SECTION  – sbs modified bituminous membrane roofing - torch-torch

1. General
   1. summary
      1. Torch Base Sheet Torch Applied Cap Sheet: Fully adhered conventional roofing system with 2 ply assembly of pre manufactured SBS modified bituminous roofing membrane over membrane underlayment, insulation, vapour retarder adhered to gypsum board sheathing on steel deck as indicated on Drawings.
      2. Section Includes:
         1. Preparation of deck surface.
         2. Deck sheathing board.
         3. Vapour retarder.
         4. Roof insulation.
         5. Insulation overlay board.
         6. Base sheet and base sheet flashing.
         7. Cap sheet and cap sheet flashing.
         8. Accessory items.
         9. Sheet metal flashings related to roofing, including parapet and cap flashings.
      3. Related Requirements:
         1. Section 05 50 00 – Metal Fabrications.
         2. Section 06 10 00 – Rough Carpentry.
         3. Section 07 21 13 – Board Insulation.
         4. Section 07 62 00 – Sheet Metal Flashing and Trim.
         5. Section 07 72 33 – Roof Hatches and Accessories.
         6. Section 07 92 00 – Joint Sealants.
   2. reference standards
      1. Canadian Roofing Contractors' Association (CRCA):
         1. Roofing Specification Manual.
      2. American Society for Testing and Materials (ASTM):
         1. ASTM D 4263 83 (2012), Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
      3. Canadian General Standards Board (CGSB):
         1. CGSB 37 GP 56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing.
         2. CGSB 37 GP 64M, Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-up Roofing.
         3. CAN/CGSB 37.5 M89, Cutback Asphalt Plastic Cement.
         4. CAN/CGSB 37.28 M89, Reinforced, Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and Waterproofing.
         5. CGSB 37 GP 9Ma, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing or Waterproofing.
      4. Canadian Standards Association (CSA):
         1. CSA A123.4 04(R2013), Asphalt for Constructing Built up Roof Coverings and Waterproofing Systems.
         2. CSA A231.1-14/A231.2-14, Precast Concrete Paving Slabs / Precast Concrete Pavers.
         3. CSA B111 1974 (R2003), Wires, Nails, Spikes and Staples.
         4. CSA O121 08(R2013), Douglas Fir Plywood.
         5. CSA O151 09(R2014), Canadian Softwood Plywood.
      5. Underwriters Laboratories Canada (ULC):
         1. CAN/ULC S107-10, Methods of Fire Tests of Roof Coverings.
         2. CAN/ULC S701 11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
         3. CAN/ULC S702 14, Standard for Mineral Fibre Thermal Insulation for Buildings.
         4. CAN/ULC S704 11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.
   3. submittals
      1. Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
      2. Action Submittals: Provide the following submittals before starting any work of this Section:
         1. Product Data: Submit copies of membrane manufacturers current technical data sheets describing the physical properties and recommended installation procedures.
         2. Shop Drawings:
            1. Submit sloped insulation manufacturer's proposed roofing diagrams and layouts for review by the Consultant.
            2. Submit membrane manufacturer's standard details that will be used for this project, indicate changes that must be made to make the details project specific for review by the Consultant.
      3. Informational Submittals:
         1. Certificates:
            1. Provide roofing system materials that are compatible with building air and vapour retarders specified under Section 07 27 13 – Modified Bituminous Sheet Air Barriers.
   4. SYSTEM PERFORMANCE
      1. Roofing System: Prevent water migration from entering building through the roof membrane.
      2. Supply roofing materials from a single manufacturer, from roof deck to roof membrane, to ensure all system components are compatible and warranties can be achieved.
   5. QUALITY ASSURANCE
      1. Obtain roofing membrane materials through one source from a single manufacturer and install using workers who are trained and approved by the roofing membrane manufacturer; maintain a full-time experienced journeyman roofer, and at least one apprentice per crew on the Work at all times.
