

PART 1 – GENERAL**1.1 GENERAL INSTRUCTIONS**

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

1.2 SECTION INCLUDES

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1.3 SUMMARY

- .1 Section includes:
 - .1 Two-ply styrene-butadiene-styrene (SBS) modified bituminous membrane roofing; as follows:
 - .1 Exposed membrane roofing system.
 - .2 Roofing insulation.
 - .3 Air and vapour barrier.
 - .4 Associated roofing accessories and *Products*.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with Divisions 21, 22 and 23 to ensure that roof drains are suitable for roofing system design.
 - .2 Coordinate with *Subcontractors* of roof mounted items, equipment, and mechanical and electrical work at roof so that installation will not subvert the integrity of the roofing system.
 - .3 Coordinate with installation of air barrier at walls to ensure complete continuity of air barrier system for building. Roofing air barrier membrane to lap by 75 mm (3") minimum and terminate with wall system air barrier membrane.
 - .4 The *Contractor* shall ensure that the manufacturer meets with the necessary parties at the *Site* to review and discuss *Project* conditions as it relates to the integrity of the roofing assembly.

1.5 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 *Product* data sheets:
 - .1 Submit manufacturer's *Product* data sheets for each type of *Product* indicated in the Shop Drawings.

.3 *Shop Drawings*; general details:

.1 Include plans, elevations, sections, details, and attachments to other work for the following:

- .1 Base flashings, cants, and membrane terminations.
- .2 Tapered insulation, including slopes.
- .3 Crickets, saddles, and tapered edge strips, including slopes.
- .4 Insulation fastening patterns.

.4 Certificates:

- .1 Installer certificates: The *Contractor* shall *Provide* installer certificates signed by the roofing system manufacturer certifying that installer is approved, authorized, or licensed by manufacturer to *Install* roofing system.
- .2 Manufacturer certificates: The *Contractor* shall *Provide* manufacturer certificates signed by the roofing manufacturer certifying that roofing system complies with requirements specified in subsection 2.2 - Performance/Design Requirements– of this Section.

- .1 Submit evidence of compliance with performance requirements.

.5 Roofing manufacturer's warranty and design criteria:

- .1 Submit copy of completed roofing manufacturer's pre-installation notification form at least 10 *Working Days* prior to commencement of roofing installation.
- .2 Submit copy of roofing manufacturer's warranty specimen and warranty design criteria for roofing system prior to commencement of roofing installation.

.6 Samples:

- .1 Submit samples complete with the manufacturer's labels intact, of materials to be used for work of this Section prior to commencement of work. Allowing 5 working days for review and acceptance by the *Consultant* and roofing inspection company. Do not proceed with work until samples are accepted.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.

1.7 QUALITY ASSURANCE

.1 Qualifications:

- .1 Manufacturers: Company specializing in manufacturing the *Products* specified in this Section, with a minimum of 10 years' experience.
- .2 Installers / applicators / erectors: The *Contractor* shall *Provide* work of this Section, executed by competent installers with minimum five years' experience in application of *Products*, systems and assemblies specified and with approval and training of *Product* manufacturers.

- .1 The roofing *Subcontractor* must be approved by the membrane manufacturer for the warranty program specified. Submit *Subcontractor's* certification letter prepared by the membrane manufacturer.
- .2 Execute work of this Section only under full time supervision of qualified *Subcontractor's Site* supervisor.
- .3 Mock-up:
 - .1 Prepare a 10 m² (100 ft²) mock-up of the work of this Section. Incorporate materials and methods of fabrication and installation identical with project requirements.
 - .2 Install mock-up at roof area location directed by the *Consultant*. Retain accepted mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and workmanship.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver roofing materials to the *Site* in original containers with seals unbroken and labelled with the manufacturer's name, *Product* brand name and type, date of manufacture, and directions for storage.
- .2 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- .3 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- .4 Handle materials carefully to preclude damage. Follow manufacturer's written recommendations.
- .5 Package materials and identify on attached labels the manufacturer, brand, contents, weight as applicable, and *Product* and specification numbers.
- .6 Protect edges of roll goods from damage during handling, and store rolls on end to prevent flattening.
- .7 Do not store roofing materials on roof. Store them in a dry area protected from inclement weather while roofing installation is not in progress. Store above materials under opaque, breathable and waterproof tarpaulins or in sheds.
- .8 Prevent compression of insulation panels at any point and breakage of edges and corners. Discard wet, cupped, bowed, or otherwise damaged insulation from *Place of the Work*.
- .9 Protect edges and corners of precast concrete paving slabs to prevent damage.

