consultant in writing of defects.
- .2 Prior to commencement of work ensure:
 - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 INSTALLATION: GENERAL

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.
- .5 Use only insulation boards free from chipped or broken edges that is dry, and unsoiled.
- .6 Use largest possible dimensions to reduce number of joints.
- .7 Offset both vertical and horizontal joints in multiple layer applications.
- .8 Do not enclose insulation until it has been reviewed by Consultant.
- .9 Install rigid insulation to maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements.
- .10 Saw-cut and trim insulation neatly to fit spaces. Butt edges and ends tight. Fit insulation tight against mechanical, electrical and other items protruding plane of insulation. Fill voids with foamed-in-place insulation compatible with installed insulation; refer to Section 07 21 19.
- .11 Follow the instructions for use of materials of insulation and accessory manufacturers.
- .12 Install insulation horizontally. Offset vertical joints minimum 300 mm.
- .13 Leave insulation joints unbonded over line of expansion and control joints; bond a continuous 150 mm wide strip of primary vapour membrane over expansion and control joints using compatible adhesive.

3.4 INSTALLATION: PERIMETER INSULATION

- .1 Install board insulation to vertical surfaces with adhesive applied in accordance with manufacturer's written instructions, and as follows:
 - .1 Interior Application: Extend boards as indicated on Drawings.
 - .2 Exterior Application: Extend as indicated on Drawings.
 - .3 Apply adhesive to the substrate by the "dab" method not less than 10 mm x 20 mm size at 150 mm centres; bed the insulation in the adhesive before the adhesive loses its tack or skins over.
 - .4 Protect below grade insulation on vertical surfaces from damage during backfilling by applying protection board; set in adhesive according to insulation manufacturer's written instructions.

3.5 INSTALLATION: UNDERSLAB INSULATION

- .1 Extend boards as indicated on Drawings and as follows:
 - .1 Lay boards on level compacted fill.
 - .2 Protect top surface of horizontal insulation from damage during concrete work by applying protection board.

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 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.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM)

- .1 ASTM C167-09, 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 C665-12, 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 F1667-11a1, 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: as indicated on Drawings, or as required to achieve specified R-values.

2.2 ACCESSORIES

- .1 **Insulation clips:**
 - .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.
- .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 Install batts between framing members, structural components and other items snug and tight.
- .3 Cut and trim batts neatly to fit spaces. Use batts free from ripped or damaged back and edges.
- .4 Do not compress insulation to fit into spaces.
- .5 Install batt insulation where indicated with continuous vapour retarder on the warm side of the insulation in accordance with ASTM C1320.
- .6 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .7 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.
- .8 Fill stud space of exterior framed walls with insulation full depth of studs.
- .9 Hold insulation in position with clips, wires or as recommended by manufacturer when insulation is installed in horizontal locations.
- .10 Do not enclose insulation until it has been reviewed by Departmental Representative.

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 32.1 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.) (1.3 to 1.8 lbs./cu.ft.) and minimum (RSI-value of 0.79 per 25 mm) (R-value of 4.5 per 1") 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 hollow metal doorframes, penetrations through air seal, and at framing perimeters as required to maintain continuity of air barrier.

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·s) @ 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 INFORMATION 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 minimum 3-years documented 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 32.1 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 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
 - .1 Architectural Woodwork Standards (AWS), 2nd Edition plus errata.
- .2 ASTM International (ASTM)
 - .1 ASTM D5116-17, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
 - .2 ASTM F1667-17, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA O118.1-08(R2013), Western red cedar shakes and shingles.
 - .2 CAN/CSA O141-05(R2014), Softwood Lumber.
- .4 Cedar Shake and Shingle Bureau (CSSB)
 - .1 CSSB Exterior and Interior Wall Manual, 2016 Edition.
- .5 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber, 2014 Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance Division 01: Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
- .2 Submit samples in accordance with Division 01: Submittal Procedures.
 - .1 Submit duplicate of each type of shingle and trim in required width, 600 mm long, in dry condition.
- .3 Manufacturer's Instructions: Provide to indicate special handling criteria and installation sequence.
- .4 Submit closeout data in accordance with Division 01: Closeout Submittals.
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions.
 - .2 Submit manufacturer's warranties as specified.