      2. Roofing and sheet metal work will be performed in conformance with the roofing manufacturer's written recommendations using materials that meet the requirements of CAN/ULC S107 to obtain a Class A fire resistance rating; submit proof that roofing materials meet required performance when requested by the Consultant.
      3. Conform to Roofing Specifications as published by Canadian Roofing Contractors Association (CRCA) as a reference.
      4. Perform the work of this Section by a company which is a member in good standing of the Ontario Industrial Roofing Contractors' Association (OIRCA) and which has a minimum of five (5) years of proven satisfactory experience in the Work of this Section.
         1. Follow Ontario Industrial Roofing Contractors' Association "Good Practice and Minimum Standards Code No. GP-67-1" latest revision when higher application standards are not specified.
      5. Execute work of this Section using an applicator approved by the roofing membrane manufacturer.
   6. fire protection
      1. Protect roof junctions at parapets, roof curbs and upstands with a fire-resistant tape or barrier to prevent combustible materials within assemblies from ignition arising from the use of torches. Install prior to installation of base sheets.
      2. Use a heat detector gun to spot any smouldering or concealed fire at the end of each workday. Establish a minimum one-hour fire watch after torch application.
      3. Do not apply torch directly to dry or unprotected wood surfaces.
      4. Maintain a clean site and have one approved ABC fire extinguisher within 6 meters of each roofing torch. Respect all safety measures described in manufacturer's technical data sheets. Do not place torches near combustible or flammable products.
   7. STORAGE, DELIVERY, HANDLING AND PROTECTION
      1. Deliver materials to the job site, handle and store in original packages and containers with manufacturer's seals and labels intact. The manufacturer's name, brand, mass, specification number and lot number must be shown on the labels.
      2. Store materials in weatherproof shelters having floors that will protect the materials from moisture. Store materials on end. Avoid prolonged exposure of light or heat sensitive materials to sunlight.
      3. Do not store materials on roof in concentrations that exceed design live load.
      4. Place plywood runways over the Work to enable the movement of materials and other traffic during construction of roofing.
      5. Protect surrounding surfaces against damage from roofing work. Where hoisting is necessary, hang tarpaulins to protect walls during delivery of materials from ground to roof.
      6. In the event of materials damage by the elements, improper handling or other causes, such materials will be rejected and will be replaced at no extra cost to the Owner. Remove rejected materials promptly from the site.
      7. During roofing work, exposed surfaces of finished walls must be protected with tarp to prevent damage. Contractor shall assume full responsibility for damage.
   8. PREINSTALLATION MEETING
      1. Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings.
      2. Include the roofing manufacturer's representative, roofing contractor's representative, the roofing inspector, the Contractor, the Consultant and Owner.
      3. The purpose of this meeting is to review installation conditions particular to this Project and review materials specified in this Section.
      4. The roofing inspector will complete the minutes and prepare a report for this meeting.
   9. Site conditions
      1. Minimum ambient application temperature shall not be less than -20 deg C. Notify Consultant and roofing inspector where installation is required below stated minimum temperature and submit manufacturer's standard cold weather installation practices prior to proceeding with Work of this Section.
   10. WARRANTY
       1. Manufacturer's Material Warranty:
          1. Contractor must warranty that the roofing membrane and membrane flashings will stay in place and remain leak proof for two (2) years.
          2. Roofing membrane manufacturer must warranty the membrane and membrane flashings for leak coverage as a result of faulty materials for a period of fifteen (15) years from the date of Substantial Completion.
       2. Workmanship Warranty:
          1. Submit a two (2) year written warranty of the workmanship of this Section against all failures except as the result of structural failure of substrate. The Contractor shall repair any leaks in roofing membrane, flashing membrane and related sheet metal work resulting from faulty workmanship for a period of two (2) years. Ensure warranty is submitted on OIRCA's "standard form of warranty."
       3. Submit for Owner's acceptance, manufacturer's warranty document indicated above, executed by an authorized company official.