1.9 FIELD CONDITIONS

- .1 Weather limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 EXTENDED WARRANTY

- .1 Warrant work of this Section in accordance with Section 01 78 36 - Warranties for a period of two years from the date of Substantial Performance.
- .2 In addition, roofing manufacturer shall *Provide* total system warranty including the following:

- .1 Roofing membrane manufacturer will issue a written document in the *Owner's* name, valid for warranty duration, for the repair of leaks in the roofing membrane to restore the roofing system to dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. Include copy of required warranty with close out documentation.
- .2 Warranty shall cover entire cost of the repair(s) required to maintain dry and watertight roofing system during the full warranty duration.
- .3 Warranty shall include for labour, materials, and workmanship.
- .4 Warranty shall be non-prorated with no dollar limit (NDL) for duration of warranty.
- .5 10-year warranty duration from the date of Substantial Performance.

PART 2- PRODUCTS

2.1 ROOFING SYSTEM MANUFACTURER

- .1 General:
 - .1 Single source responsibility: each roofing component to be by one manufacturer.
- .2 Acceptable roof system manufacturers: Subject to compliance with requirements, *Provide Products* by one of the following:
 - .1 Firestone Building Products.
 - .2 GAF Materials Corporation.
 - .3 IKO Industries.
 - .4 Siplast.
 - .5 Soprema.
 - .6 Or *Equivalent*.

2.2 PERFORMANCE/DESIGN REQUIREMENTS – GENERAL

- .1 Roofing system: The roofing system shall include roofing system materials required to achieve roofing membrane manufacturer's warranty.
- .2 Roofing materials, components, and assemblies shall resist environmental and wind (uplift) loads, and effects of those loads in accordance with the Ontario Building Code.
- .3 General performance: Installed roofing system and base flashings shall withstand wind uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.
- .4 Material compatibility: *Provide* roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- .5 Roofing system: Prevent water from entering building and roofing assembly through roofing membrane.
- .6 Roofing system design:

- .1 Roofing system assemblies shall have been successfully tested by a qualified testing agency to resist project roofing uplift pressures in accordance with the Ontario Building Code.
- .2 Roofing system shall meet roofing system manufacturer's 145 kph (90 mph) wind speed requirements or equivalent FM Class 60 Windstorm Classification for wind uplift pressures, and to cladding design wind loads indicated in wind study report, as applicable.
- .7 Roof covering classification: Roof assembly shall have a Class C classification as determined in conformance with CAN/ULC S107-10 "Standard Methods of Fire Tests of Roof Coverings".
- .8 Air barrier system shall accommodate substrate movement, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding the following specified limits and requirements:
 - .1 Air permeance of air barrier material: Maximum 0.02 L/s m² at 75 Pa (0.004 cfm/ft² at 1.57 psf) in accordance with ASTM E2178-13.
 - .2 Rate of air leakage of air barrier system: Maximum 0.15 L/s m² at 75 Pa (0.030 cfm/ft² at 1.57 psf) in accordance with ASTM E283-04 (2012).
 - .3 Water vapour transmission for air / vapour barriers: Maximum 5.7 ng/Pa.m².s. (0.1 perms).
 - .4 Pull-off strength of liquid or sheet applied membrane and laps: Cohesive or substrate failure permitted when tested to specified wind load. Air barrier system shall transfer wind load to structure and shall resist 100% of design wind load or minimum of 2.15 kPa (45 psf), whichever is greater.
 - .5 Low temperature flexibility: to -30°C (-22°F) in accordance with CGSB 37-GP-56M-1985.
- .9 Air barrier system shall be joined in an airtight and flexible manner to air barrier material of adjacent building envelope air barrier systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between the following unless otherwise applicable:
 - .1 Walls and openings.
 - .2 Across construction, control, and expansion joints.
 - .3 Penetrations.
- .10 Solar Reflectance: roof shall have a minimum Solar Reflectance Index (SRI) of 78.