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, handle, store and protect materials in accordance with manufacturer's instructions.
- .2 Store materials in safe area, away from construction traffic; store under cover and off ground, protected from moisture.

1.5 WARRANTY

- .1 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 32.1 of General Conditions "C" is extended to 24 months.

PART 2 PRODUCTS

2.1 WESTERN RED CEDAR SHINGLES

- .1 Western Red Cedar Shingles: solid wood shingles, CSA 0118.1, graded to meet NLGA Grading Standards, CSA 0118.1, and as follows:
 - .1 Length: match existing;
 - .2 Exposure: to match adjacent existing;
 - .3 Width: 4" minimum, and to achieve width range and mix of adjacent existing;
 - .4 Thickness: as required to match adjacent existing;
 - .5 Profile: custom shaped as required to match adjacent existing;
 - .6 Premium Grade: 100% edge grain, 100% clear, and 100% heartwood.

2.2 WESTERN RED CEDAR ACCESSORIES

- .1 Trim boards, as required for a complete installation:
 - .1 Western Red Cedar: solid wood trim boards, graded to meet NLGA Grading Standards, paragraph 200 and WRCLA.
 - .2 Grade: Clear Heart, to NLGA 200a.
 - .3 Surface: surfaced one side and two edges (S1S2E).
 - .4 Texture: smooth.
 - .5 Moisture Content: kiln dried to less than 15% moisture content, confirm moisture content and provide testing results to Departmental Representative prior to application.

2.3 VENTILATING GRID

- .1 Ventilating Grid: Rigid, flat 1220 mm x 2440 mm engineered plastic grid panels with 6 mm long stand-off dimples for an overall panel thickness of 13 mm. Weight per panel shall be approximately 3.6 kg (113 g lb/.09 sq.m.). Vertical load capacity: ?3629 kg/.09 sq.m.. Ventilating grid shall be purpose-made to provide drainage and ventilation space in building assemblies (e.g., roof, wall, under slab, etc.).
- .2 Ventilating grid manufacturer's insect-resistant venting J trim end closures made from PVC, with vent holes punched in bottom of trough for drainage and ventilation.
- .3 Accessories: manufacturer's supplied or recommended stainless steel fasteners suitable for job conditions and substrates.

2.4 ACCESSORIES - GENERAL

- .1 Air and Vapour Barrier: to Section 07 27 14 - Air Barriers and Vapour Retarders.
- .2 Fasteners: to ASTM F1667, SAE No. 316 stainless steel, sized as required.
 - .1 Siding installation: stainless steel splitless ring-shanked nails with flat head. Splitless nails shall be minimum 7/32" (0.6 cm) head.
- .3 Sealants: to Section 07 92 00 – Joint Sealants.
- .4 Sheet Metal Flashing and Trim: to Section 07 62 00 – Sheet Metal Flashing and Trim.

2.5 FABRICATION

- .1 Fabricate mouldings, fascia, and trim to match adjacent existing work, to Architectural Woodwork Standards (AWS), Premium Grade.
- .2 Fabricate items rigid, plumb and square, as detailed, with tight, bevelled, hairline joints. Sand work smooth, set all nails and screws.

PART 3 EXECUTION

3.1 COMPLIANCE

- .1 General: comply with Part 9 - Housing and Small Buildings of the 2015 National Building Code of Canada.
- .2 Comply with manufacturers' printed installation instructions, technical datasheets, and standard and job-specific details for each product and assembly specified.
- .3 Cedar Shingle Siding: comply with CSSB Exterior and Interior Wall Manual.
- .4 Mouldings, Fascia, and Trim: comply with Architectural Woodwork Standards (AWS), Premium Grade.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Check and verify that no irregularities exist that would affect quality of execution of work specified.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.3 PREPARATION

- .1 Coordinate with Division 02 work, and coordinate sequence work with other trades as required.
- .2 Obtain measurements from site.
- .3 Protect finished surfaces and materials of other trades from damage.