2. Products
   1. fasteners
      1. Roofing Fasteners to Steel Decking: Cadmium-plated flat-headed, self-tapping screws, No. 12 of Type A or AB, in conformance with CSA B35.3.
      2. Insulation Fasteners to Decking: Screws and stress plates, galvanized steel, minimum 50 mm diameter spaced one per 0.25 m2, penetrating a minimum of 38 mm into top of flutes for corrosion and wind lift factors.
   2. Adhesives
      1. Membrane Roofing Materials Adhesive: Cold adhesive-mastic composed of a bituminous binder, added to bonding agents and solvents compatible with specified roofing products.
      2. Insulation and Cover Board Adhesive: Manufacturers standard adhesives specifically formulated for installation of plastic insulation to roofing materials.
   3. AUXILIARY LEVELLING SURFACE
      1. Glass Mat Faced Roof Boards: Non-structural, glass mat faced gypsum panels having water resistant core and proprietary non-asphaltic primed surface; and as follows:
         1. Applicable Standard: ASTM C 1177 for manufacturing; ASTM D 3273 for mould resistance.
         2. Thickness: 13 mm
         3. Surface Burning Characteristics: In accordance with CAN/ULC S102.
         4. Flame Spread: 0
         5. Smoke Developed: 0
         6. Long Edges: Square.
         7. Location: Roof substrates over steel decks and sheathing for parapets.
         8. Acceptable Materials:
            1. Georgia Pacific DensDeck Prime.
            2. CertainTeed GlasRoc Sheathing.
   4. VAPOUR RETARDER
      1. Modified bituminous, self-adhering roof membrane, designed specifically for installation to dry steel decks; width 1140 mm and having a non-slip surface and UV resistant opaque surface.
      2. Vapour Retarder Continuity Strip: SBS membrane with non-woven polyester reinforcement, glass grid and elastomeric bitumen. Sanded upper surface; underside self adhesive, compatible with wall and roof air/vapour retarder membranes as recommended by accepted membrane manufacturers below.
   5. CARPENTRY
      1. Wood roof materials shall be as specified in Section 06 10 00 – Rough Carpentry. Do not use pressure treated materials where SBS membrane materials are to be adhered to wood fabrications.
   6. INSULATION
      1. Primary Flat and Sloped Insulation: Polyisocyanurate foam rigid board roof insulation consisting of largest panels practical, having square edges, minimum LTTR RSI 1.04/25 mm, total thickness as indicated on Drawings, sloped to a minimum 2% perpendicular from edge of roof to a minimum thickness of 25 mm; conforming to ULC S704, Type 3, Class 2, to a tolerance not exceeding 3 mm from nominal size in any dimension:
         1. Acceptable Materials:
            1. Atlas AC Foam III.
            2. Johns Manville, E'NRG'Y 3.
   7. MEMBRANE UNDERLAYMENT
      1. Cover board for roof slope less than 6%: 25 mm asphalt coated wood fibreboard conforming to CSA A247 M, Type 1, apply in two layers of 13 mm with joints offset, fully adhered to primary insulation.
   8. FLAME-STOP MEMBRANE
      1. Description: Self-adhesive membrane composed of SBS modified bitumen and a glass mat reinforcement, designed to prevent flames from penetrating into voids, cavities, and openings before installing heat-welded membranes.
      2. Basis of Design Materials: SOPRAGUARD Tape by SOPREMA.
   9. ACCEPTABLE MEMBRANE MANUFACTURERS
      1. Products from the following membrane manufacturers are acceptable for Work of this Section, use only materials from one manufacturer:
         1. Soprema Canada.
         2. Henry Company.
         3. IKO Industries Ltd.
   10. ROOF MEMBRANE BASE SHEETS
       1. Membrane for torched application, for use with roof slopes less than 6%.
       2. Roofing membrane with glass-mat reinforcement and elastomeric bitumen, top and bottom face covered with thermofusible plastic film, in accordance with CGSB 37 GP 56M, type 2, class C, grade 1.