2.3 PERFORMANCE/DESIGN REQUIREMENTS – FIRE PROTECTION

- .1 At the end of each *Working Day*, use a heat detector gun or equipment as recommended by the membrane manufacturer to spot smouldering or concealed fire. Schedule the work to ensure workers are still on location at least two hours after torch application.
- .2 Never apply the torch directly to any wood surfaces. Conform with fire safety recommendations of the manufacturer and the CRCA.
- .3 Throughout roofing installation, maintain the *Place of the Work* in a clean condition and have one approved ABC fire extinguisher within 6 m of each roofing torch. Torches must never be placed near combustible or flammable *Products*.

2.4 ROOFING MEMBRANE AND FLASHING SHEETS

- .1 Roof membrane base sheet and base sheet flashing: CGSB 37.56, SBS-modified asphalt membrane sheet.
 - .1 Reinforcement:
 - .1 180 gm/m² non-woven polyester.
 - .2 Thickness:
 - .1 3 mm (0.160") minimum.
- .2 Roofing membrane cap sheet and cap sheet flashing: CGSB 37.56, SBS-modified asphalt membrane sheet with non-woven polyester reinforced elastomeric bitumen, protected by coloured granules.
 - .1 Reinforcement:
 - .1 180 gm/m² non-woven polyester.
 - .2 Thickness:
 - .1 4 mm (0.140") minimum.

2.5 AUXILIARY ROOFING MEMBRANE MATERIALS

- .1 General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing system.
- .2 Mastic sealant: Polyisobutylene, plain or modified bitumen, non-hardening, non-migrating, non-skinning, and non-drying.
- .3 Metal flashing sheet: Metal flashing sheet is specified in Section 07 62 00 – Metal Flashing.
- .4 Miscellaneous accessories: *Provide* miscellaneous accessories recommended by roofing manufacturer.
- .5 Aggregate surfacing: gravel with no foreign material, ASTM D1863/D1863M- 05(2011) e1, water washed, dry, free of dirt and dust, hard, dry, clean, and graded in sizes from 9 mm to 12 mm.

2.6 ASPHALT MATERIALS

- .1 Asphalt primer: CGSB 37-GP-9Ma-1983.
- .2 Roofing asphalt: CAN/CSA A123.4-04, Type 2 or Type 3.

2.7 SUBSTRATE BOARDS

- .1 Substrate board: ASTM C1177/C1177M-08, glass-mat, water-resistant gypsum substrate, factory primed.
 - .1 Thickness:
 - .1 12.7 mm (1/2").
 - .2 Acceptable *Products*:
 - .1 Georgia Pacific 'Dens Deck Prime'.

.2 Or *Equivalent*.

2.8 AIR AND VAPOUR BARRIERS

- .1 Glass fibre sheet: ASTM D2178/D2178M-15, Type IV, asphalt-impregnated, glass-fibre felt (to be used in conjunction with asphalt).
- .2 Aluminized bitumen sheet: Air / vapour barrier membrane shall be manufactured by coating an aluminum foil with oxidized bitumen. Water vapour resistance: 16 ng/Pa.s.m². Both surfaces lightly sanded.
- .3 SBS modified bitumen membrane, reinforced with a fibreglass mat in conformance with Prefabricated membrane, complying with CGSB 37-GP-56M-1985.

2.9 ROOF INSULATION

- .1 General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- .2 Rigid polyisocyanurate insulation board, inorganic felt faced:
 - .1 Description: Closed-cell polyisocyanurate foam core integrally laminated to heavy, durable and dimensionally stable inorganic coated-glass facers, CAN/ULC S704-03 Type 2 and Class 3, HCFC free, 138 kPa (20 psi) minimum compressive strength (at 10% deformation), CAN/ULC-S126-06, LTTR value in accordance with CAN/ULC S770-00.
 - .2 Board size:
 - .1 1220 mm x 1220 mm (4 ft x 4 ft).
 - .3 Tapered insulation: *Provide* factory-tapered insulation boards fabricated to slope of 1:48 (1/4 inch per 12 inches) unless otherwise indicated.
 - .4 *Provide* preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated in the shop drawings for sloping to drain. Fabricate to slopes indicated, and no less than 1:48 (1/4 inch per 12 inches) in addition to roof structure slope or to tapered insulation slope as applicable.