- .4 Ensure services and roughing-in work, affected by, or are connected to or through this work, are complete and acceptable.
- .5 Be sure that the walls are smooth, without protuberances. Remove or hammer flush nail ends or points.

3.4 WEATHER BARRIER

- .1 Weather Barrier (air barrier): installation shall be in accordance with the requirements of Section 07 27 14 - Air Barriers and Vapour Retarders.

3.5 VENTILATION GRID SYSTEM (DRAINAGE PLAIN)

- .1 General: the gap (space between back of cladding and face of weather barrier) created by the ventilating grid system shall be minimum 25 mm.
- .2 Confirm that weather barrier system has been fully installed and reviewed by Departmental Representative.
- .3 Install grid system manufacturer's insect-resistant venting J trim at the bottom edge of base of walls, straight and true to line. Fasten in place as recommended by manufacturer.
- .4 Install ventilating grid, working from edges and openings using an uncut side of ventilating grid as a starter whenever possible to provide adequate support for terminal ends and edges of cedar roof shingles. Ensure approximately 13 mm gap between sheets to allow for expansion.
- .5 Cut ventilating grid sheets as required to suit during installation.
- .6 Fasten to substrate through weather barrier using recommended fasteners; fasten through pre-formed attachment holes located at every 4th grid interstation.

3.6 FLASHING

- .1 Sheet Metal Flashing and Trim: to Section 07 62 00.
- .2 Install flashings at windows, doors, and penetration details as required.
- .3 Install metal flashing over underlayment at corners.

3.7 SHINGLE INSTALLATION

- .1 Keyways shall match keyways of adjacent existing cedar shack siding, but not less than the following instruction:
 - .1 For every 4" width of dry Western Cedar shake material, the product will expand 1/8". Space keyways accordingly.
- .2 Keep ½-inch clearance of first course from surfaces below. Integrate flashings into the construction as recommended by the CSSB Exterior and Interior Wall Manual.
- .3 Select shingles that meet dimensional and profile requirements. Discard shingles that do not meet requirements.
- .4 Fasten wood shingles, two nails only per shake, 1-inch above the exposure line and 1-inch in from the sides.
- .5 Wall exposure for shingles and shingles shall be no more than 40% of their length, to provide full coverage in the spaces between them.

- .6 Mitre and lace cedar shingles at inside and outside corners; match construction at adjacent existing shake siding.

3.8 TRIM INSTALLATION

- .1 Installation standard / quality level: to Architectural Woodwork Standards (AWS), Premium Grade.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Form joints to conceal shrinkage.
- .4 Fastening:
 - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .3 Blind-nail to solid wood backing; fasteners shall penetrate 1-1/4" (32 mm) into backing.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

3.9 CAULKING

- .1 Seal gaps at windows, doors, corners, and other exterior joints that are exposed to potential water intrusion, to Section 07 92 00 – Joint Sealants: premium quality multi-component polyurethane sealant, colour to match expected weathered appearance of siding as closely as possible (submit samples to Departmental Representative for initial colour selections before ordering materials). Different colours will be required at white cedar and red cedar locations.

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 A653/A653M-15e1, Standard 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 C754-15 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .4 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .5 ASTM D822/D822M-13 Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .2 Canadian Roofing Contractors Association (CRCA)
 - .1 CRCA Roofing Specifications Manual, 2012.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA S136-12 Package, 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).
- .4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
 - .1 CCMC-2002, Registry of Product Evaluations.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 Architectural Sheet Metal Manual, 7th Edition, 2012.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and technical datasheets for sheet metal roofing assembly, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Proof of manufacturer's CCMC listing and listing number.
 - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

- .3 Shop Drawings:
 - .1 Indicate arrangement of pre-finished Roof Sheet, including joints, types and locations of supports, fasteners, flashing, gutters, mitres, and all metal components related to the roof installation. Include for underlayment as part of the roof system.
 - .2 Drawings shall be signed and sealed by a Professional Engineer attesting to the ability of the metal panels assembly to withstand the specified loads.

- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm coloured samples of each sheet metal material.

1.3 QUALITY ASSURANCE

- .1 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. Installer shall be a member of the Canadian Roofing Contractors Association or affiliate organization.
- .2 Obtain each type of metal roofing system through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location, and in accordance with manufacturer's recommendations.
 - .2 Store and protect sheet metal roofing assembly materials and products from damage or deterioration.
 - .3 Replace defective or damaged materials with new.

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.
- .3 Provide manufacturer's standard 35-year finish warranty for factory-applied PVDF coating system.

PART 2 PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 General: The complete roof cladding system shall meet the following performance/design criteria and maintain its intended appearance, remain wind and watertight, allow for expansion and contraction of metal components and transmit loads to the supporting structural back-up.
- .2 The Work of this Section shall comply with the requirements, guidelines and recommendations of the CRCA Roofing Application Standards Manual.
- .3 The design and erection of a complete metal roof system is the responsibility of this Section and shall be based on the performance criteria specified. The method assembly, reinforcing and anchorage is schematic and shows general intent only. Location and methods of providing same shall be this Section's responsibility, who shall design the assembly, reinforcing and anchorage to suit specific conditions in an acceptable manner complying with the requirements specified herein.
- .4 Design and install panel system and all connections to withstand earthquake forces, snow loads and wind loads in accordance with the requirements of the National Building Code of Canada 2015 and amendments (NBCC). Pull out resistance of fasteners shall be 1 kN or greater. Point load capacity per 100 mm diameter shall be 1.8 kN or greater.
 - .1 Design roof system to resist;
 - .1 Snow loads and snow build-up and rain load, expected in this geographical region NBCC climatic data, 50-year probability.
 - .2 Wind loads, positive and negative, expected in this geographical region NBCC climatic data, 50-year probability.
 - .3 Dead load of roof system.
 - .4 If the roof system is to be designed as a shear diaphragm, then the factored shear design loads "Q" and the flexibility factors "F" must be shown on the structural drawings.
 - .2 Deflection of the roof system is not to exceed 1/240th of the span for the specified live loading.
 - .3 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
 - .1 Temperature Change (Range): 20 deg C, ambient; 40 deg C, material surfaces.
- .5 Provide flashing as shown and as required to make the system wind and watertight, and still allow for thermal movement.
- .6 All fastenings shall be concealed to the maximum extent possible.
 - .1 Where exposed in finished surfaces, screw heads shall be neat and symmetrical, made completely watertight and capable of allowing expansion and contraction of metal roof cladding. Exposed fasteners shall be colour-matched stainless steel to finished metal cladding and as scheduled.

- .7 Thermal Movements: The metal wall and associated flashing systems shall be so designed and constructed as to provide for such expansion and contraction of component materials as will be caused by an ambient temperature range of -40°C to +60°C without causing harmful buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .8 Provide and/or make allowances for free noiseless vertical and horizontal thermal and wind loading movement, due to the contraction and expansion of any and all component parts.
- .9 Assembly and erection procedures shall take into account the ambient temperature range and wind pressure at the time of installation.
- .10 The system shall provide clear internal paths of drainage in order to drain any trapped moisture to the exterior, discharging moisture in a manner avoiding staining of architectural finishes, collecting in puddles, formation of unsafe icicles and dripping onto pedestrians.
- .11 Fasten panel assembly to building structure in a manner, which transmits all loads to the main structure without exceeding the capacity of any fastener.

2.2 PLYWOOD SHEATHING AND EXTERIOR GRADE PLYWOOD

- .1 Plywood sheathing and exterior grade plywood: Exterior Grade Douglas Fir Plywood to Section 06 10 00 - Rough Carpentry; roof sheathing shall have T&G edges.