       3. Components and Characteristics:
          1. Reinforcement: Non-woven polyester.
          2. Elastomeric Bitumen: Mix of selected bitumen and SBS polymer.
          3. Mark top face with lines to ensure proper roll alignment.
          4. Reinforcing Weight: 180 g/m2.
          5. Membrane Thickness: minimum 2.2mm.
       4. Basis of Design Materials: Sopralene FLAM 180 by Soprema
       5. Membrane Base Sheet Flashing (stripping):
          1. Primer: Manufacturer's recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of self adhesive membranes suitable for application temperatures.
          2. Roofing membrane with non-woven polyester reinforcement and glass grid and elastomeric bitumen. Top face covered with thermofusible plastic film, underside self adhesive and protected by silicone release paper in accordance with CGSB 37 GP 56M type 2, class C, grade 1.
          3. Components and Characteristics:
             1. Reinforcement: Non-woven polyester and glass grid.
             2. Elastomeric Bitumen: Mix of selected bitumen and SBS polymer.
             3. Mark top face with lines to ensure proper roll alignment.
             4. Reinforcing Weight: minimum 160 g/m2.
             5. Membrane Thickness: minimum 3.0mm.
          4. Basis of Design Materials: Flam Stick by Soprema.
   11. ROOF MEMBRANE CAP SHEETS
       1. Field area and flashing cap sheets:
          1. Roofing membrane with non-woven polyester reinforcement and elastomeric bitumen with flame-retarding agent. Top face protected by coloured granules, underside covered with a thermofusible plastic film, in accordance with CGSB 37 GP 56M type 1, class A, grade 2.
          2. Components and Characteristics:
             1. Reinforcement: Non-woven polyester.
             2. Elastomeric Bitumen: Mix of selected bitumen and SBS polymer.
             3. Protection: Coloured granules - light grey.
             4. Reinforcing Weight: 250 g/m2
             5. Membrane Thickness: 4 mm
             6. ULC Class **[C] [A]**
          3. Basis of Design Materials: Flam 250 Granules by Soprema.
   12. FLASHING AND SHEET METAL
       1. Hot-dipped galvanized steel, prefinished of colour selected by Consultant and as specified in Section 07 62 00 – Sheet Metal Flashing and Trim.
   13. CONCRETE PAVERS
       1. Concrete Pavers: High density hydraulic pressed pavers, nominal 600 mm x 600 mm weight not exceeding 45 kg per unit, colours selected by Consultant from standard range, **[having a minimum Solar Reflective Index (SRI) 78]**, and as indicated on Drawings.
       2. Pedestals: High density polyethylene formed into an 8 x 8 grid like structure with integral spacer ribs on upper surface and shims for proper level alignment.
   14. ACCESSORIES
       1. Bituminous Primer: Asphaltic, and compatible with SBS modified bituminous membrane.
          1. Basis of Design Materials: Elastocol 500 by Soprema.
       2. Torches: Use only torches designed for torching roofing material and acceptable to manufacturer.
       3. Roof drain: Refer to Mechanical Drawings.

SPEC NOTE: Use the following for conventional ballasted roofing.

* + 1. Ballast: River gravel, round, washed, free from dust, humidity, ice, snow and foreign objects. Nominal diameter 38 mm, applied at a rate of 50 kg/m2.

1. Execution
   1. SURFACE EXAMINATION AND PREPARATION
      1. Surface examination and preparation must be completed in conformance with manufacturer's written instructions.
      2. Inspect deck conditions (including slopes and wood blocking), including but not limited to: up stands and parapets, construction joints, roof drains, plumbing vents, ventilation outlets and other penetrations. Notify Contractor of conditions that do not conform to manufacturer's requirements so that required corrections can be made. The start of roofing work will mean roofing conditions are acceptable for work completion.