2.10 INSULATION ACCESSORIES

- .1 General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with roofing assembly.
- .2 Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
- .3 Insulation adhesive:
 - .1 Modified asphaltic insulation adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- .4 Cant strips:
 - .1 Insulation cant strips; perlite: ASTM C728-13, perlite insulation board, cut to *Provide* 45 degree transition from horizontal to vertical surfaces.

.5 Cover board:

- .1 Cover board; cellulose fibreboard: Asphalt treated and coated fiberboard in accordance with CAN/ULC S706-02, 12.7 mm (1/2") thick.

.1 Thickness: 12.7 mm (1/2").

.6 Substrate joint tape: 150 mm (6") wide, coated, glass fibre.

2.11 FASTENERS AND RESTRAINTS

- .1 General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing system.
- .2 Factory-coated steel fasteners and plates complying with corrosion-resistance provisions in FM 4470, designed for fastening roofing components to substrate, tested by manufacturer for required pullout strength and wind uplift resistance, and acceptable to roofing manufacturer.
- .3 Termination bars: Pre-punched aluminum bar 25 mm (1") wide x 1.5 mm (1/16") thick x 3048 mm (10 ft) long with 6.4 mm (1/4") x 9.5 mm (3/8") slotted holes on 200 mm (8") centres.

2.12 WALKWAY PAVERS

- .1 Precast paver slabs: CSA A231.1-14/A231.2-14, 610 mm (24") square x 45 mm (1-3/4") height, slip resistant textured finish, minimum 45 MPa (6526 psi) compressive strength, minimum 4.5 MPa (653 psi) (mean) flexural strength, minimum 4.5% (by mass) water absorption, maximum allowable average loss of mass of not greater than 50 g/m² (0.16 oz/ft²) after 28 cycles.
- .2 Precast support pads: 25 mm (1") thick, extruded expanded polystyrene insulation, in accordance with CAN/ULC S701-11, Type 4, Class B, self-extinguishing, 35 psi at 5% deflection compressive strength, thermal conductivity (k) factor of 0.029 at 23.8 °C.

2.13 EXPANSION JOINTS

- .1 Description:
- .1 Manufactured from a proprietary copolymer with internal polyester reinforcement, monolithic seam vulcanization.
- .2 Movement and fabrication: Tri-directional movement capability, joint waterproofing system shall be factory fabricated in one piece for the entire contiguous expansion joint or where length of joint exceeds manufacturer's shipping and handling guidelines shall be lapped and vulcanized by manufacturer's mechanics on *Site*, repair of damaged materials shall be performed by manufacturer's mechanics.
- .3 Compatible with adhesives and membranes associated with expansion joint construction in accordance with manufacturer's installation instructions.
- .4 Warranted by manufacturer to cover full warranty duration specified in this Section.
- .5 Hydrostatic pressure limit: Working pressure in column of water shall perform under static limit not to exceed 10 m (33 ft).
- .2 Acceptable *Products*; to suit type of roofing assembly and movement design requirements:
- .1 Situra Inc. 'RedLINE'.
- .2 Situra Inc. 'FlamLINE'.

.3 Or *Equivalent*.

2.14 FLASHINGS AND PENETRATION FLASHINGS

- .1 Prefinished metal flashings in accordance with Section 07 62 00 – Metal Flashing.
- .2 Roof drains; Stainless steel bolts, leader diameter size maximized to suit existing drain outflow pipe, deck clamps, stainless steel control flow insert, ballast guard, bitumen coated flanges, vandalproof hinged access gate (Allen-key operable) complete with drain seals:
 - .4 Drain body construction:
 - .1 Aluminum.
 - .5 Lexcor 'Flash-Tite Superdrains-FSD-FLAT',
 - .6 Thaler Metal Industries 'RD-FLAT'.
 - .7 Or *Equivalent*.
- .3 Prefabricated plastic pans; insulation filler and sealer; designed and provided for roof penetrating component in each case and for specified roofing system. Use gooseneck types for wiring and conduit.
 - .1 Lexcor 'Roof Protrusion Flashing'.
 - .2 Thaler Roofing Specialties 'Stack Jack Flashing'.
 - .3 Or *Equivalent*.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, with roofing installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - .1 Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - .2 Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - .3 Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 23 – Steel Roof Decking.
 - .4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.
- .2 Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 METHOD OF INSTALLATION