2.3 AIR AND VAPOUR BARRIER MEMBRANE

- .1 High Temperature Roofing Membrane: self-adhered composite membrane consisting of a high softening point, SBS rubberized asphalt compound integrally laminated to a cross-laminated polyethylene film with anti-slip coating. Membrane shall meet or exceed the following minimum physical properties and tested values:
 - .1 Thickness: 1 mm.
 - .2 Minimum Application Temperature: $\geq 5^{\circ}\text{C}$.
 - .3 Elongation, to ASTM D412 Die C Modified, tested to ultimate failure of rubberized asphalt: 250%.
 - .4 Minimum Tensile Strength, to ASTM D412: $\geq 4128 \text{ kN/M}^2$.
 - .5 Flow @110°C, to ASTM D1970: None.
 - .6 Adhesion to plywood, to ASTM D903: 850 N/m.
 - .7 Flexibility at -43°C, to ASTM D1970: $< 0.004 \text{ cfm/ft}^2$.
 - .8 Water Vapour Transmission, to ASTM E96: 2.8 ng/Pa.s.m².
- .2 Accessories: provide membrane manufacturer's recommended or supplied primer, mastic, termination bars and anchors, roof to-wall pre-manufactured transition membrane, through wall membrane.

2.4 PREFINISHED SHEET METAL MATERIALS FOR ROOFING AND FLASHING

- .1 Allow for up to 10 weeks of lead time in Project Schedule
- .2 Panel: Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230, and as follows:
 - .1 Minimum Base Metal Thickness (i.e., prior to galvanizing): 0.76 mm (22 gauge).
 - .2 Surface: regular spangle.
 - .3 Profile similar to the following:
 - .1 T-style ribs at 400 mm spacing.
 - .2 Ribbed in direction of seam.
 - .3 Hidden fastener system, overlapping sheet joints.
 - .4 Colour: as selected by Departmental Representative from manufacturer's standard range.
 - .4 Factory-Applied Coating:
 - .1 Polyvinylidene fluoride (PVDF) factory-applied paint system over Galvalume™ hot dipped coated sheet metal.
 - .2 Class: FIS.
 - .3 Custom Coating System (allow extra time in schedule as required):
 - .1 Valspar Flurothane® Coastal coating; Colour: QC9937 Tan FC.
 - .4 Specular gloss: 30 units +/- 5 to ASTM D523.
 - .5 Coating thickness: Two-coat system with total Dry Film Thickness (DFT) of 1.7 to 2.0 mils.
 - .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.

2.5 INSULATION

- .1 Semi-Rigid Fibrous Insulation: Unfaced, preformed fibrous mineral slag board insulation in accordance with CAN/ULC S702 and as follows:
 - .1 ASTM C612 Type IVB.
 - .2 RSI value / 25.4mm @ 24°C: RSI 0.75/25 mm minimum.
 - .3 Combustion Characteristics: non-combustible in accordance with CAN/ULC S114.
 - .4 Flame spread and smoke developed = 0 in accordance with CAN/ULC S102.
 - .5 Tested to ASTM C795: Stress Corrosion Cracking Tendency of Austenitic Stainless Steel - Passed
 - .6 Tested to ASTM C665: Corrosion of Steel - Passed
 - .7 Density: 96 kg/m³.
 - .8 Compressive Strength to ASTM C1104: 17 kPa @ 10% compression, and 28 kPa @ 25% compression.

- .9 Reaction to moisture to ASTM C1338: Determination of Fungi Resistance - Passed.
- .10 Reaction to moisture to ASTM C1104: Moisture Sorption - 0.07%.
- .11 Edges: square.
- .12 Size: 406 mm x 1220 mm x thickness as indicated on Drawings.