      3. Do not begin work before surfaces are smooth, dry, and free of ice and debris. Use of calcium or salt is forbidden for ice or snow removal.
      4. Do not start Work of this Section until plumbing, carpentry and other related work has been completed.
      5. No materials shall be installed during rain or snowfall.
      6. Provide fire protection during installation.
   2. METHOD OF INSTALLATION
      1. Install roofing elements on clean and dry surfaces, in conformance with manufacturer's instructions and recommendations.
      2. Roofing work must be completed in a continuous fashion as surfaces are readied and weather conditions permit.
      3. Seal seams that are not covered by a cap sheet membrane in the same day. Do not install cap sheet if any moisture is present at base sheet seams.
      4. Whenever membranes are torch applied, a continuous and even bead of molten bitumen must be visible as the membrane is unrolled and torched.
   3. SITE PROTECTION
      1. Protect finished work to avoid damage during roof installation and material transportation. Install protective boardwalks over installed roofing materials to enable passage of people and products. Assume full responsibility for any damage.
   4. EQUIPMENT FOR WORK EXECUTION
      1. Maintain roofing equipment and tools in good working order.
      2. Use torches recommended by roofing materials manufacturer.
   5. GYPSUM BOARD INSTALLATION ON STEEL DECK
      1. Screw gypsum board levelling surface into the upper rib surfaces at a minimum rate of one (1) fastener per 0.25 m2, 12 screws and washers for each 1220 mm x 2440 mm board.
      2. Increase rate to one (1) fastener per 0.20 m2, 15 screws and washers for each 1220 mm x 2440 mm board, for a distance of 2440 mm around the perimeter of the roof and 45 degrees across the corners at a distance of 3050 mm from the corner of the building.
      3. Cut boards so edges rest on centre of upper ribs. Cut straight lines with adequate tools.
      4. Where slopes change directions, cut boards cleanly. Avoid breaking boards to acquire deck form. Place boards perpendicular to deck ribs for continuous support at extremities.
      5. Board joints must be staggered, in half-lengths, and perfectly butted. Joints must be sealed with heat-resistant tape in both directions to prevent any asphalt leakage into building interior.
   6. INSTALLATION OF VAPOUR RETARDER - SELF-ADHERED
      1. Overlap self-adhered roof vapour retarder onto the air and vapour retarder membrane from adjoining walls to ensure total continuity.
      2. Overlap side and end laps in shingle fashion, a minimum of 50mm (2").
      3. Install self-adhering vapour retarder membrane at insulation perimeters and around each element piercing the insulation to ensure sealed connections with base sheet at up stands.
      4. Apply firm pressure over entire surface of vapour retarder by rolling to ensure full contact to substrate.
   7. INSULATION INSTALLATION
      1. Adhere insulation with adhesive in conformance with manufacturer's recommendations for wind uplift criteria for building type, height and geographic location. Adhesive must be applied to clean surfaces in accordance with manufacturers written instructions.
      2. Vertical joints between level boards and sloped modules, and between two rows of insulation board must be staggered.
      3. Install only as much insulation as can be covered by roof membranes the same day.
   8. INSTALLATION OF MEMBRANE UNDERLAYMENT (CONVENTIONAL ROOFING)
      1. For slopes greater than or equal to 6%, use mechanical fasteners at base of slopes and horizontally across the slope at maximum 10 metre intervals. Install fasteners so that they hold down insulation and membrane. It is not expected that roof slopes will exceed 9%. Fasteners must penetrate the top flute of the steel deck.
      2. For roofs with slopes less than 6%, apply hot asphalt at a minimum rate of 1 kg/m2, following methods and temperatures recommended by insulation manufacturer and the CRCA to underside of membrane underlayment boards. Once asphalt has cooled but is still hot enough for good adherence without burning, install boards on primary insulation.
      3. Firmly set the membrane underlayment boards, long joints continuous and short joints staggered. Boards must be evenly and tightly butted together, with joints offset from primary insulation joints.