- .1 Prepare surfaces and complete waterproofing work in conformance with roofing manufacturer's printed installation instructions.
- .2 Install roofing elements on clean and dry surfaces, in conformance with manufacturer's instructions and recommendations.
- .3 Roofing work must be completed in a continuous fashion as surfaces are readied and weather conditions permit.
- .4 Seal seams that are not covered by a cap sheet membrane in the same *Day*. Do not install cap sheet when moisture is present at/in the base sheet seams.
- .5 Whenever membranes are torch-applied, a continuous and even bead of molten bitumen must be visible as the membrane is unrolled and torched.
- .6 Lay roofing membrane free from wrinkles, air pockets, fishmouths, tears, and prominent lap joints. Full bond cap sheet to base sheet. Seams shall be lapped and fully bonded.
- .7 Prior to installation of base sheet and cap sheet, allow sheet to relax after unrolling. Relax time to be as recommended by manufacturer based on concurrent ambient temperature.
- .8 Extend roofing to outer edges of roof and up vertical surfaces at least 200 mm (8") above horizontal roofing, and full height beneath counter flashing and top of curb flashing.
- .9 Complete roofing up to line of termination for each *Working Day*.

3.4 SUBSTRATE BOARD (SHEATHING/UNDERLAY)

- .1 Lay substrate board with tightly butted joints. Longitudinal joints must be at right angles to flute direction. Joints occurring along widths of board to be continuously supported on top flange of metal deck. Stagger end joints of adjacent board by 1/2 the board width.
- .2 Ensure substrate board is immediately protected with membrane.
- .3 Mechanical fasteners to penetrate top flutes only; by no less than 19 mm (3/4") and by no more than 25.4 mm (1"). Check underside of deck before installation to eliminate damaging existing conditions below deck.
- .4 Tape all seams in substrate board prior to the installation of the air / vapour barrier. Use 150 mm (6") wide strips of self-adhering base sheet to prevent leakage into the building.

3.5 APPLICATION OF PRIMER

- .1 Roofing substrates surfaces shall receive a coat of primer at a rate required by roofing manufacturer's printed installation instructions.
- .2 Surfaces to be primed must be free of rust, dust or any residue that may hinder adherence.
- .3 Cover primed surfaces with roofing membrane as soon as possible (same *Day* coverage for self-adhesive membranes).

3.6 AIR AND VAPOUR BARRIER

- .1 Built-up two-ply asphalt and fibreglass felt: Install two glass-fibre felt plies lapping each felt 483 mm (19 inches) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt.

Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 14°C (25°F) of equiviscous temperature.

- .2 Completely seal air and vapour barrier at terminations, obstructions, and penetrations to prevent air movement into roofing.

3.7 ASPHALT APPLICATION

- .1 Asphalt Heating: Heat roofing asphalt and apply within plus or minus 14°C (25°F) of equiviscous temperature unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 14°C (25°F) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
- .2 Apply asphalt at Equiviscous Temperature (EVT) and do not spread more than 1830 mm (6 ft) of hot asphalt in front of each roll and reduce distance accordingly during cold weather. Ensure hot asphalt in kettle is in constant use and circulation to avoid distillation.
- .3 Apply asphalt at minimum rate of 1.2 kg/m² (25 lb/100 ft²) and as specified herein for aggregate surfacing flood coat.