2.6 ACCESSORIES AND OTHER MATERIALS

- .1 General: Provide components required for complete metal roofing assembly, including trim; copings; fascia; corner units; vented ridge cap, connector flanges, foam closures, and end panels; clips; flashings; sealants; gaskets; fillers; closure strips; etc. as required; match material and finish of metal roofing system.
- .2 Roof Vents/Louvers with insect/ critter/rodent protective screen critter/rodent proof.
- .3 Plastic cement: to CAN/CGSB-37.5.
- .4 Z-girts and C-channels: to CSA S136; minimum 1.2141 mm (18-gauge) thick; Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 Z girts and C channels, coating applied after fabrication.
- .5 Clip System:
 - .1 Thermally responsive clips to be fabricated from a minimum of 0.61 mm (0.018") steel, with minimum Z275 galvanized coating designed to accommodate expansion and contraction of the roof sheet.
 - .2 Roof Fasteners: as specified by manufacturer to resist wind uplift and sliding snow forces.
- .6 Seam Cap:
 - .1 Seam Caps: Provide seam caps for full length of the roof panel with sealant of non-skinning, non-drying sealant on the unexposed side. Caps to be mechanically seamed onto panel side-laps. Fabricated from Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 having a nominal core thickness 0.61mm (0.024"). Finish and colour to match roof sheet.
- .7 Clamp-to-Seam Snow Fence:
 - .1 Snow Brackets: extruded 6061-T6 aluminum.
 - .2 Z-Brackets: extruded 6005-T5 Aluminum.
 - .3 Tubing: 6061-T6 aluminum with 1" outside diameter and .0125 wall thickness.
 - .4 Tubing Couplers: 6061-T6 Aluminum shaft with stainless washers and tightening bolts, nylon slip washers and rubber expansion washers.
 - .5 Tubing Caps: Type 302 stainless steel.
 - .6 Tubing Collars: 6061-T6 aluminum with stainless steel set screws.
 - .7 Ice Stops: 601-T6 aluminum with stainless fasteners.
 - .8 Finish: mill finish.

- .9 Acceptable Materials:
 - .1 Z3 - 3 Bar Clamp-to-Seam Snow Fence, by Rocky Mountain Snow Guards, Inc., or similar with same or better performance characteristics and material properties, able to withstand same or higher loads.
- .8 Isolation coating: alkali-resistant bituminous paint.
- .9 Plastic cement: to ASTM D4586 / D4586M.
- .10 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
- .11 Sealant/caulking: neutral-cure silicone sealant, to ASTM C920 and ASTM C719 Class 50; \pm 50% movement capability.
- .12 Fasteners:
 - .1 Colour: match roof.
 - .2 Primary Seam Fasteners: metal screws with rubber washers as supplied or recommended by sheet metal roofing manufacturer. Self-tapping screws, hardened carbon steel shank with heavy cadmium plating and chromate finish, lengths as required.
 - .3 General Duty Fasteners: self-drilling metal screws as supplied or recommended by sheet metal roofing manufacturer, lengths as required.
- .13 Continuous butyl tape: as supplied or recommended by sheet metal roofing manufacturer.
- .14 Sheet metal flashing and trim: prefinished flashing materials to match roofing materials, except 0.8 mm minimum base metal thickness.
- .15 Penetration flashing: pre-manufactured silicone flashing able to withstand constant temperatures at the roofline of -50°C (-58°F) to 200°C (392°F) and up to 250°C (482°F) intermittently.
- .16 Touch-up paint: as supplied by sheet metal roofing manufacturer.

2.7 FABRICATION

- .1 Fabricate all components of the system in the factory to extent practicable, ready for field installation.
- .2 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.
- .3 Hem exposed edges on underside 12 mm, mitre and seal.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Notch Z-girts and C-channels as required to accommodate air-seal liner ribs and fins, and to allow drainage and air circulation under sheet metal roofing panels.
- .6 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

PART 3 EXECUTION

3.1 COMPLIANCE

- .1 Comply with sheet metal roofing manufacturer's printed installation instructions, technical datasheets and specifications.
- .2 Work shall meet or surpass CRCA Roofing Application Standards Manual guidelines.

3.2 COORDINATION

- .1 Cooperate and coordinate with other trades as required to ensure continuity of waterproofing, thermal barrier, vapour retarder and air barrier systems.

3.3 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.4 STRUCTURAL DECK

- .1 Roof sheathing: to Section 06 10 10 - Rough Carpentry and structural Drawings.