      4. Apply only as many boards as can be covered by roofing membrane in the same day.
      5. Cut out a 10 mm slope in a 610 mm radius around drains.
   9. INSTALLATION OF FLAME-STOP MEMBRANE (SELF ADHERED MEMBRANE)
      1. Apply self-adhering perimeter fire seal directly to perimeter and curb substrates prior to application of base sheet materials, to vertical joints in parapet or curb sheathing, and at vertical corners.
      2. Extend material 75 mm up face of parapet and 75 mm onto substrate, use hand roller to remove air bubbles.
      3. Install perimeter fire seal to act as temporary moisture seal until installation of flashing materials.
   10. INSTALLATION OF BASE SHEET (TORCH APPLIED MEMBRANE)
       1. Unroll base sheet dry onto substrate with first side lap lined up with drain centre and parallel to roof edge.
       2. Weld base sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as base sheet unrolls.
       3. This base sheet membrane must be welded directly to the substrate, proceeding from top to bottom using a propane torch.
       4. Avoid overheating. Take care to avoid excessive bitumen bleed-out at joints during installation.
       5. Ensure joints between the two layers of membrane are staggered by at least 300 mm.
       6. Overlap sheet side laps by 75 mm and end laps by 150 mm. Cut off corners at end laps to be covered by next roll.
       7. Complete welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam.
       8. Once base sheet is installed, carefully check overlapped joints.
   11. BASE SHEET FLASHING INSTALLATION (SELF ADHERING MEMBRANE)
       1. Prime substrates in accordance with manufacturer's written instructions and materials. Apply base sheet flashing membranes only when primer coat is dry.
       2. Install base sheet flashing in one (1) metre widths to cover roofing substrate over 100 mm. Overlap side laps by 75 mm. Stagger side laps by at least 100 mm from base sheet overlaps on roof to avoid excessive layering.
       3. Apply base sheet flashing directly onto substrate by removing silicone paper cover sheet. Torch roof's base-sheet plastic film on installation zone. Proceed from top to bottom. Once in place, apply pressure manually in a uniform fashion to obtain homogenous adherence over entire surface. Preferably, seal seams with rubber roller. Torch weld seam parts that are not self-adhering 38 mm at sides and 110 mm at ends). Nail at 300 mm O/C in accordance with manufacturer's written instructions.
       4. Avoid forming wrinkles, air pockets or fish mouths.
   12. ROOFING CAP SHEET INSTALLATION (TORCH APPLIED MEMBRANE)
       1. Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
       2. Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge).
       3. Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
       4. Avoid overheating. Take care to avoid excessive bitumen bleed-out at joints during installation.
       5. Unless overlap widths differ between cap and base sheets, make sure joints between the two layers are staggered by at least 300 mm.
       6. Overlap cap sheet side laps by 75 mm and end laps by 150 mm. Cut off corners at end laps to be covered by next roll. Overlap surfaces must be granule-free or degranulated.
       7. Complete welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam.
       8. Once cap sheet is installed, carefully check overlapped joints. Leave bleed-out at joints ungranulated until inspected and accepted by the roofing inspector. Apply coloured granules to bleed-out area by priming with self adhesive primer, and while still tacky shake granules onto surface and press into place.
   13. CAP SHEET FLASHING INSTALLATION
       1. Install cap sheet in one (1) metre widths. Overlap side laps by 75 mm. Stagger base and cap sheet overlaps on roof by at least 100 mm to avoid excessive layering. Make overlaps 150 mm wide.
       2. Draw parallel chalk line 150 mm from up stand or parapet bases.
       3. Sink surface granules into bed of hot bitumen with torch and round-nosed trowel from chalk line on roof to up stand or parapet base as well as over granulated vertical parts to be overlapped.