3.8 INSULATION APPLICATION – CONVENTIONAL ROOFING

- .1 Comply with up roofing manufacturer's written instructions for installing roof insulation.
- .2 Adhesively applied insulation: Install insulation adhesive in accordance with roofing manufacturer's installation instructions.
- .3 Mechanically fastened insulation: Fasteners must be attached to steel deck's upper flutes and at spacing to meet performance requirements, in accordance with roofing manufacturer's installation instructions
- .4 Nailer strips: Mechanically fasten 90 mm (3-1/2") width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - .1 4877 mm (16 ft) apart for roof slopes greater than 1:12 (1 inch per 12 inches) but less than 3:12 (3 inches per 12 inches).
 - .2 1220 mm (48") apart for roof slopes greater 3:12 (3 inches per 12 inches).
- .5 Stagger and offset vertical joints from preceding insulation boards, 305 mm (12").
- .6 Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- .7 Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- .8 Install only as much insulation as can be covered with membrane roofing in the same *Day*.
- .9 Install insulation boards with edges in moderate contact without forcing and fill gaps greater than 6 mm (1/4") with insulation.
- .10 Cut insulation to fit to blocking, upstands, and penetrations through roof; fill gaps greater than 6 mm (1/4") with insulation.

- .11 Reduce thickness of insulation at roof drains by 13 mm (1/2") for a distance of 610 mm (24") from centre drain.
- .12 Install tapered insulation under area of roofing to conform to slopes indicated.
 - .1 Apply insulation adhesive to underside and immediately bond tapered insulation to substrate.
 - .2 Apply hot roofing asphalt to underside and immediately bond tapered insulation to substrate.
- .13 Protect and keep insulation dry (in new condition). Do not install insulation which is not in dry condition.

3.9 COVER BOARD

- .1 Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 300 mm (12") in each direction. Loosely butt cover boards together. Tape joints if required by roofing manufacturer.
 - .1 Apply insulation adhesive to underside and immediately bond cover board to substrate.
 - .2 Apply hot roofing asphalt to underside and immediately bond cover board to substrate.

3.10 INSTALLATION OF REINFORCED GUSSETS

- .1 Install reinforcing gussets on inside and outside corners of base sheet flashing membrane.
 - .1 *Provide* self-adhesive base sheet flashing membrane gussets, adhered over base sheet membrane flashing into intersecting corner, with edges of gusset sealed with a bead of compatible mastic.

3.11 ROOFING DETAILS

- .1 *Install* as indicated on the *Drawings* and with various roofing details illustrated in roofing manufacturer's printed installation instructions.

3.12 INSTALLATION OF TORCH-APPLIED CAP SHEET MEMBRANE

- .1 Once base sheet, base sheet flashing, and stripping are applied and do not show defects, and installation has been reviewed by the roofing system manufacturer and the inspection and testing company, cap sheet can then be laid.
- .2 Cap sheet shall be unrolled starting from lowest point of roof. Cap sheet shall be rerolled from both ends prior to torching. Care must be taken to ensure alignment of first roll (parallel with edge of roof).
- .3 Cap sheet shall be torch welded on to base sheet membrane. During this application, both surfaces shall be simultaneously melted, forming an asphalt bead that shall be pushed out in front of cap sheet. Maintain a consistent 3 mm (1/8") wide asphalt bead at seams.
- .4 Avoid overheating.
- .5 Base sheet and cap sheet seams shall be staggered a minimum of 305 mm (12").
- .6 Overlap side laps by 75 mm (3") and end laps by 150 mm (6").
- .7 Make sure 2 membranes are properly welded without unwelded areas. Torch welding speed varies depending on weather. In cold conditions, it slows down, in warm and dry conditions, it speeds up.

- .8 After installation of cap sheet, check lap seams on cap sheet.

3.13 INSTALLATION OF TORCH-APPLIED CAP SHEET FLASHING MEMBRANE

- .1 Cap sheet flashing shall be laid in strips one metre wide. Side laps shall be 75 mm (3") and shall be staggered a minimum of 100 mm (4") from cap sheet laps and base sheet laps, in order to avoid excessive thickness.
- .2 Draw parallel chalkline at termination line of cap sheet flashing at horizontal roof deck surface. Sink surface granules into bed of hot bitumen with torch and round-nosed trowel in area between chalk line and base of upstand or parapet, as well as over any granulated vertical surfaces to be overlapped.
- .3 Cap sheet flashing shall be torch welded directly on its base sheet, proceeding from bottom to top. Torching shall soften the two membranes and ensure a uniform weld, as described under "Cap Sheet Installation". When allowed by support, cap sheet top edge shall be nailed on 305 mm (12") centres.