3.5 PREPARATION

- .1 Miscellaneous Supports: Install sub-framing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.
- .2 Install sheet metal flashings as required for proper drainage prior to installation of weather barrier materials. Weather barrier system shall overlap flashing for continuity of drainage and water flow management.
- .3 Ensure protrusions that may penetrate water resistive barrier membrane are removed before beginning installation.
- .4 Clean surfaces ready to receive materials.
- .5 Coordinate with other trades as required to maintain construction schedule.

3.6 AIR AND VAPOUR BARRIER MEMBRANE SYSTEM

- .1 Install in accordance with membrane manufacturer's printed installation instructions, technical datasheets and specifications.
- .2 Apply membrane parallel or perpendicular to slope. When applied perpendicular to slope, apply membrane beginning at low point and proceed in shingle fashion. Position the sheet to achieve correct overlap and alignment. Release upper half of release film by peeling off at 90° angle, then peel back second half of lower release film. Overlap on to clear film on sides and at ends a minimum of 70 mm for all applications. Apply firm hand pressure, or pressure with feet to press the membrane onto the substrate.
- .3 Roof Edge Applications: When membrane is folded over the roof edge, cover with sheet metal by flashing. Apply membrane far enough up the roof deck to meet local codes and to prevent leaks caused by ice dam formations.
- .4 Ridge & Valley Applications: Roll out and align manageable lengths of membrane. Slowly peel first half of release film. Press firmly in place beginning at center of ridge or valley. Repeat with second half of release film. Overlap at ends and sides a minimum of 75 mm. Apply in shingle fashion on valleys.
- .5 Vertical Termination Seals: Seal the top edge of vertical installations with a termination bead of membrane manufacturer's recommended polymer-modified sealing compound or sealant.

3.7 INSULATION

- .1 Insulation: to Section 07 21 13 – Board Insulation.

3.8 METAL ROOF PANEL INSTALLATION

- .1 Concealed Fastener Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's printed installation instructions, approved shop drawings, and project Drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- .2 Frame and close roofing system gable edges with C-channels and orient channel webs to face outwards.
- .3 Panel Sealants: Install manufacturer's provided or recommended tape sealant at panel side-laps and end-laps.
- .4 Panel Fastening: Attach panels to supports using screws, fasteners, and sealants specified by manufacturer and indicated on approved shop drawings.
 - .1 Fasten metal panels to supports at each location indicated on approved shop drawings, with spacing and fasteners specified by manufacturer.
 - .2 Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
 - .3 Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.9 CLAMP-TO-SEAM SNOW FENCE

- .1 Install snow fence at sloped roof location to hold and prevent snow from falling from roof as indicated, or as recommended by the snow fence manufacturer.
- .2 Follow architectural drawings or drawings supplied by manufacturer for location of snow brackets.
- .3 Follow manufacturer's installation instructions and layout guide.

3.10 ACCESSORY INSTALLATION

- .1 General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Coordinate installation with flashings and other components.
 - .1 Install components required for a complete metal panel assembly, including ventilating roof ridge, trim, copings, flashings, sealants, closure strips, and similar items.
 - .2 Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - .3 Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
 - .4 Cut neat holes in metal roofing to accommodate roof penetrations and install penetration flashing for a weather tight and watertight installation.
- .2 Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions. Sealing work consists of bedding between members where possible. Tool sealant to concave profile where exposed. Coordinate with Section 07 92 00 Joint Sealants.

3.11 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.

3.12 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-15, 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-15e1, 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, 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(2012)e1 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 - .9 ASTM F1667-15, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual, 2012.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A440-11 (R2016), NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights, Includes Update No. 1 (2014).
 - .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 Galvalume™ hot dipped coated sheet metal.
 - .2 Class: FIS.
 - .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: FIS-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 Consultant 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 Consultant.
- .2 Form gutters from 1.30 mm thick prefinished Z275 hot dip galvanized sheet metal. Sizes and profiles as indicated. Colours as determined by Consultant.
- .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 ASTM International (ASTM)
 - .1 ASTM C834-14, Standard Specification for Latex Sealants.
 - .2 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
 - .3 ASTM C920-14a, 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 D2240-15, 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 32.1 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