       4. Torch weld cap sheet directly onto base sheet from top to bottom to soften both membranes and obtain homogenous seal.
       5. During installation, avoid overheating membrane and excessive bitumen bleed-out at joints.
   14. WATERPROOFING AT ROOF DRAINS
       1. Mechanical drains: Install mechanical drains in accordance with the requirements of Division 22.
       2. Drains with Compressible Connectors:
          1. Install base sheet centred on drain. Cut opening of same diameter as down pipe for required water drainage.
          2. Install drain on base sheet in a layer of adhesive. Mechanically fastened to support.
          3. Torch weld base sheet roofing membrane reinforcement band 1000 mm x 1000 mm in a diagonal position to base sheet and previously primed drain flange. Apply manual pressure at drain connectors.
          4. Install cap sheet to edge of opening.
          5. Fasten dome to drain.
   15. WATERPROOFING FOR VARIOUS DETAILS
       1. Install waterproofing membranes in conformance with various roofing details illustrated in the manufacturer's installation manual and as submitted for review as noted above.
   16. APPLICATION OF GRAVEL BALLAST (CONVENTIONAL ASSEMBLY)
       1. Do not spread ballast until seams have been inspected and approved by roofing inspector.
       2. Pile the gravel in measured piles of approximately 226 kg at regular spacing before proceeding with spreading to ensure consistent thickness after application.
       3. Apply gravel over surface of filter cloth at a rate of approximately 50 kg/m2.
       4. Do not adhere gravel, spread ballast evenly to required weight.
   17. INSTALLATION OF CONCRETE PAVERS
       1. Install pavers on prefabricated pads in accordance with paver pad manufacturer's written instructions.
       2. Maintain pavers level using manufacturer's shims, where additional height is required, install additional pads. Where height adjustment exceeds 25 mm, adjust height using high density geotechnical insulation.
   18. SHEET METAL FLASHING AND TRIM
       1. Complete flashing work using specified materials described on plans and details, and as described in Section 07 62 00 – Sheet Metal Flashing and Trim.
       2. Nails, staples, screws, bolts, washers, and other metal fasteners will be made of compatible and rust-proof metals, of same colour as surfaces with which they are in contact.
       3. Shaping:
          1. Take special care when shaping sheet metal with a permanent finish.
          2. Bend sheet metal using sheet metal break. When possible, use bench and appropriate tools for shaping, bending and welding work.
          3. Fold back exposed edges by 13 mm to hide and strengthen edges.
          4. Corners, fasteners, angles and joint covers must be of same metal, gauge and finish as metal being shaped.
       4. Installation:
          1. Sheet metal work will conform to details, with plumb profiles free from deformities or defects that may hinder appearance.
          2. Space angles, fasteners, and seams to allow for normal expansion and contraction.
          3. Fasteners will be concealed type unless Consultant approves exposed fasteners in designated locations prior to installation. Metalwork must be fastened, and corners and angles must be perfectly aligned.
          4. Caulk sheet metal joints and junctions with other materials.
          5. At junctions between roof and masonry surfaces, scrape out joints to a 25mm (1") depth, insert flashing, fasten, and seal with specified sealer.
          6. Install appropriate flashing, cap sheet, counter flashing, casings and other accessories to vents, pipes, and other ducts to ensure perfect sealing.
   19. CLEANING
       1. The work site must be routinely cleared of rubbish and other materials that may hinder roof installation, performance or present a fire hazard.
       2. At completion of work remove waste materials and items that could cause a roof puncture.
       3. Clean adjacent surfaces of asphalt, bitumen, and other roofing materials deleterious to appearance or function.
   20. FIELD QUALITY CONTROL
       1. Inspection and testing of roofing application will be carried out by testing laboratory designated by Owner in cooperation with the Consultant.
       2. \*\*\*\*\*\*\*Inspection fees will be paid by the Owner in accordance with Section 01 45 00 – Quality Control, **[from the Cash Allowance on behalf of the Owner in accordance with Section 01 21 00 – Allowances.]**
   21. protection
       1. Protect installed work and materials.

END OF SECTION