3.14 WATERPROOF EXPANSION JOINT INSTALLATION

- .1 *Install* all components of the system in accordance with the manufacturer's printed instructions.
- .2 The system is to be wholly encapsulated between the plies of the modified bitumen membrane in a roofing system.

3.15 ROOF DRAINS

- .1 Ensure that roof drains are set to permit drainage, located at lowest possible location, and properly secured. Cut and slope insulation at each drain to form a sump and to accommodate flashing immediately surrounding drain. Review final locations with the *Consultant* prior to installation of drains.
- .2 Drain sumps to be *Provided* by the tapered insulation manufacturer.
- .3 Temporarily block drain pipes during application of membrane. Remove blocking when work is not in progress and after work of this Section is completed.
- .4 Carry membrane and insulation to edge of drain base and trim around drain opening. Top ply to be granulated cap sheet flashing to minimum 200 mm (8") from edge of drains.
- .5 Ensure that installation of drain and membrane is performed in accordance with recommendations of drain manufacturer.
- .6 Prime drain flange and allow to dry.
- .7 Embed first felt ply in a coat of waterproofing mastic and extend plies of felt into the drain opening of drains, and trim as required.
- .8 Fill void between drain body and roof insulation board/base structure support with two- component polyurethane foam insulation.

3.16 ROOF PENETRATIONS

- .1 *Install* curb flashings around ducts, pipes, structural steel, and other projections through membrane systems in conformance with manufacturer's written instruction and as detailed.
- .2 Install penetration flashing supplied under work of mechanical and under the work of this Section, in accordance with roofing manufacturer's installation instructions.

- .3 Prime metal flanges with primer and allow solvents to flash off prior to installation.
- .4 Remove poly film on areas to receive metal flashing. Set metal flange in full layer of waterproofing mastic to *Provide* positive bond and seal.
- .5 *Install* base ply to the base of the metal flashing staying short of curved metal section.
- .6 *Install* cap ply to the base ply flashing ensuring a full bond to the base ply and apply bead of waterproofing sealer at the termination point.

3.17 METAL FLASHINGS

- .1 *Install* metal flashings in accordance with Section 07 62 00 – Metal Flashing.

3.18 PAVER INSTALLATION

- .1 Public area pavers:
 - .1 *Install* paver pedestals in accordance with manufacturer's recommended installation instructions.
 - .2 Paver installation:
 - .1 *Install* pavers in accordance with paver manufacturer's written instructions. Align the top cap joint spacers with paver edges. Level pavers in succeeding rows.
 - .2 *Install* pavers tightly butted into pedestals. Form minimum joint widths.
 - .3 Shim or adjust to level and as necessary to prevent rocking of pavers.
 - .4 Installation tolerances:
 - .1 Step in face alignment between paver faces: Plus or minus 1.5 mm (1/16").
 - .2 Jog in joint alignment between paver sections: Maximum 1.5 mm (1/16").
 - .5 Do not use pavers with chips, cracks, voids, stains, or other defects which might be exposed to view in the finished work.
 - .6 Machine cut pavers as necessary to fit the conditions indicated. Joints shall be no wider than the typical paver to paver joint.

3.19 FIELD QUALITY CONTROL

- .1 Conduct quality control in accordance with Section 01 45 00 – Quality Control and as follows:
 - .1 Inspection and testing:
 - .1 Prior to installation of cap sheet membrane, base sheet membrane installation shall be reviewed by manufacturer and inspection and testing company, who shall each submit field review reports to the *Consultant*.
 - .2 Independent inspection and testing company shall perform:
 - .1 Inspections and *Provide* inspection reports.
 - .2 Tests and *Provide* test reports:
 - .3 Core cuts (if requested).

- .2 Manufacturer's field review to be in accordance with Section 01 45 00 – Quality Control.

3.20 ADJUSTING AND CLEANING

- .1 Remove applicator's equipment and debris as work progresses, and at completion of the work of this Section in accordance with Sections 01 77 00 – Contract Closeout Procedures and Submittals.
- .2 Remove bituminous markings from finished surfaces.
- .3 Repair or replace defaced or disfigured finishes caused as a result of the work of this Section.

END OF SECTION